



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
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Honolulu, Hawaii 96850

In Reply Refer To:
1-2-2008-F-0108
1-2-2005-F-356

JUN 18 2008

Colonel Matthew T. Margotta
U.S. Army Commander
Department of the Army Headquarters
United States Army Garrison, Hawaii
Schofield Barracks, Hawaii 96857-5000

Subject: Amendment of the Biological Opinion of the U.S. Fish and Wildlife Service for
Military Training at Makua Military Reservation (1-2-2005-F-356)

Dear Colonel Margotta:

This responds to your January 11, 2008, letter requesting an amendment to the June 22, 2007 "Reinitiation of the 1999 Biological Opinion of the U.S. Fish and Wildlife Service for Routine U.S. Army Military Training at Makua Military Reservation, Island of Oahu" (1-2-2005-F-356) (Makua Biological Opinion) pursuant to section 7 of the Endangered Species Act of 1973 (Act), as amended. The Makua Biological Opinion addressed impacts from ongoing training activities conducted by the military, to 39 listed plants, Oahu tree snail (*Achatinella mustelina*), Oahu elepaio (*Chasiempis sandwichensis ibidis*) and critical habitat for 36 plant species and Oahu elepaio. This Amendment will be appended to the Makua Biological Opinion. This Amendment was necessary, pursuant to 50 CFR §402.16, because the August 2007, Waialua Fire burned a significant number of federally endangered *Hibiscus brackenridgei* (ma'ō hau hele, native yellow hibiscus), substantially reducing the status of the species and increasing the magnitude of the effects that military training at Makua Military Reservation (Makua) could have on this species. This Amendment addresses the potential effects of military training at Makua to *H. brackenridgei*. It also addresses effects of the development of a fuelbreak, designed to protect an extant population of *H. brackenridgei* and critical habitat for a number of taxa including *Abutilon sandwicense*, *Bonamia menziesii*, *Eugenia koolauensis*, *Euphorbia haeleeleana*, *Hibiscus brackenridgeii* and *Nototrichium humile*. This Amendment will augment the sections of the Makua Biological Opinion that addressed *Hibiscus brackenridgei* ssp. *mokuleianus*, and critical habitat for *Bonamia menziesii*, *Euphorbia haeleeleana*, *Hibiscus brackenridgeii* and *Nototrichium humile* that were addressed in that Opinion. All other information within the Makua Biological Opinion is still valid and remains in effect. This Amendment addresses *Hibiscus brackenridgei* which was federally listed as endangered on November 10, 1994 (59 FR 56333), with emphasis on the subspecies *Hibiscus brackenridgei* ssp. *mokuleianus* addressed in the Makua Biological Opinion. Critical habitat for *Abutilon sandwicense* and *Eugenia koolauensis*, which occurs within the proposed fuelbreak area, but not within the area threatened by training-related fire, is addressed for the first time in this Amendment.

CONSULTATION HISTORY

October 3, 2007: The U.S. Fish and Wildlife Service (Service) received a letter from the Army, reporting that the Waialua Fire, ignited on private land on Sunday August 12, 2007, had impacted nine endangered plant species occurring on State and private land. This report indicated that approximately 90 percent of the *Hibiscus brackenridgei* occurring on Oahu were impacted by this fire. Post-fire surveys were completed by Army Natural Resources Staff, with assistance from the Service and Hawaii Department of Land and Natural Resources Staff and Flying R Ranch.

October 3, 2007 through February 26, 2008: The Service, Army Natural Resources Staff, Army Installation Fire and Safety Office, State of Hawaii Department of Land and Natural Resources, the Makua Implementation Team, the Natural Resources Conservation Service, Center for the Environmental Management of Military Lands, Castle & Cooke, Hawaii Inc., Dole Food Company Hawaii, and Flying R Ranch collaborated in the conceptual design of the Puulu to Alaiheihe Management Unit and Fuelbreak.

January 11, 2008: The Service received a reinitiation request letter which included a report updating the status of *Hibiscus brackenridgei* on Oahu.

February 1, 2008: Army Natural Resource Manager, Michelle Mansker, provided the Service with the project description addressing the reduced population status of *Hibiscus brackenridgei* and associated Army conservation measures.

May 27, 2008: The Service transmitted a project description, incorporating editorial revisions, to Army Natural Resource Manager Michelle Mansker, who approved the changes on the same date.

May 29, 2008: Army Natural Resource Manager, Michelle Mansker, granted the Service an extension of the due date for this Amendment to June 18, 2008.

ACTION AREA SUMMARY

The action area pursuant to section 7 regulations consists of all areas to be affected directly or indirectly by the Federal action including land proposed as management units, land occupied by stabilization plant population units, and adjacent lands where fuelbreaks and firebreaks are established to reduce fire threat to these management and population units pursuant to the Makua Implementation Plan (U.S. Army Garrison, 2003e) and the Makua Implementation Plan Addendum (U.S. Army Garrison 2005a), as updated in annual Makua Implementation Team meetings (U.S. Army Garrison 2006c and 2007). As described in the Action Area Summary of the Makua Biological Opinion, it was determined the Army's actions within the portion of the action area that encompasses the management units outside of the training action area would have beneficial effects to listed species and critical habitat. However, impacts from vegetation management within the newly-proposed 34-hectare (ha) (86-acre (ac)) Puulu to Alaiheihe fuelbreak area may effect *Hibiscus brackenridgei* and critical habitat for six species, and are addressed in this formal consultation. The term "action area" has been refined in this

Amendment to refer to the proposed Puulu to Alaiheie fuelbreak area in addition to the area at risk of training-related wildland fire described in the Makua Biological Opinion (Figure 1). If Army Natural Resource Staff determine that any additional action may adversely affect a listed species or designated critical habitat, the Army will coordinate with the Service prior to implementing that action.

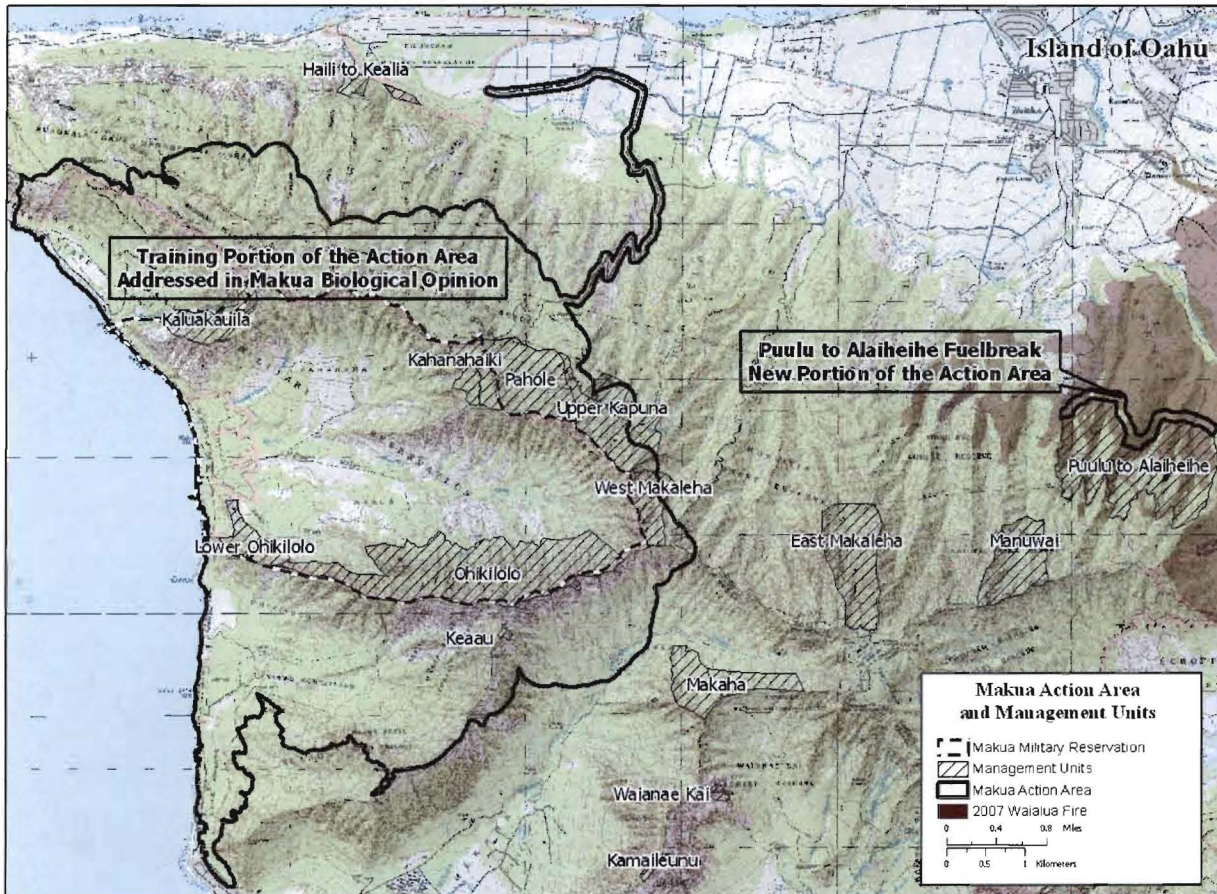


Figure 1. Training and fuelbreak portions of the Makua action area and adjacent management units.

PROJECT DESCRIPTION

The Army training action analyzed in the Makua Biological Opinion (completed in June 2007) will be implemented with the addition of the supplementary conservation measures detailed in this project description. The conservation measures described in this project description were developed to minimize the risk of fire to *Hibiscus brackenridgei* in order to address the severe impacts of the 2007, Waialua Fire, on this species. Four *H. brackenridgei* ssp. *mokuleianus* populations (two within the Makua action area and two outside the action area) will be managed to achieve stabilization goals pursuant to the Makua Implementation Plan Addendum and this project description, as adapted by the Makua Implementation Team.

Summary of Army Actions to Minimize and Offset Wildland Fire Impacts to *Hibiscus brackenridgei*

Expedited stabilization of *Hibiscus brackenridgei* requires control of the threat of fire to the four populations of *H. brackenridgei* ssp. *mokuleianus* designated “manage for stability” population units as outlined in the Makua Implementation Plan Addendum (U.S. Army Garrison 2005a). Development and implementation of fuelbreaks and firebreaks to protect these population units was identified as an urgent action by the Makua Implementation Team (January 28, 2008). Site selection for the four *H. brackenridgei* ssp. *mokuleianus* population units was addressed by the Makua Implementation Team, in coordination with the Service. Site priorities may change through time based on changes in land ownership, site access, plant population status, and other factors. Fuelbreaks and firebreaks have been designed to reduce the risk of fire spreading outside the south lobe of the firebreak road at Makua and to protect management units and plant population units from wildland fire. Prior to use of any weapon at Makua, fuel treatments within and adjacent to the *H. brackenridgei* growing in Lower Ohikilolo Management Unit will be increased and fuel treatments will be maintained to further minimize fire risk to these endangered plants on the installation. Within three years of the completion of this Amendment, and prior to implementation of Column B weapons restrictions (see Makua Biological Opinion), additional fuelbreaks and firebreaks will be developed and maintained to afford additional protection to the three stabilization population units of *H. brackenridgei* which are located outside Makua Valley. Specifications for fuel modifications for the protection of the Puulu to Alaihehe population unit, developed by Oahu’s interagency wildland fire management community (Greenlee *et al* 2007), are outlined in this project description. Fuel treatments to provide the other sites with similar protection are being developed in coordination with the Service (Beavers 2008). Fuel modifications are designed to stand alone in effectively halting the spread of a guinea grass headfire burning under 97th percentile fire weather conditions. In addition, fuels will be modified to minimize fire intensity and firebrand production to minimize short-range spotting into areas occupied by *H. brackenridgei*. A firebrand is a flaming or glowing fuel particle that can be carried naturally by wind, convection currents, or by gravity into unburned fuels. A head fire is a fire spreading or set to spread with wind and slope vectors and a spot fire is a fire ignited outside the perimeter of the main fire by a firebrand. The Army will continue to provide assistance as necessary to the interagency wildland fire suppression agencies to protect the areas identified in this project description from fire, as described in further detail below. As fuelbreaks are completed and the City and County of Honolulu and the State of Hawaii become better equipped to protect these endangered species populations from fires ignited by the public, the magnitude of the Army’s response to these fires may be reduced. As new techniques are developed through research, modifications to fuelbreaks and firebreaks outlined in this project description may be made through the adaptive management process of the Makua Implementation Team, in coordination with the Service.

Specific Fuel Treatments Within the Makua Action Area

The north and south lobes of the training area at Makua are surrounded by a firebreak road, which is maintained as a passable road, cleared to bare mineral soil to a width of 6 meters (m) (20 feet (ft)). Fuelbreaks are swaths of less flammable vegetation, where fuel load or continuity is manipulated mechanically, or with prescribed fire, grazing, herbicide, or by other

means, in order to stop or slow fire spread. The maintenance schedule of each of the fuel treatment areas will vary due to accessibility, unexploded ordinance, topography, and vegetation response. Fuelbreak and firebreak descriptions are detailed in the Makua Biological Opinion, as modified, below, in this Amendment. The assigned Army Wildland Fire Incident Commander and the senior Range Control officer staffing Makua during live-fire training are both responsible for daily documentation confirming completion of all fuel treatments in this Amendment.

A. Grass removal within 3 m (10 ft) of *Hibiscus brackenridgei* and within Weed Control Area:

Within the Lower Ohikilolo Management Unit, all live and dead grass will be removed from within 3 m (10 ft) of all *Hibiscus brackenridgei* such that total grass cover is maintained at less than one percent. Fuel will be reduced within the remainder of the 3-ha (7-ac) weed control area (labeled A in Figure 2) such that the area will not support the spread of fire given upslope wind speeds of 15 mph and one-hour fuel moisture of eight percent and under more severe burning conditions. Given these conditions, fire spread could occur, but the fire would not be hot enough or have a long enough residence time to kill *H. brackenridgei* (i.e., lethal temperatures of 60 degree Celcius temperatures for more than one minute (Kayll 1968, pp. 96-98 and Methven 1971, p.8).

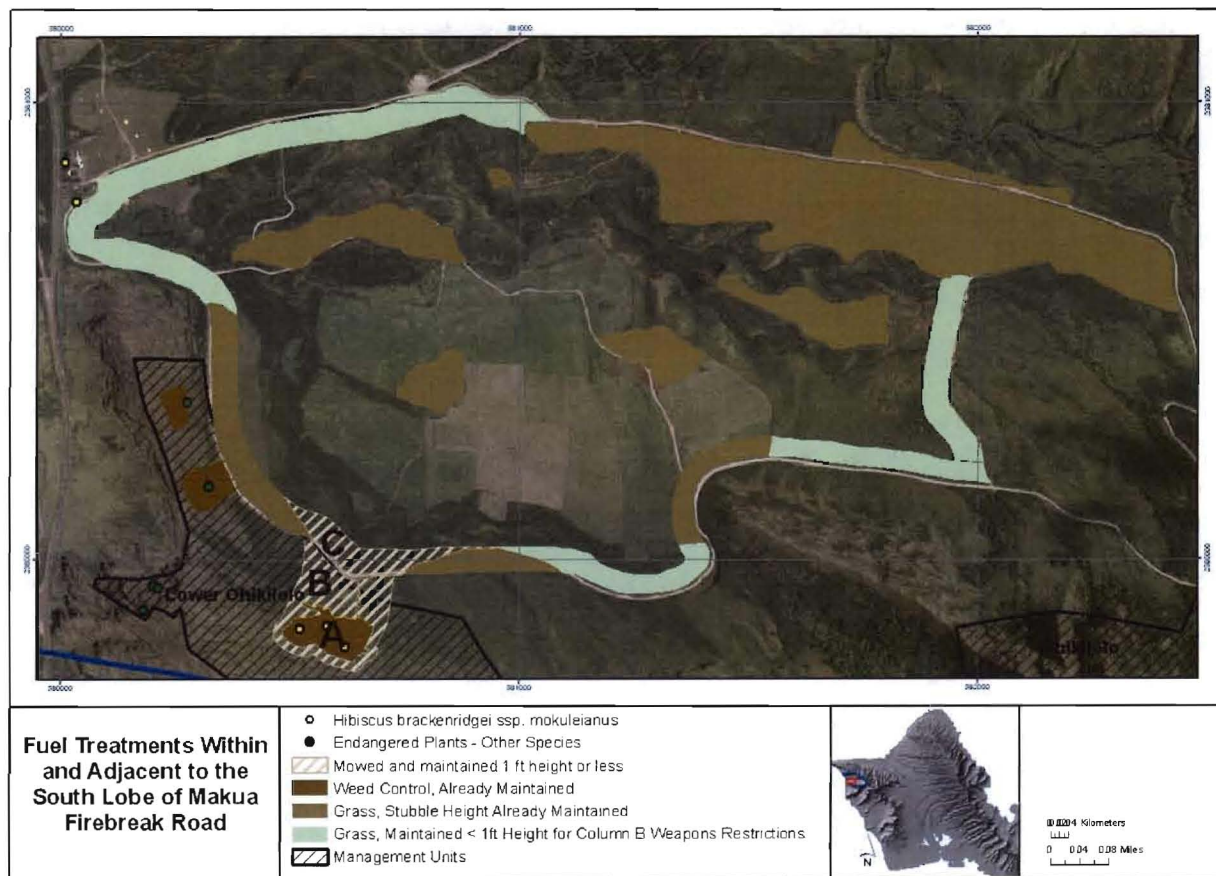


Figure 2. Summary of fuel treatments in the vicinity of the South Lobe of the firebreak road at Makua.

This grass control is currently achieved with frequent herbicide application (Figure 3), and cliff areas that are too steep to access will be excluded from treatments. This level of grass control will remain in place whenever live herbaceous fuel moisture, as measured in the Weather Information Management System (WIMS) at the Makua Range weather station, is less than 150 percent. The rainfall associated with wet periods, when live herbaceous fuel moisture exceeds 150 percent, will enable a high density of grass seedlings to become established. This young vegetation would not contribute to fire spread because of its high moisture content.

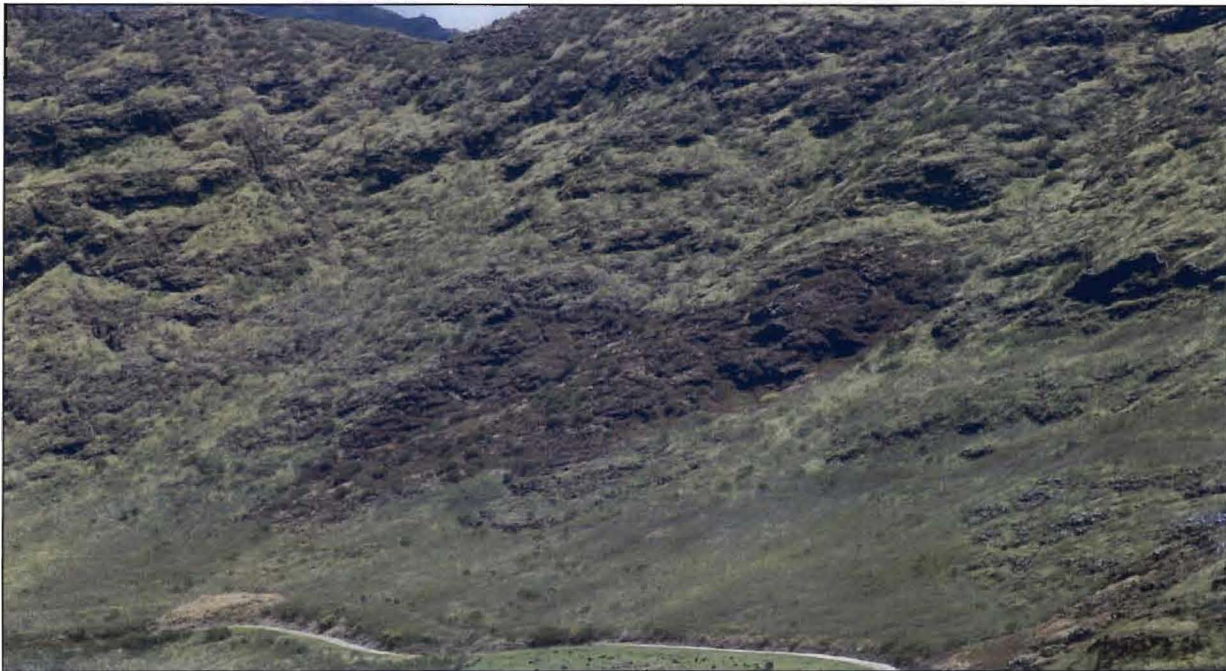


Figure 3. Existing weed control area protecting *Hibiscus brackenridgei* at Makua from fire.

B. New Mowed Area: To further minimize fire risk to *Hibiscus brackenridgei* growing in Lower Ohikilolo Management Unit, grass below and adjacent to the existing weed control area will be mowed. Fuel within the 3.1-ha (7.6-ac) area (labeled B in Figure 2) between the firebreak road and the *H. brackenridgei* population and within 20 m (66 ft) of the outer perimeter of the *H. brackenridgei* weed control area, will be mowed within one year of completion of this Amendment and prior to the use of any weapon or prescribed burning. This fuel treatment will be maintained continuously, regardless of training intensity, for the 30-year timeline of the Makua Biological Opinion. Vegetation height will be maintained at 0.3-m (1-ft) height or less or vegetation cover will be reduced to less than 20 percent cover within each square meter (10.8 square feet) in this fuel treatment area. Fuel wetting may be substituted for more permanent fuel modification during the six month period following completion of this Amendment, to provide training opportunities before grass mowing can be completed. Fuel would be periodically sprayed with water with either an irrigation system or hand-held water hoses such that a minimum of 0.01 inches of water falls throughout Area B within two hours of the initiation of the training or burning activity. Area B would be re-treated with 0.01 inches of water every four hours during the training or burning activity. This wetting treatment is designed to ensure fire could not spread in this area of the firebreak. The Service will be contacted prior to the use of this wetting treatment to view its implementation.

C. Fuel Treatment Inside Firebreak Road Grass inside the southern lobe of the firebreak road is, and will continue to be, maintained to stubble height in Objectives Badger, Buffalo, Coyote, Deeds, Deer, Elk, and Wolf, where most weapons are targeted (see Figure 2, Grass, Stubble Height Already Maintained). All flammable material is and will continue to be cleared from firing points and detonation areas pursuant to DA PAM 385-63 (2003, as updated) and the Makua Biological Opinion.

Vegetation within a 60-m (197-ft) strip along the inside edge of the south lobe of the firebreak road will be maintained at 0.3-m (1-ft) height or less by mowing (see Figure 2).

Approximately half this area is mowed and already meets this specification. In the Project Description of the Makua Biological Opinion, 17 ha (42 ac) of this fuel treatment area, which was not being mowed, was scheduled to be treated prior to implementation of Column B weapons restrictions. To provide more immediate protection to the *Hibiscus brackenridgei* growing in Lower Ohikilolo Management Unit, the 60-m (197-ft) strip of vegetation along the inside the southwest corner of the south lobe of the firebreak road (a 2-ha (5-ac) area (Figure 2, area labeled C) will be no taller than 0.3-m (1-ft) height when any weapons are used or prescribed burning is conducted at Makua. The remaining 15 ha (37 ac) of fuel treatment along the inside of the firebreak road will be completed prior to implementation of Column B weapons restrictions and will meet these specifications any time a weapon (including all weapons listed in Table PD 2 of the Makua Biological Opinion) is in use at Makua. Fuel wetting, as described for Area B (above) may be substituted for more permanent fuel modification during the six month period following completion of this Amendment, to provide training opportunities and time for grass mowing to be completed.

Fuel Treatments in the Puulu to Alaiheihe Gulch Area The impact of the 2007 Waialua Fire to *Hibiscus brackenridgei* underscores the need to expedite development of fuelbreaks and firebreaks to protect at-risk population units from fire. Within three years of the completion of this Amendment, (provided landowner and lessee permission is secured and maintained), the *H. brackenridgei* in the vicinity of Puulu to Alaiheihe Gulches will be protected from wildland fire by a fuelbreak adequate to halt fire spread and minimize spot fire occurrence in the *H. brackenridgei* conservation area. An interagency team of wildland fire management specialists has drafted a plan for a fuelbreak to traverse the bottom edge of the proposed conservation area (Figures 4 and 5). The Army will provide assistance to the interagency conservation community to ensure this fuelbreak is completed and operational within three years of the completion of this Amendment and that it remains effective for the life of the Biological Opinion.

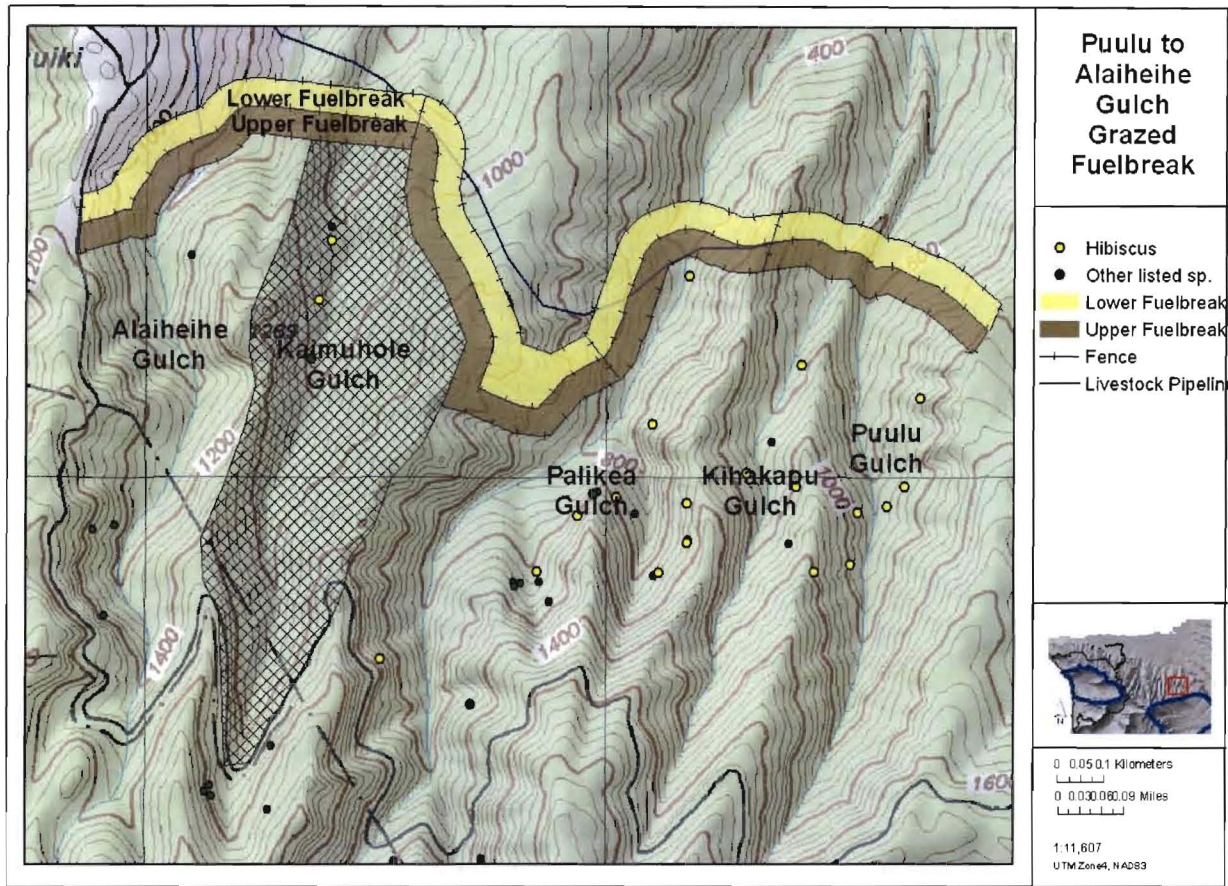


Figure 4. Puulu to Alaiheihe Gulch fuelbreak to protect *Hibiscus brackenridgei* population on upper slope with prescribed grazing below.

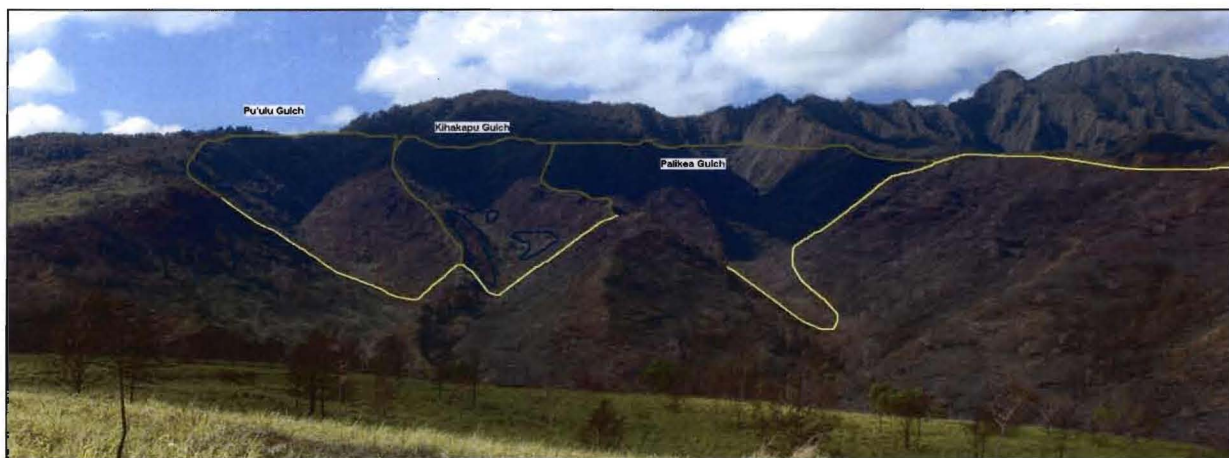


Figure 5. Approximate location of the top of the Proposed Puulu to Alaiheihe fuelbreak showing, from left to right, Puulu Gulch, Kihakapu Gulch, and Palikea Gulch.

A 34-ha (86-ac) fuelbreak will be constructed along the bottom edge of the Puulu to Alaiheihe Gulch *Hibiscus brackenridgei* population unit and it will be intensively managed with prescribed grazing to protect the remaining *H. brackenridgei* in this area. The fuelbreak

location, adjacent to the areas that were vegetated by forest fuels prior to the 2007 Waialua Fire, is designed to minimize fire risk to the listed species and critical habitat within the Puulu to Alaihehe Management Unit. The fuelbreak will be subdivided with cross-fencing to enable intensive grazing and rotation of working animals. Cross-fencing will divide the fuelbreak into upper and lower halves. Half the fuelbreak would be grazed to such an extent, vegetation would not carry fire, similar to heavily grazed areas which contributed to fire containment efforts in the northwest perimeter of the Waialua Fire (Keir and Cannarella 2007) (Figure 6). Within this intensively managed half of the fuelbreak, there may be some discontinuous pockets of heavier fuel that would support fire spread, but there will always be a continuous width, a minimum of 20 m (66 ft) wide, within the 60-m (197-ft) wide intensively managed area, that would not carry fire. These narrower areas may include sparsely vegetated cliffs. Year-round, throughout a minimum of 90 percent of the length of the fuelbreak, the fuel on either the upper or lower portion will be managed to the level necessary to prevent breach by a headfire. Any area, such as the steepest areas, not managed to this prescribed level with grazing (up to 10 percent of the fuelbreak length) must be actively managed in an alternative way (for instance with out-planting of trees and shrubs, in conjunction with grass control and a narrow handline) to achieve effectiveness as a fuelbreak in the long-term. Research, including installation of areas of shaded fuelbreak may be conducted along portions of the fuelbreak and the fuelbreak location or dimensions may be changed with the approval of the Service.

To provide working animals with adequate energy to perform intensive grazing in the fuelbreak, supplemental feeding may be necessary. Water sources, feed, and mineral supplements would be strategically placed within the fuelbreak to ensure adequate fuel reduction throughout the treatment area. The Army may hire the local lessee, who operates cattle and goat ranch on the property, or another contractor to manage grazing within the fuelbreak area. Cattle, goats, sheep, or other suitable livestock may be rotated through the fuelbreak area to achieve fuelbreak goals. During the winter rainy season, when grass is green (for instance, whenever live herbaceous fuel moisture, as measured in the Weather Information Management System (WIMS) at the Dillingham remote automated weather station, is greater than 150 percent, the fuelbreak will not need to be grazed to maintain effectiveness. This green grass would not contribute to fire spread because of its high moisture content. Heavier stands of ungrazed vegetation will minimize soil erosion during the rainy season.



Figure 6. Intensively grazed areas which contributed to fire containment efforts in the northwest perimeter of the Waialua Fire (Photos taken August 30, 2007).

While it is recovering from periods of more intensive grazing, the other half of the fuelbreak will be managed to minimize significant spot fire production. The onset of significant fire

spotting activity is generally acknowledged to occur at fire intensities of approximately 435-700 Btu/ft/sec (1,500-2,413 kW/m) (Hough and Albini 1978, p. 5; Hirsch *et al* 1979, p.3 and 12, Alexander *et al* 2004, pp. 1-2, Omi 2005, pp. 151-153). This corresponds to flame lengths of between seven and nine feet. Andrews (1986, p.10) predicts spotting to begin when flame lengths reach eight to 11 feet. BehavePlus fire behavior model (Andrews *et al* 2005) indicates that guinea grass head fire intensity is generally below this threshold under 97th percentile burning conditions, on a 60 percent slope with upslope winds, when live herbaceous fuel moisture is greater than 120 percent or when the grass is grazed to a fuel loading of less than 2.0 tons/acre (as shown in Figure 7).



Figure 7. Fuel on half of the fuelbreak would not be as heavily grazed, but would be managed to reduce fire intensity to minimize spot fire production (Photo taken at Dillingham Ranch, August 12, 2007).

Because the fuelbreak will not need to be grazed when grass is green, grass cover will be higher and erosion will be minimized during the wet season. Figure 8 illustrates the seasonal variation in grass cover associated with various levels of grazing and rainfall at Flying R Ranch.



Figure 8. Pasture (with a road crossing back and forth through it) grazed by goats, unburned in the Waialua Fire (top) compared with the same site during the wet season (bottom).

The fuelbreak was selected because the fire suppression helicopter response necessary to protect the site from fire, in the absence of a fuelbreak, is cost-prohibitive and, based on contractor availability during the 2007 Waialua Fire, unreliable. A fuelbreak is needed because impacts of the fire to listed species and native forest, as well as the severe erosion of topsoil that occurred in the burned forest areas (Beachy 2007) are inconsistent with recovery of the species and conservation of the critical habitat units. Alternatives to the grazed fuelbreak were considered, but their impacts, costs, or effectiveness made them less suitable for this site than the proposed grazed fuelbreak. Placement of the grazed fuelbreak lower down on the slope would leave a larger area of guinea grass in which spot fires could proliferate and exceed suppression resource capabilities. Slopes are too steep to install a mid-slope road along the forest edge, and erosion associated with the cut banks would have been severe (Kacir 2007 and Koob 2007). A mid-slope shaded fuelbreak, in which native shrubs are planted, would not be effective unless guinea grass is controlled within the fuelbreak area. The landscape-scale use of herbicide within the shaded fuelbreak, as well as within another alternative in which herbicide would have been broadcast to create a mineral soil firebreak, were not selected

because they were more labor intensive would result in greater soil erosion than the selected grazed fuelbreak (Beavers, 2006). As the guinea grass fuel model is refined as grazed fuels are studied, the Army will coordinate with the Service to alter fuelbreak specifications. The Army has contracted the U.S. Forest Service to study fire behavior in recently grazed and burned guinea grass stands to increase our knowledge regarding efficient, effective management and maintenance of fuelbreaks.

Specific Army Fire Suppression Assistance to State and City and County

Training at Makua is contingent upon the successful augmentation and reintroduction of endangered species populations and the control of threats to these populations outside the Makua installation boundary. As fuelbreaks are completed and the City and County of Honolulu and the State of Hawaii become better equipped to protect these endangered species populations from fires ignited by the public, the magnitude of the Army's response to these fires would be reduced. Historically the Army has provided firefighter and fire suppression helicopter support to fires threatening these off-installation areas. As funding and fire suppression resources are available, the Army will continue to assist other Federal agencies, State, and City and County fire suppression organizations with the suppression of fires that threaten the management units and manage for stability population units (Figure 9).

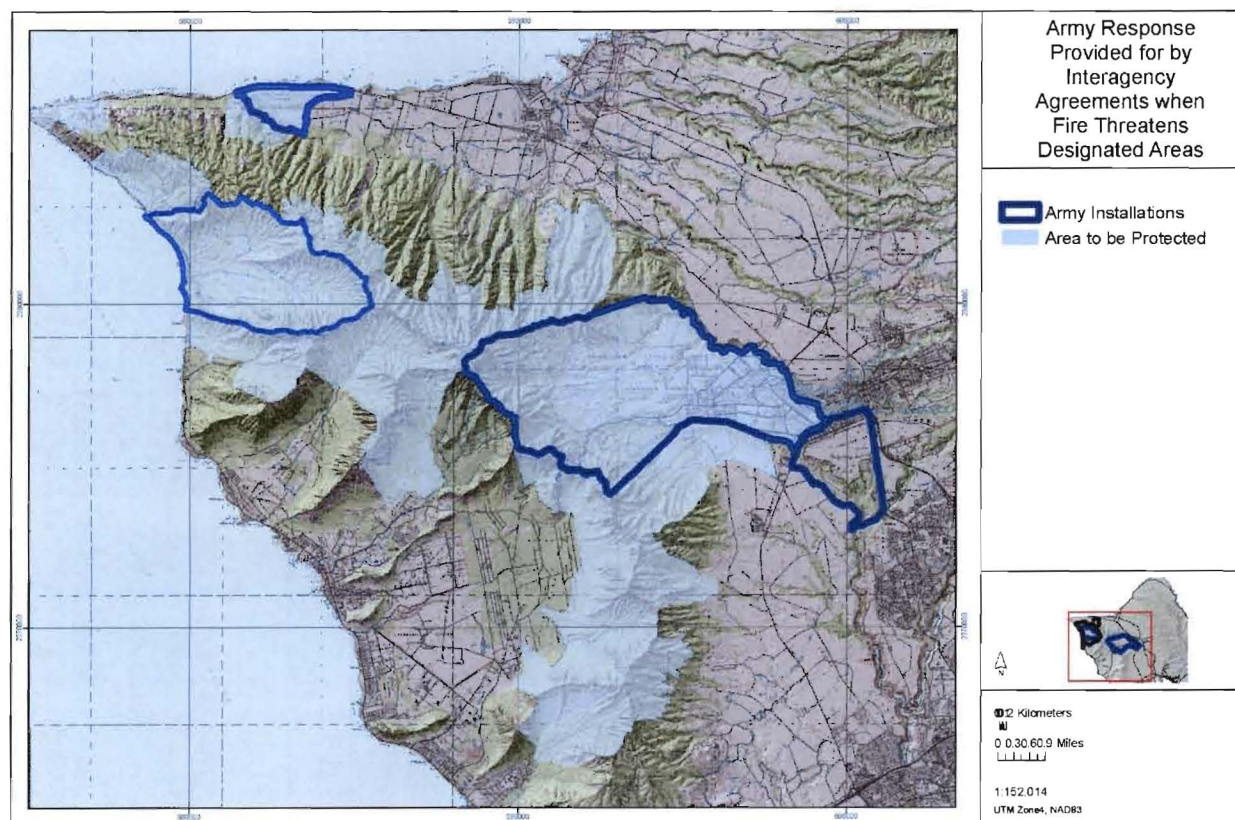


Figure 9. The Army will maintain agreements with the State of Hawaii and City and County of Honolulu, which will enable the rapid deployment of Army-funded helicopter fire suppression forces and ground firefighting forces to better ensure fires do not impact the blue shaded areas.

The use of Army-funded aerial and ground firefighting resources may be authorized as necessary on a case-by-case basis when the designated Fire Response Area is threatened by fire. The Army Wildland Fire Management Officer, Army Wildland Fire Assistant Fire Management Officer, Department of Public Works Natural Resources Manager, their supervisors in the chain of command, or the Federal Fire Department Unified Command Incident Commander have the authority to dispatch fire suppression helicopters, under contract with the Army, to these and other fires. The Army also maintains agreements with the interagency wildland fire community, which provide for use of military aircraft on interagency fires in Hawaii.

Makua Implementation Plan – Stabilization Overview

Four *Hibiscus brackenridgei* ssp. *mokuleianus* populations (two within the Makua action area (Makua and Keaau) and two outside the action area (Puulu to Alaiheihe and Haili to Kawaiu) will be managed to achieve stabilization goals pursuant to the Makua Implementation Plan Addendum, as adapted by the Makua Implementation Team (U.S. Army Garrison 2005a).

Makua Population Unit The Makua Population Unit will continue to be managed to achieve stabilization goals pursuant to the Makua Implementation Plan Addendum (U.S. Army Garrison 2005a). In February, 2008, 23 Army-propagated seedlings were out-planted in the Lower Ohikilolo Management Unit. All mature and immature *Hibiscus brackenridgei* growing in Lower Ohikilolo Management Unit are currently represented in genetic storage. Full genetic storage will be maintained for all Makua immature and mature plants throughout the life of the Makua Biological Opinion. Full genetic storage is considered to be maintained for a *Hibiscus brackenridgei* ssp. *mokuleianus* plant when at least one cutting from the original plant is growing vigorously in the nursery or a secure ex situ site, or when ten or more viable seeds are secured in storage.

Puulu to Alaiheihe Population Unit Although 96 percent of the adult plants and 99 percent of the immature plants in the Waialua area were killed by the 2007 Waialua Fire (U.S. Army Garrison 2008; pp 7-29), seedlings are abundant in the vicinity of burned *H. brackenridgei* plants. The Army is working closely with the interagency conservation community to ensure the future protection of the Puulu to Alaiheihe manage for stability *H. brackenridgei* population unit. Although the Army will fund the majority of the actions described in this project description, portions of the project may be funded by the Service, Hawaii Department of Land and Natural Resources, U.S.D.A. Natural Resource Conservation Service, the landowner and lessee, and other public and private conservation organizations. The Army will (provided landowner permission is granted and maintained) ensure the Puulu to Alaiheihe Management Unit and fuelbreak shown in Figure 10 are completed and operational within three years.

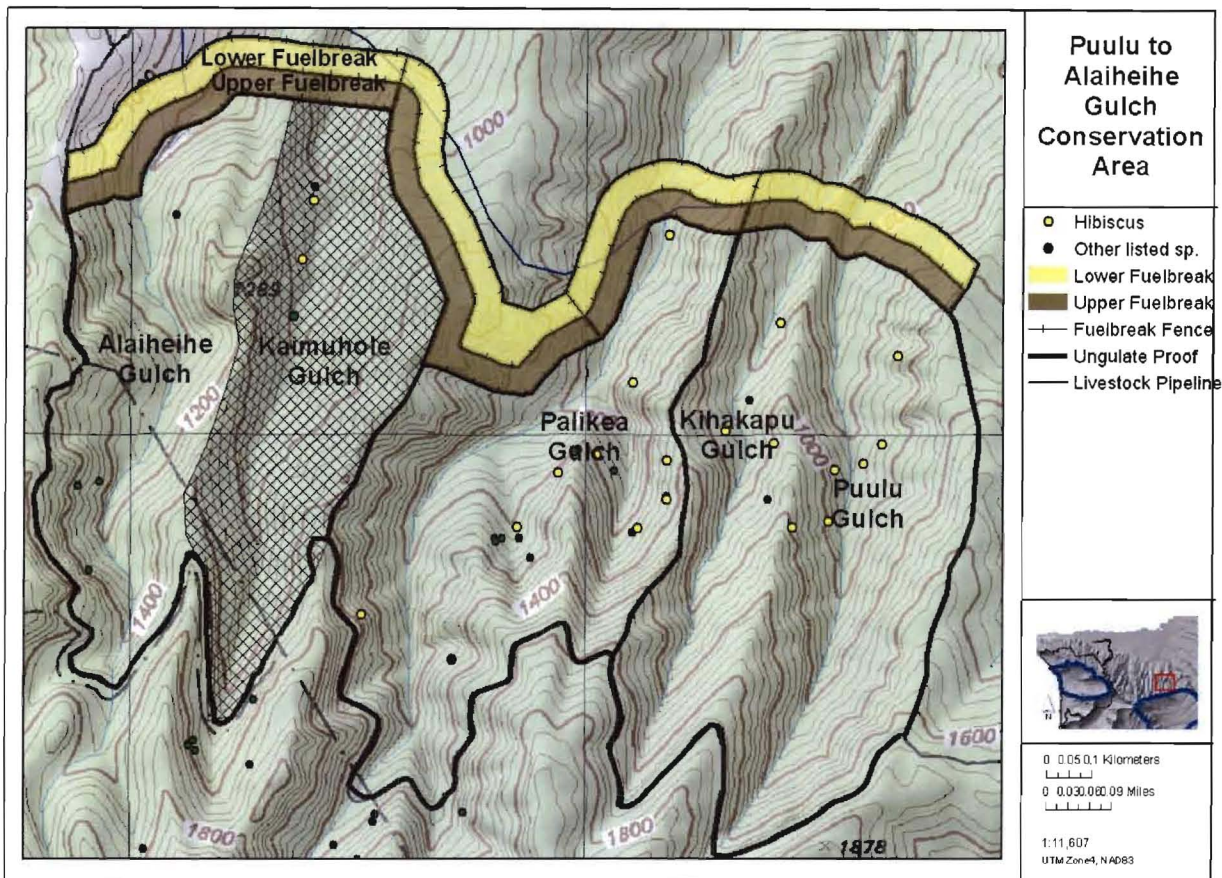


Figure 10. The Army will ensure that ungulate-exclusion fencing is completed and areas are free of ungulates within three years of the completion of this Amendment.

The Makua Implementation Team identified this fuelbreak and ungulate exclusion as the highest priority management action for these gulches. The team believes protection from fire and ungulates will provide opportunity for at least 75 percent of pre-fire adult plus immature *H. brackenridgei* population to re-establish. If in five years, the population has not recovered to a minimum size of 469 individuals (seventy five percent of 625 plants is 469 plants), the Makua Implementation Team will develop additional measures to ensure rapid restoration and maintenance of population size. Weed control targets that apply to the other Makua Implementation Plan management units will not apply to this new area, and other than any adaptive management which may be developed by the Makua Implementation Team, the Army would not conduct weed control within this new area. Numeric stabilization goals have not been refined for this species, and a population structure with 50 mature, reproducing individuals remains the Army’s management objective for this population unit. The site is predominantly on Castle & Cooke Hawaii property and is partially on State Forest Reserve and State Natural Area Reserve land. Castle & Cooke Hawaii and the Army are nearing completion of a right-of-entry agreement which would serve as a template for the right-of-entry agreement for Puulu to Alaihehe population unit management. The Army is working diligently with the State to finalize access agreements to provide for the Army fence construction on the State portion of the project area. The Army will survey the seedlings in the fire area (two to three times a year) to determine seedling numbers and document any ungulate

browse and grass competition impacts. Where browsing impact is found, the Army will install temporary fencing to protect seedlings until permanent fencing can be completed.

STATUS AND ENVIRONMENTAL BASELINE OF SPECIES AND CRITICAL HABITAT

The population status of *Hibiscus brackenridgei* was significantly reduced as a result of the 2007 Waialua Fire and the biological and ecological information relevant in analyzing the effects of the action to this species has been updated in this Amendment. Because a fuelbreak proposed to protect a *H. brackenridgei* population is located partially within areas designated as critical habitat for six plant taxa, impacts to critical habitat are addressed in this Amendment as well. Four of the six affected taxa's critical habitat units were addressed in the Makua Biological Opinion and are updated here. Critical habitat for two taxa (*Abutilon sandwicense* and *Eugenia koolauensis*) which were not addressed in the Makua Biological Opinion (because no units occur within the training portion of the action area) are addressed for the first time in this Amendment.

General environmental baseline factors, which are uniform for all species and critical habitat in the training portion of the action area, are described in the Makua Biological Opinion and remain valid. Baseline factors that apply to all critical habitat units within the Puulu to Alaiheihe fuelbreak area are addressed in the General Environmental Baseline Factors section below. These factors include past and present impacts of all Federal, State, or private actions, and other human activities in the action area; anticipated impacts of all proposed Federal projects in the action area that have already undergone formal consultation; and impact of State or private actions that are contemporaneous with the consultation. Details on unique or important factors for particular species or critical habitat units are discussed more fully in the species-specific status and baseline descriptions that follow.

General Environmental Baseline Factors within the Proposed Puulu to Alaiheihe Fuelbreak

The proposed Puulu to Alaiheihe fuelbreak is located on the north slope of the Waianae Mountains, on the north shore of Oahu, in steep valleys ranging in elevation from 158 to 402 m (520 to 1,320 ft). In the fuelbreak area, rainfall averages range from 1105 to 1240 millimeters (43 to 49 inches) per year (Giambelluca *et al* 1986). Slopes within the fuelbreak area average 51 percent but intermittent vertical rock cliff areas are distributed throughout its length (U.S. Geological Survey 2003). The fuelbreak is located on land held in title by Castle & Cooke Hawaii, Inc. The property is leased by Robert Cherry, who operates Flying R Ranch, a cattle and goat production operation. Portions of the fuelbreak are within areas designated as critical habitat for the six taxa shown in Table 1. The fuelbreak area is occupied by alien vegetation as a result of past and present ranching and wildfires, including portions of the 2,269-ha (5,606-ac) Waialua Fire of 2007 (see Table 1 and Figure 1).

Table 1. Critical Habitat Found Within the Puulu to Alaiheihe Fuelbreak Portion of the Action Area.

Critical Habitat Taxa	Size of Critical Habitat Unit	Percentage of Critical Habitat Unit		
		Within Puulu to Alaiheihe Fuelbreak	Burned in Waialua Fire (2007)	Protected From Fire by Fuelbreak
<i>Abutilon sandwicense</i>	604 ha (1,492 ac)	1%	18%	30%
<i>Bonamia menziesii</i>	94 ha (232 ac)	6%	55%	94%
<i>Eugenia koolauensis</i>	113 ha (279 ac)	14%	80%	34%
<i>Euphorbia haelealeana</i>	357 (881 ac)	6%	53%	35%
<i>Hibiscus brackenridgei</i>	560 (1385 ac)	6%	64%	28%
<i>Notrichium humile</i>	237 (586 ac)	3%	44%	74%

According to the Hawaii Gap Analysis Program vegetation map, as of 2005, the proposed grazed fuelbreak area contained the following vegetation: Koa Haole Shrubland: 11 ha (27 ac), Christmas Berry Shrubland: 7 ha (18 ac), Alien Grassland: 7 ha (16 ac), Kiawe-Koa Haole Forest and Shrubland: 7 ha (17 ac), Alien Forest: 1 ha (4 ac), Alien Shrubs and Grasses 2 ha (4 ac) and Mixed Native-Alien Forest 0.2 ha (0.4 ac) (Hawaii Gap Analysis Program 2005). Before human settlement on Oahu, vegetation in lowland areas such as this probably consisted of dry grasslands and shrublands, and shrublands and forests in some areas may have extended all the way to the coast (Cuddihy and Stone 1990). Major threats to critical habitat in the action area related to human activities are non-native plants and animals introduced by Polynesian and Euro-American settlers. These invasive species include ungulates (pigs, goats, cattle, and sheep), rodents (rats and mice), insects (black-twig borer, Chinese rose beetle, two-spotted leaf hopper, long-legged ant, white fly, and scales), other invertebrates (snails and slugs), and hundreds of invasive weed species that compete with native plants for growing space, light, water, and soil nutrients (See the Makua Biological Opinion for more detailed information).

No Federal projects within the fuelbreak portion of the action area have been addressed in any previous formal or informal consultations. Adjacent lands include the Puulu to Alaiheihe Management Unit, the Kaimuhole Gulch portion of which was designated for Army management pursuant to the Makua Implementation Plan Addendum (U.S. Army Garrison 2005a). The Puulu to Alaiheihe Management Unit is predominantly on private land, but extends into the lower edges of the Mokuleia Forest Reserve and Kaala Natural Area Reserve areas managed by the Hawaii Department of Land and Natural Resources.

Status of the Critical Habitat – *Abutilon sandwicense*

Critical Habitat Description

A total of 783 ha (1,935 ac) has been designated as critical habitat for *Abutilon sandwicense* and within six distinct units on Oahu (Figure 11). Critical habitat unit A, on state and private land, the largest of the units, at 604 ha (1,492 ac), was designated to provide habitat for five populations of 300 mature, reproducing *A. sandwicense* (68 FR 36020). Units B through F total 197 ha (443 ac), range in size from 30 ha (74 ac) to 49 ha (121 ac), and are each designated to provide habitat for one population of 300 mature, reproducing *A. sandwicense*

(68 FR 36016, 68 FR36021). Within these units, the primary constituent elements include, but are not limited to, the habitat components provided by steep slopes or gulches in dry to mesic lowland forest and containing one or more of the following associated native plant species: *Antidesma pulvinatum*, *Diospyros sandwicensis*, *Elaeocarpus bifidus*, *Eugenia reinwardtiana*, *Hibiscus arnottianus*, *Metrosideros polymorpha*, *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Pipturus albidus*, *Pisonia* sp., *Pittosporum* sp., *Pleomele* sp., *Psydrax odorata*, *Rauvolfia sandwicensis*, *Reynoldsia sandwicensis*, or *Sapindus oahuensis*; at elevations between 215 and 725 m (705 and 2,378 ft). 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 that are included as primary constituent elements of the habitat required for the conservation of this species (68 FR 36400).

The major threats to *Abutilon sandwicense* critical habitat are competition from the non-native plant species *Ageratina riparia*, *Aleurites moluccana*, *Clidemia hirta*, *Ficus microcarpa*, *Grevillea robusta*, *Hyptis pectinata*, *Ipomoea* sp., *Kalanchoe pinnata*, *Leucaena leucocephala*, *Melia azedarach*, *Melinis minutiflora*, *Montanoa hibiscifolia*, *Oplismenus hirtellus*, *Panicum maximum*, *Passiflora suberosa*, *Pimenta dioica*, *Psidium cattleianum*, *Psidium guajava*, *Rivina humilis*, *Schinus terebinthifolius*, *Syzygium cumini*, and/or *Toona ciliate*; fire; damage from the black twig borer and Chinese rose beetle; habitat degradation and/or destruction by feral pigs and goats and trampling by cattle (Service 1998b; 56 FR 55770; 68 FR 35951).

Approximately 18 percent (105 ha (269 ac) of the 604-ha (1,492-ac) *A. sandwicense* critical habitat unit A (14 percent of all critical habitat designated for this taxa) was burned in the 2007 Waialua Fire (see Figure 11).

Environmental Baseline of the Critical Habitat

Status of the Critical Habitat in the Action Area Less than one percent (4 ha (10 ac)) of *Abutilon sandwicense* critical habitat unit A occurs within the Puulu to Alaiheihe Fuelbreak portion of the Makua action area (see Figure 11). No *A. sandwicense* critical habitat occurs within the training portion of the Makua action area.

Threats to the Critical Habitat in the Action Area Threats to *Abutilon sandwicense* critical habitat in the Puulu to Alaiheihe fuelbreak portion of the action area include fire, grazing, trampling, disturbance by feral pigs, and competition from invasive exotic plants including guinea grass. Ninety-six percent of *A. sandwicense* critical habitat in the fuelbreak portion of the action area was classified as alien vegetation (Hawaii Gap Analysis Program 2005), the site is currently managed as a pasture for cattle and goats (Cherry 2008) and all of the *A. sandwicense* critical habitat within the fuelbreak area was burned in the 2007 Waialua Fire (see Figure 20).

Ongoing Conservation Actions for the Critical Habitat Within the Action Area Other than interagency fire protection efforts, no ongoing conservation actions benefit *Abutilon sandwicense* critical habitat in the Puulu to Alaiheihe fuelbreak portion of the action area.

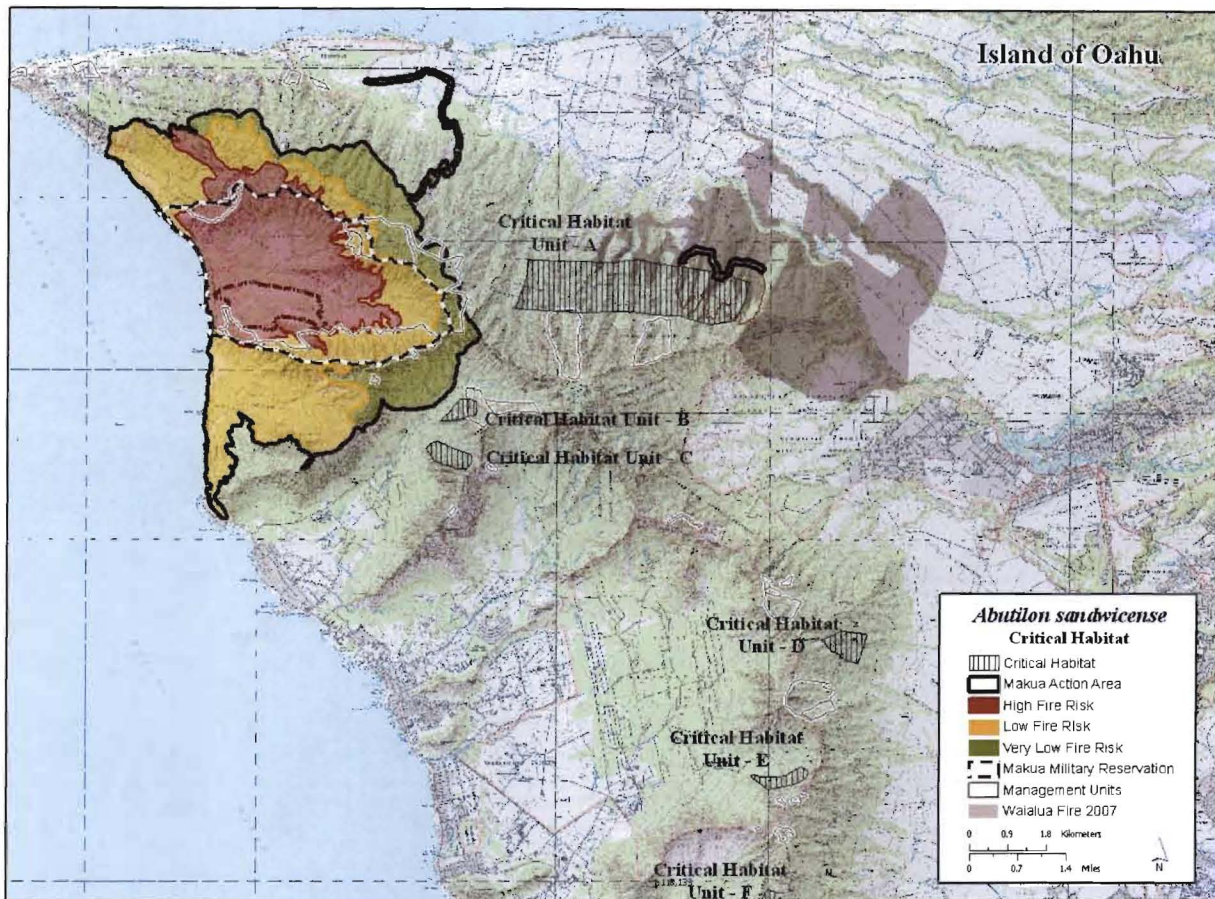


Figure 11. *Abutilon sandwicense* critical habitat in the Waianae Mountains.

Status of the Critical Habitat – *Bonamia menziesii*

The Makua Biological Opinion's description of *Bonamia menziesii* critical habitat remains valid. In summary, a total of 1,795 ha (4,415 ac) has been designated as critical habitat for *B. menziesii* within nine distinct units on four Hawaiian Islands. Two critical habitat units on Kauai total approximately 513 ha (1,267 ac), one unit on Maui is 536 ha (1,325 ac), five units totaling 608 ha (1,503 ac) are designated on Oahu, and one 163-ha (402-ac) unit is designated on Hawaii. Each of the critical habitat units was designated to provide habitat for one population of at least 300 mature, reproducing individuals of *B. menziesii* (68 FR 9116, 68 FR 25934, 68 FR 35950, 68 FR 39624). The primary constituent elements of the units on Oahu include steep slopes or level ground in dry or mesic forest in open or closed canopy at elevations between 81 and 658 m (266 and 2,158 ft), containing one or more of the following associated native plant species: *Acacia koa*, *Alyxia oliviformis*, *Dianella sandwicensis*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Erythrina sandwicensis*, *Hedyotis terminalis*, *Leptecophylla tameiameia*, *Melicope* sp., *Metrosideros polymorpha*, *Myoporum sandwicensis*, *Nestegis sandwicensis*, *Pisonia* sp., *Pittosporum* sp., *Pleomele* sp., *Pouteria sandwicensis*, *Psydrax odorata*, *Rauwolfia sandwicensis*, *Sapindus oahuensis*, *Sicyos* sp., *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 that are included as primary constituent elements of the habitat required for the conservation of this species (68 FR 35950). The major threats to the primary constituent

elements of the critical habitat include the black twig borer, fire, habitat degradation by feral pigs, and stochastic events. Non-native plants, especially *Andropogon virginicus*, *Clidemia hirta*, *Psidium cattleianum*, *Pterolepis glomerata*, and *Toona ciliata*, compete with associated native plants for light, space, and nutrients. In addition, predation of associated native plants by rats, slugs and the Chinese rose beetle threaten critical habitat

Environmental Baseline of the Critical Habitat

Status of the Critical Habitat in the Action Area A total of 34 ha (83 ac) of *Bonamia menziesii* critical habitat, accounting for approximately two percent of range-wide critical habitat for this species, and five percent of all of critical habitat designated for this species on Oahu, occurs within the two portions of the Makua action area (Figure 12). Four percent (28 ha (69 ac)) of all *B. menziesii* critical habitat designated on the island of Oahu is located in two units located entirely within the training portion of the Makua action area and approximately one percent (6 ha (14 ac)), of the 94-ha (232-ac) critical habitat Unit C is located in the proposed Puulu to Alaiheihe fuelbreak portion of the action area. Originally land was proposed as critical habitat for *E. haeleleana* 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 B is a residual portion of that larger piece of proposed critical habitat.

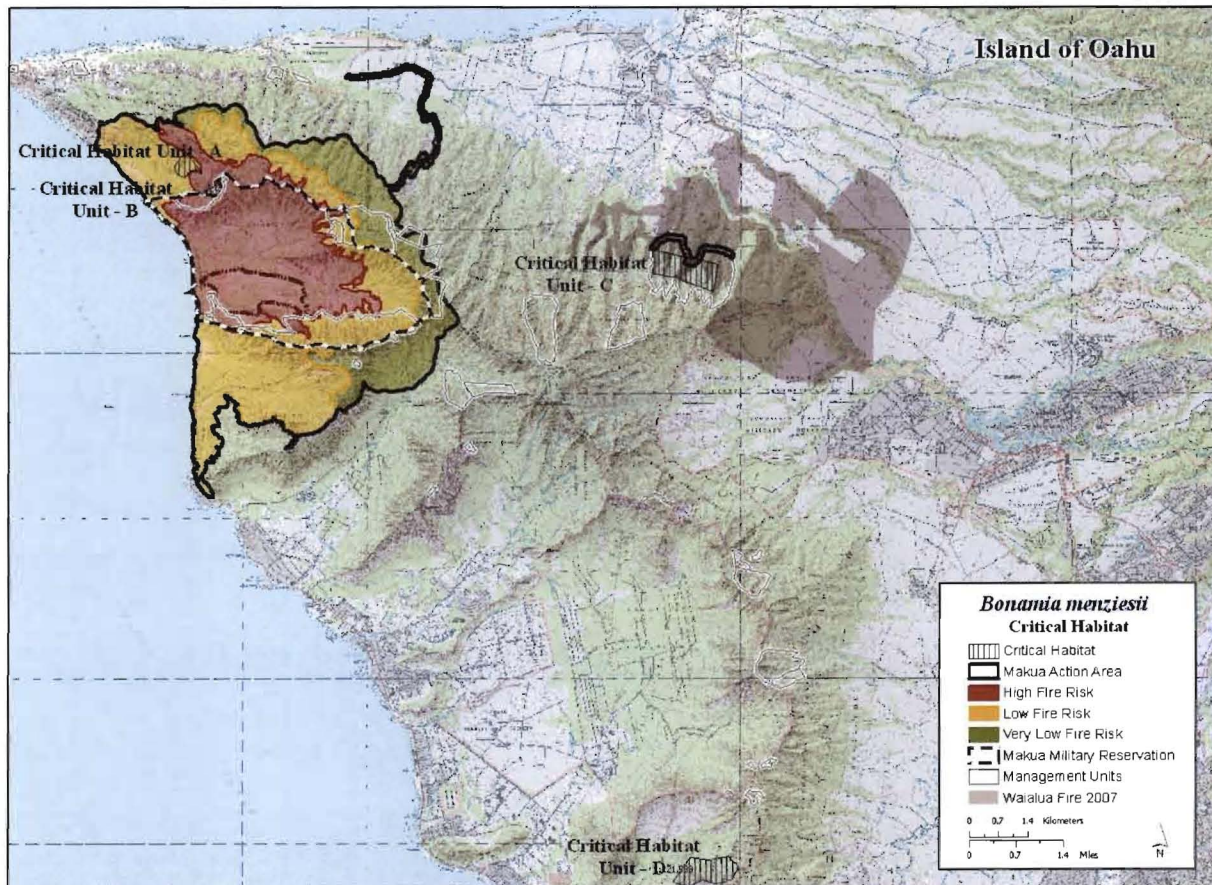


Figure 12. *Bonamia menziesii* critical habitat in the Waianae Mountains.

Within the training portion of the action area, the eight-ha (20-ac) critical habitat unit B, accounting for one percent of *Bonamia menziesii* critical habitat on Oahu, occurs entirely within the high fire risk zone and a 20-ha (49-ac) unit is located in the high and low fire risk zone. These critical habitat units together provide habitat for the conservation of one population of at least 300 mature, reproducing individuals of *B. menziesii*. It is estimated that only one-quarter of the critical habitat within the Makua action area for this species has a native plant component of more than 75 percent (U.S. Army Garrison 1999a and Kawelo, 2004).

Ninety seven percent of the 6 ha (14 ac) of *Bonamia menziesii* critical habitat located in the fuelbreak portion of the action area was classified as alien vegetation (Hawaii Gap Analysis Program, 2005), all of it is currently managed as a pasture for goats (Cherry 2008) and all of it was burned in the 2007 Waialua Fire (see Figure 12).

Threats to the Critical Habitat in the Action Area Threats to *Bonamia menziesii* 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. In summary and to update the Makua Biological Opinion's description of threats, in 2006, the Yokohama Fire, ignited on State land adjacent to Makua, burned 96 percent of *B. menziesii* critical habitat unit A (U.S. Army Garrison 2006f). The edges of unit A appear to have been previously burned in fires attributed to the military in 1970 and 1984 (Costales 2006). Approximately 33 percent of the 7-ha (18-ac) critical habitat unit B was impacted by the 2003 escaped prescribed burn (Enriques 2003). Threats to *B. menziesii* critical habitat Unit C, in the Puulu to Alaiheihe fuelbreak portion of the action area are the same as those in the training portion of the action area except the fuelbreak area is not threatened by fires associated with military training at Makua. Approximately 55 percent of the 94-ha (232-ac) *B. menziesii* critical habitat unit C was burned in the Waialua Fire (see Figure 12). Unit C was designated to provide habitat for one population of *B. menziesii*.

Ongoing Conservation Actions for the Critical Habitat Within the Action Area Conservation actions that include Army fencing and control of non-native plants and rats, described in the Makua Biological Opinion, remain valid. Other than interagency efforts to protect this area from fire, no ongoing conservation actions benefit *B. menziesii* critical habitat in the proposed Puulu to Alaiheihe fuelbreak portion of the action area.

Status of the Critical Habitat – *Eugenia koolauensis*

Critical Habitat Description

Critical habitat was designated for *Eugenia koolauensis* in three units totaling 385 ha (952 ac) on Oahu and one unit of 471 ha (1,164 ac) on Molokai. Critical habitat unit A on Oahu, at 114 ha (280 ac), is located on private land. Critical habitat units B and C on Oahu (149 ha (369 ac) and 122 ha (303 ac) respectively), are both located on State and private land. Critical habitat unit A on Molokai is located on private land (68 FR 35949-35998 and 68 FR 12982-13141). Within the critical habitat units on Oahu, the primary constituent elements include, but are not limited to, gentle to steep slopes or ridges in mesic or dry forests dominated by *Metrosideros polymorpha* or *Diospyros* sp. and containing one or more of the following associated native plant species: *Alyxia oliviformis*, *Bobea elatior*, *Carex meyenii*, *Dicranopteris linearis*,

Leptecophylla tameiameia, *Myrsine lessertiana*, *Nestegis sandwicensis*, *Pleomele halapepe*, *Pouteria sandwicensis*, *Psydrax odorata*, or *Rauvolfia sandwicensis*; at elevations between 57 to 437 m (187 to 1,433 ft) (Service 2003a). On Molokai, *Eugenia koolauensis* was found in rocky gulches or on gentle slopes with deep soil between 475 and 992 m (1,558 and 3,254 ft) in elevation. Associated native plant species include *Diospyros sandwicensis*, *Erythrina sandwicensis* (wiliwili), *Nesoloma polynesianum*, *Nestegis sandwicensis*, *Nototrichium sandwicensis*, *Reynoldsia sandwicensis*, or *Xylosma hawaiiense* (68 FR 35949-35998).

The major threats to *Eugenia koolauensis* critical habitat on Oahu are habitat degradation by feral pigs; competition with non-native plant species such as *Acacia confusa*, *Aleurites moluccana*, *Araucaria columnaris*, *Ardisia elliptica*, *Casuarina equisetifolia*, *Clidemia hirta*, *Cordyline fruticosa*, *Eucalyptus* sp., *Grevillea robusta*, *Hyptis pectinata*, *Lantana camara*, *Melia azedarach*, *Oplismenus hirtellus*, *Panicum maximum*, *Passiflora laurifolia*, *Passiflora suberosa*, *Psidium cattleianum*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*. Approximately 80 percent (90 ha (223 ac)) of the 113-ha (280-ac) *E. koolauensis* critical habitat unit A (27 percent of all critical habitat designated for this taxa) was burned in the 2007 Waialua Fire (see Figure 13).

Environmental Baseline of the Critical Habitat

Status of the Critical Habitat in the Action Area Approximately 14 percent (16 ha (40 ac)) of the 113 ha (280 ac) of *Eugenia koolauensis* critical habitat unit A occurs within the Puulu to Alaiheie Fuelbreak portion of the action area (Figure 13). No *E. koolauensis* critical habitat occurs within the training portion of the Makua action area.

Threats to the Critical Habitat in the Action Area Threats to *Eugenia koolauensis* critical habitat in the Puulu to Alaiheie fuelbreak portion of the action area include fire, grazing, trampling, disturbance by feral pigs, and competition from invasive exotic plants including guinea grass. Approximately 80 percent (90 ha (223 ac)) of *E. koolauensis* critical habitat unit A was burned in the Waialua Fire (see Figure 13).

Ongoing Conservation Actions for the Critical Habitat Within the Action Area Other than interagency fire protection efforts, no ongoing conservation actions benefit *Eugenia koolauensis* critical habitat in the Puulu to Alaiheie fuelbreak portion of the action area.

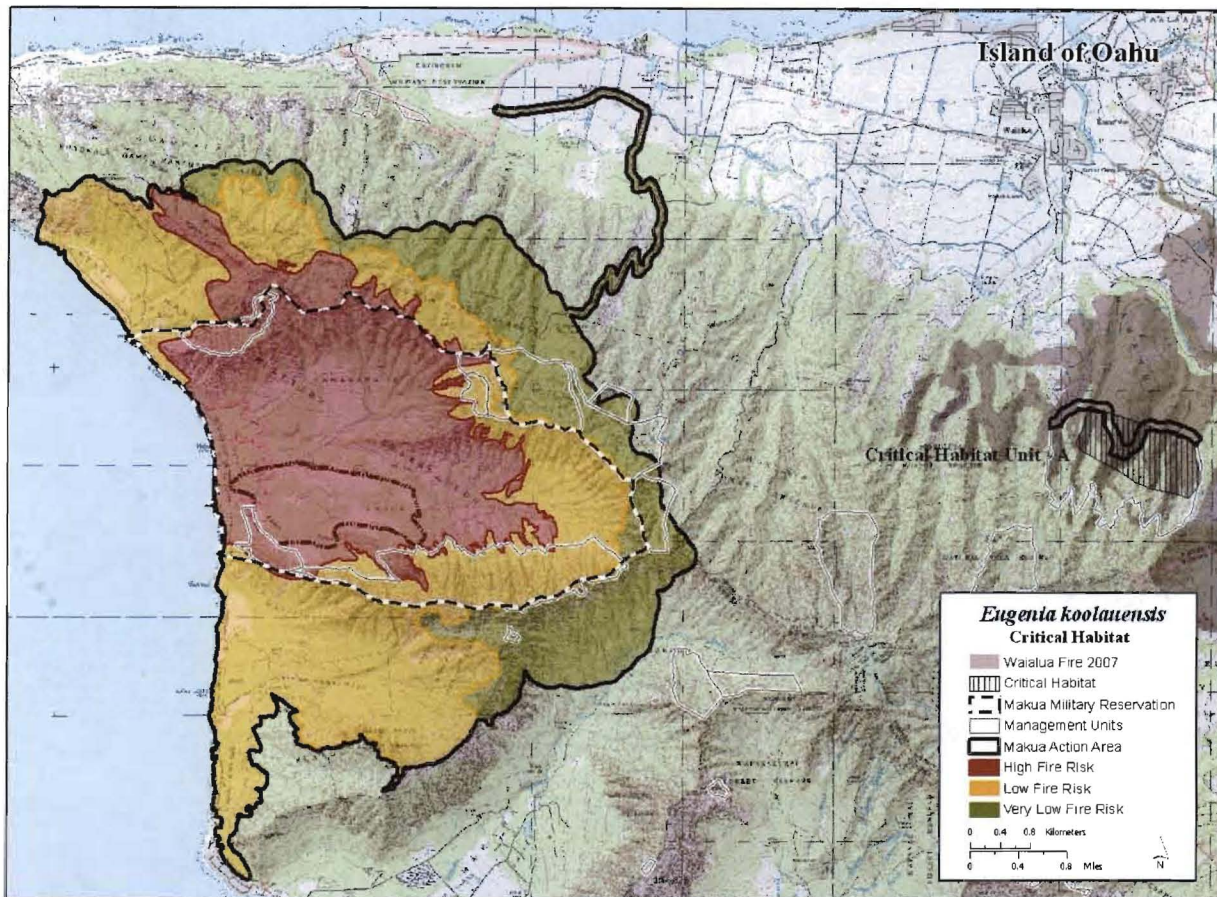


Figure 13. *Eugenia koolauensis* occurring in the vicinity of the Makua action area.

Status of the Critical Habitat – *Euphorbia haeleeleana*

A total of 1,020 ha (2,522 ac) in five separate units has been designated for *Euphorbia haeleeleana*. Three units on Kauai total 659 ha (1,630 ac) and two on Oahu total 361 ha (892 ac). Each unit on Kauai was designated to provide habitat for two populations. On Oahu unit B is 357 ha (881 ac) and was designated to provide habitat for three populations with a minimum of 300 mature, successfully reproducing *E. haeleeleana* individuals (68 FR 9116; 68 FR 35950). Originally land was proposed as critical habitat for *E. haeleeleana* 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 residual portion of that larger piece of proposed critical habitat and represents approximately 4 ha (10 ac). The primary constituent elements of the critical habitat include dry forest dominated by *Diospyros* sp. and containing one or more of the following associated native plant species: *Dodonaea viscosa*, *Erythrina sandwicensis*, *Pleomele* sp., *Psydrax odorata*, *Reynoldsia sandwicensis*, or *Sapindus oahuensis*; and elevations between 156 and 526 m (512 and 1,725 ft). 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 conservation of the species (68 FR 35950). The Makua Biological Opinion's characterization of threats to *E. haeleeleana* critical habitat remains valid.

Environmental Baseline of the Critical Habitat

Status of the Critical Habitat in the Action Area *Euphorbia haeleleana* critical habitat unit A 4 ha (10 ac) is located entirely within the high fire risk zone of the training action area (Figure 14) and approximately 75 percent of the unit is vegetated by native plants (Kawelo 2004; Service 2004a). Approximately six percent of the 357-ha (881-ac) critical habitat unit B is within the Puulu to Alaiheihe fuelbreak portion of the action area. Less than one percent of the *E. haeleleana* critical habitat located in the fuelbreak portion of the action area was classified as Mixed Native-Alien Forest and the rest is mapped as alien vegetation in 2005 (Hawaii Gap Analysis Program) and approximately 90 percent of it was burned in the Waialua Fire (see Figure 14). The whole fuelbreak area is currently managed as pasture for goats (Cherry 2008).

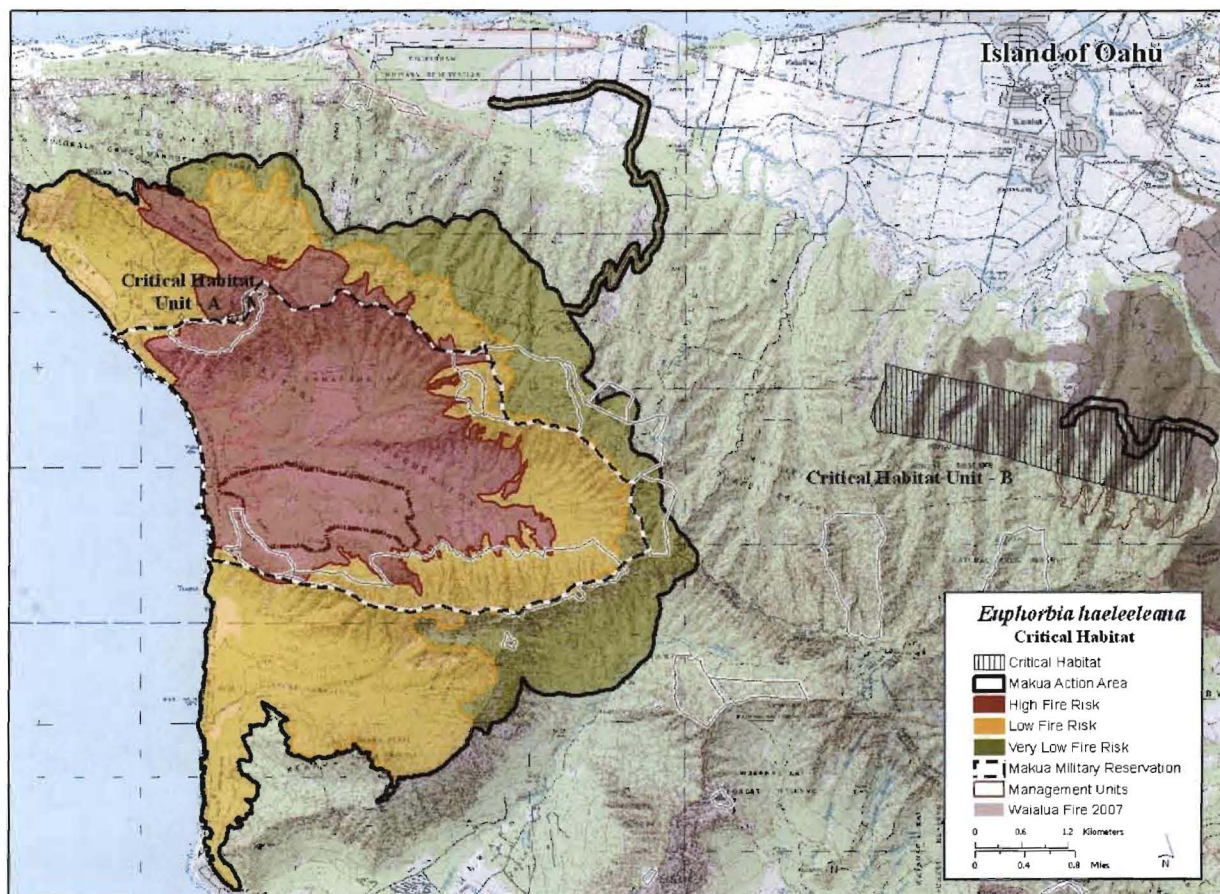


Figure 14. *Euphorbia haeleleana* critical habitat in the Makua Action Area vicinity.

Threats to the Critical Habitat in the Action Area Threats to *Euphorbia haeleleana* 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. Approximately half of unit A was burned in the 1995 and 2003 escaped prescribed burns at Makua (Enriques 2003) and the entire critical habitat unit is within the areas mapped as burned by the 1970 and 1984 military fires (Costales 2006). Within the fuelbreak portion of the action area, approximately 53 percent of critical habitat unit B is within the mapped perimeter of the 2007 Waialua Fire (Keir and Cannarella 2007) and more than half the unit is on private land currently used to raise cattle and goats (Cherry 2008).

Conservation Needs and Ongoing Conservation Actions for the Critical Habitat in the Action Area Conservation needs for *Euphorbia haelealeana* 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 haelealeana* 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. haelealeana* 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*.

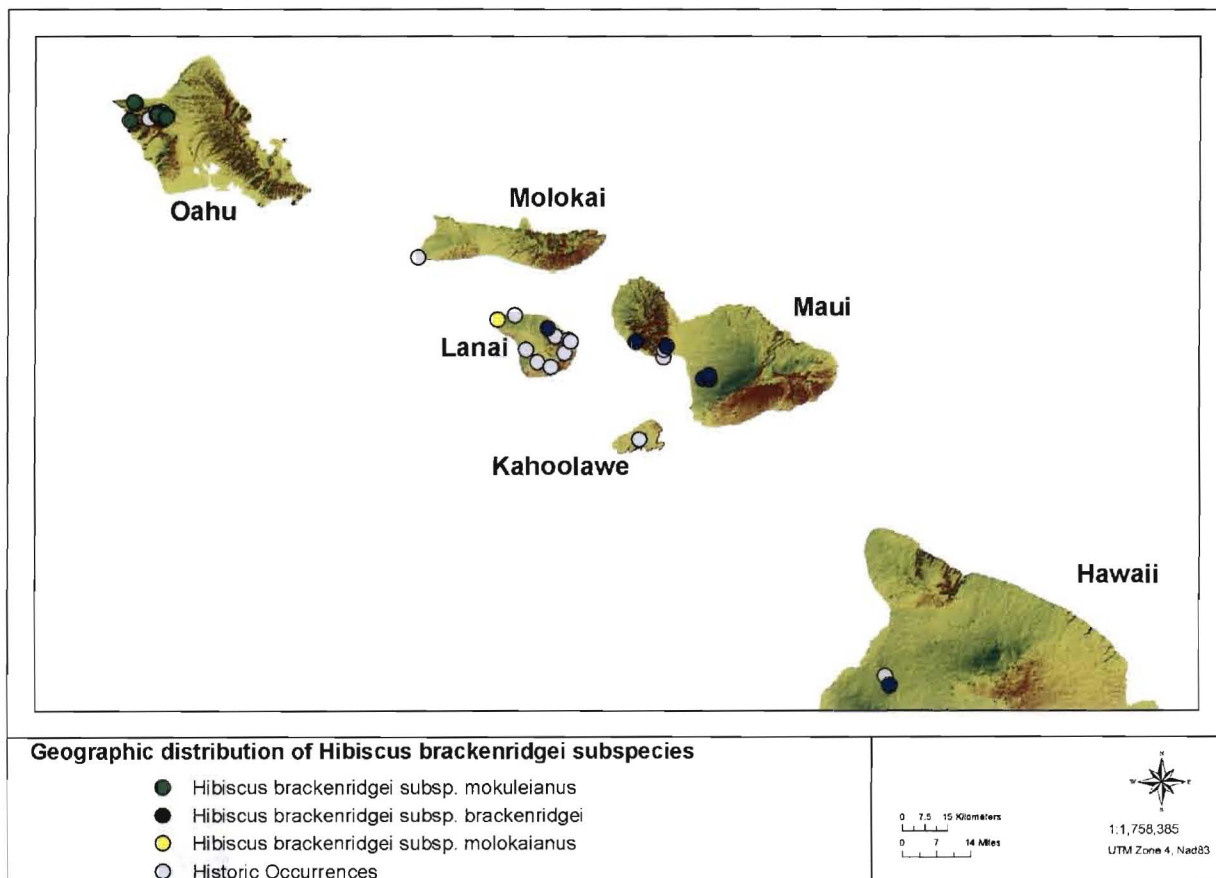


Figure 15. Range-wide geographic distribution of subspecies of *Hibiscus brackenridgei*.

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 Alaihehe 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).

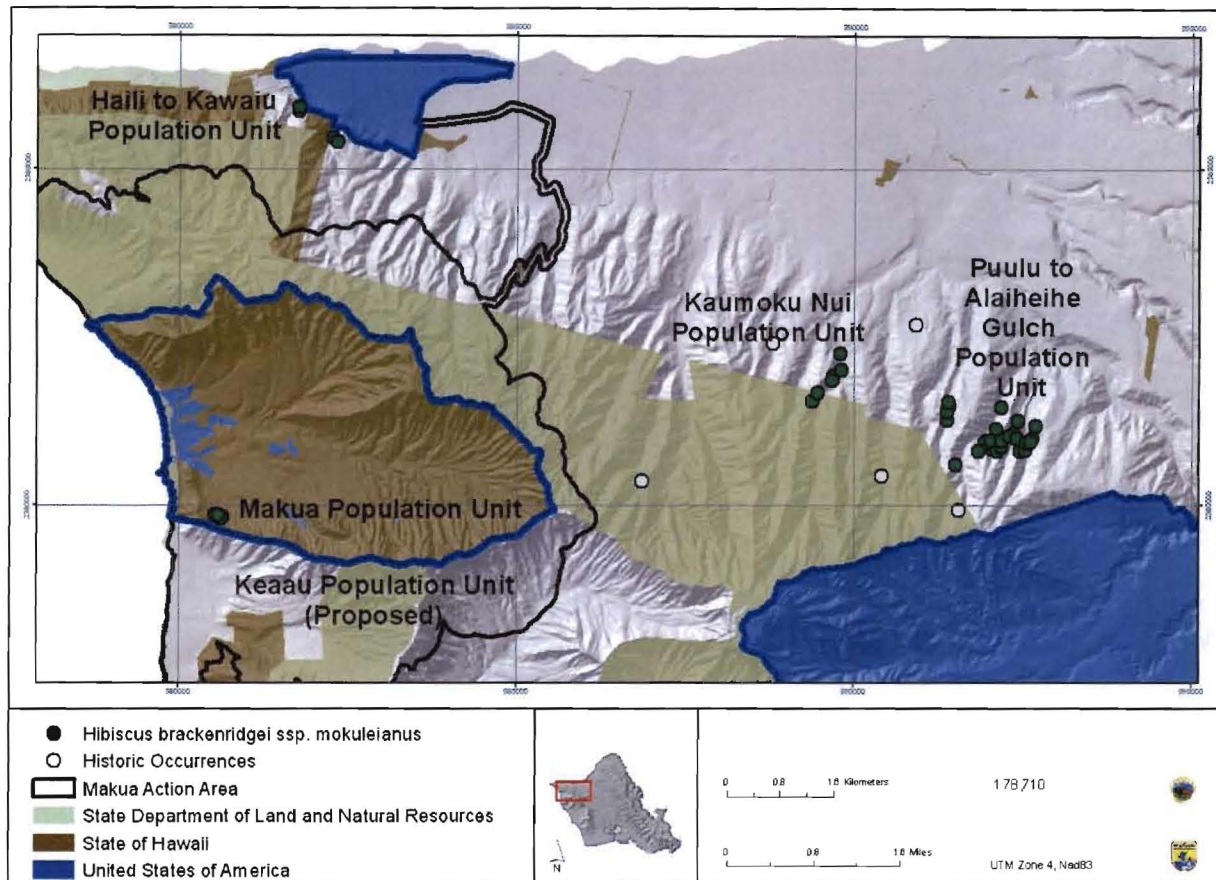


Figure 16. Current and historic distribution of *Hibiscus brackenridgei* ssp. *mokuleianus* in the Waianae Mountains.

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).

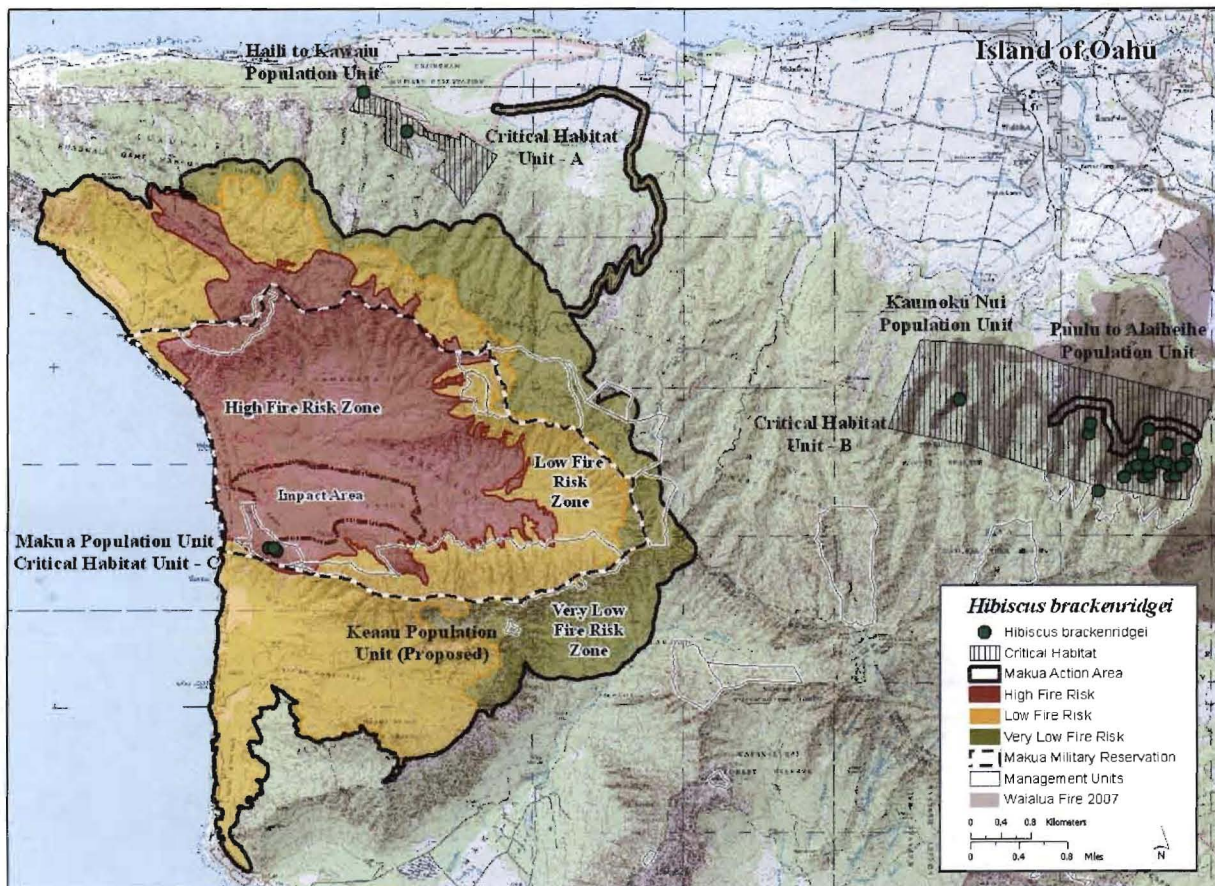


Figure 17. *Hibiscus brackenridgei* population units and critical habitat in the vicinity of the Makua Action Area.

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.

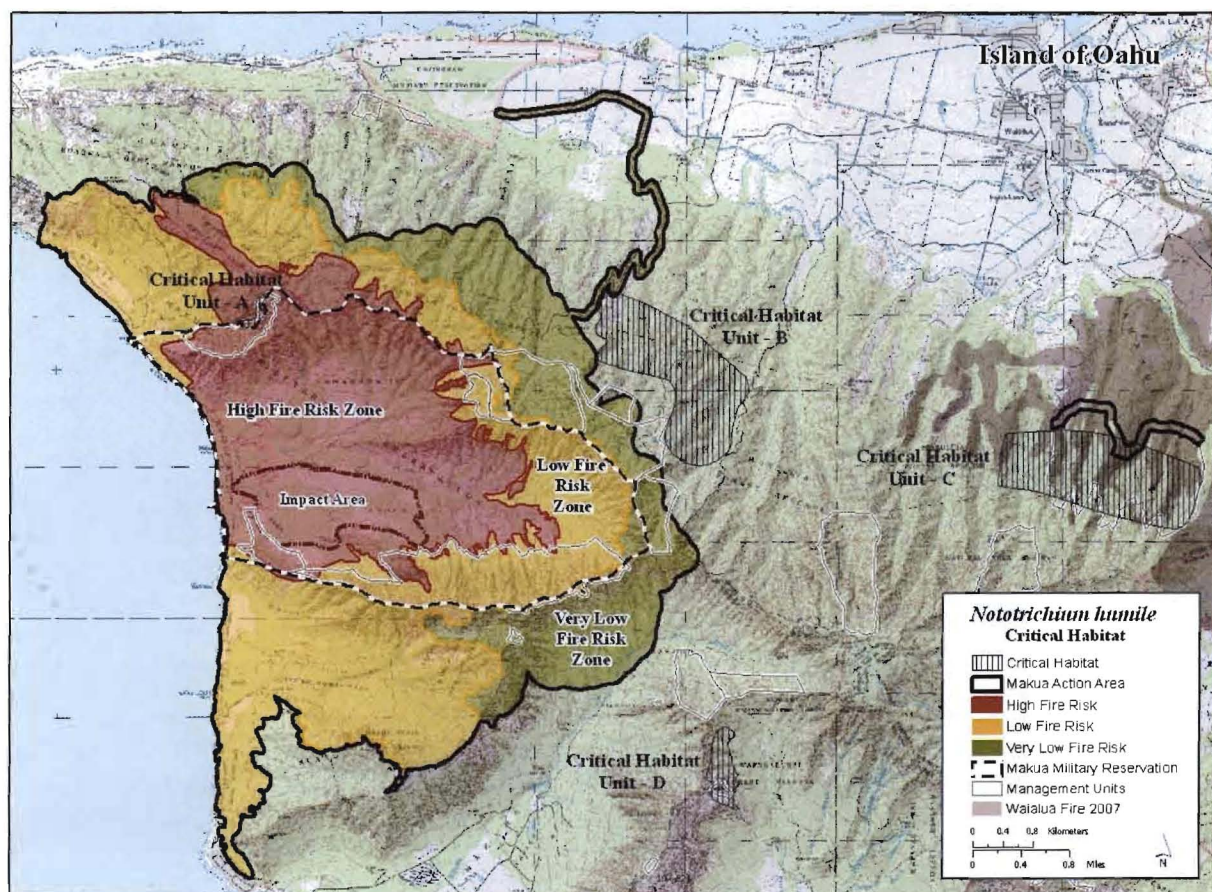


Figure 18. *Nototrichium humile* critical habitat in the vicinity of the Makua Action Area.

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

Opinion), except the fuelbreak area is not threatened by fires associated with military training at Makua. Approximately 44 percent (104 ha (258 ac) of the 237-ha (586-ac) *N. humile* critical habitat unit C was burned in the Waialua Fire (see Figure 18).

Ongoing Conservation Actions for the Critical Habitat Within the Action Area The conservation actions that include Army fencing and control of non-native plants and rats described in the Makua Biological Opinion remain valid. Other than interagency fire protection efforts, no ongoing conservation actions benefit *N. humile* critical habitat in the Puulu to Alaiheihe fuelbreak portion of the action area.

EFFECTS OF THE ACTION

Effects of the action as described in the Project Description of the Makua Biological Opinion and analyzed in the General Effects and species specific effects sections of that Opinion are, with the exceptions noted in this Amendment, still valid. General effects of the proposed Puulu to Alaiheihe fuelbreak, as well as updated general effects of fire retardant and foam, which are applicable to all species and critical habitat addressed in this Amendment, are presented below. Species-specific analysis of effects of training, fuelbreak development, and other Army activities and conservation measures associated with the proposed action are addressed individually following the general effects section.

General Effects of the Proposed Puulu to Alaiheihe Fuelbreak

Development and maintenance of the proposed 35-ha (86-ac) grazed fuelbreak along the bottom edge of the Puulu to Alaiheihe Management Unit will result in adverse impacts to a small portion (one to 14 percent) of critical habitat units designated for six plant taxa (see Table 1). The consequence of grazing management in the fuelbreak area is the temporary loss of vegetative primary constituent elements, increased cover of invasive grass, and increased erosion. The loss of vegetative primary constituent elements within this portion of the critical habitat units will reduce their ability to provide for the conservation of populations of the taxa pursuant to recovery goals. Although years of more intensive grazing within the fuelbreak area will make it more difficult to restore native forest to this grazed area, this adverse impact is not permanent, and it is offset by the reduction in fire impact it affords the species and critical habitat areas above its location. Adverse effects of fuelbreak maintenance to critical habitat would be similar to ongoing impacts to the site associated with ranching, fire, and non-native plant invasion. Fifty three percent (113 ha (280 ac) of the 210-ha (519-ac)) Puulu to Alaiheihe Management Unit area was burned in the Waialua Fire. This fuelbreak, in conjunction with the proposed exclusion of ungulates from the proposed Puulu to Alaiheihe Management Unit, will provide suitable conditions for natural and management-assisted post-fire regeneration of burned areas. Without implementation of the proposed action, this privately-owned site and the forested areas above it are likely to sustain a net loss of recovery value as they continue to be impacted by major threats.

The adverse effects of grazing on shrub and tree survival and recruitment are well documented in Hawaii. Intensive prescribed grazing results in the death of hardwood adults and seedlings and a depletion of the hardwood soil seed bank (Cabin *et al* 2000, pp. 443-446, Blackmore and Vitousek 2000, pp. 627-628, Allen 2000, pp. 1039-1040, Castillo *et al* 2006, pp. 19-21).

Because hardwood species are among the primary constituent elements of critical habitat for all six taxa addressed in this Amendment, grazing will reduce the conservation value of the critical habitat areas within the fuelbreak.

The fuelbreak, with its integrated 60-m (197-ft) intensively grazed area of fuel, will effectively minimize fire risk to the species and critical habitat above it by halting the spread of guinea grass head fires and minimizing spot fires within the management unit. Guinea grass fires produce numerous short-range spot fires within 60 m (197 ft) of the head of the fire (J. Greenlee 2007). In the Waialua Fire area, heavily grazed pastures were not breached by the guinea grass head fire (Figure 19, see Figure 6 photos). The guinea grass pastures within and below the proposed fuelbreak area were not intensively grazed at the time of the fire (Cherry 2008). Creation of the proposed fuelbreak will ensure fuels are continuously managed to minimize fire threat to the management unit.

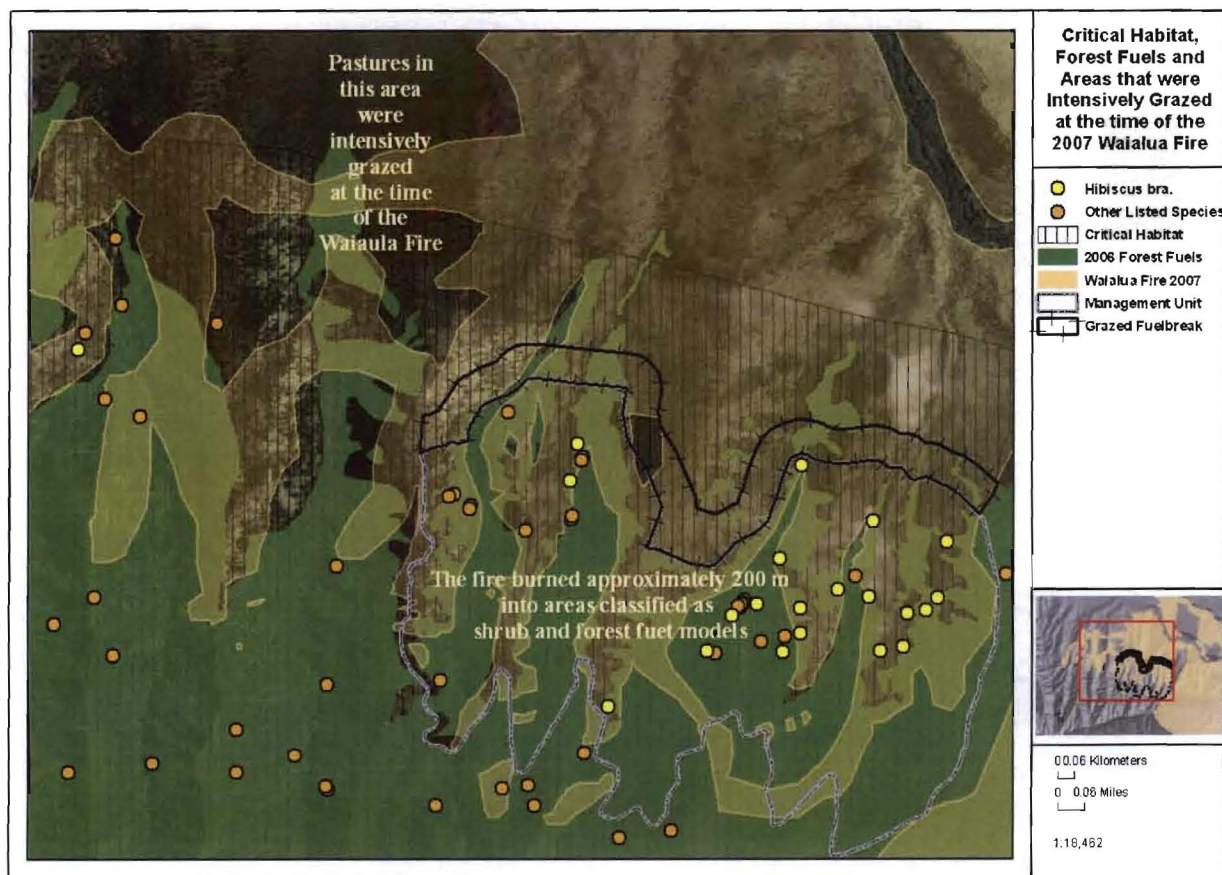


Figure 19. Grazed areas and Forest fuels impacted by the Waialua Fire in the Puulu to Alaiheihe Management Unit area.

By reducing the broad head fire area into a number of small spot fires and limited head fire breaching (in the 10 percent of the area that may not be maintained at the time of the fire), the fuelbreak will reduce the length of active fire perimeter, increasing the likelihood future fires will be contained. In the Waialua Fire, numerous long-range spot fires, ignited grass and forest fuels upwind of the grazed areas and grew large enough to coalesce due to the absence of adequate fire suppression response (Keir and Cannarella 2007). BehavePlus fire behavior

two studies (Larson and Duncan 1982, p. 701; Bradstock et al. 1987, p. 75) have shown high mortality in leguminous shrubs and forbs after retardant application. Indirectly, retardant can affect plant communities and rare plants by facilitating the invasion of non-native species (Bell 2003, p. 20-21, 23; Larson and Newton 1996, p. 140). Retardant application can also affect plant communities and rare plants indirectly by attracting more herbivore and browsers to an application site (Larson and Duncan 1982, p. 702), presumably because of the increased quality of the forage or an increase of biomass. Increases in biomass (Bell 2003 p. 2-3, 21; Larson and Newton 1996, p. 139; Larson and Duncan 1982, p. 701), and decreased plant diversity (Larson and Newton 1996, p. 140; Bradstock et al. 1987, p. 75) have also been noted in the literature but these effects may only last for one year (Bell 2003, p. 3, 20; Larson and Newton 1996, p. 139). These adverse effects to individual plants and critical habitat units would be offset by the increased effectiveness of the fire suppression effort at conserving nearby plant individuals and critical habitat.

Effects of the Action on *Abutilon sandwicense* Critical Habitat

Less than one percent (4 ha (10 ac)) of *Abutilon sandwicense* critical habitat unit A (accounting for approximately one half of a percent of all critical habitat designated for this taxa) occurs within the Puulu to Alaiheihe Fuelbreak portion of the Makua action area (Figure 20). Impacts of grazing management of the fuelbreak area are described in the general effects section of this Amendment. In summary, prescribed intensive grazing will minimize hardwood seedlings establishment, deplete the hardwood soil seed bank, and result in an increase in cover of invasive grass.

Because hardwood species are among the primary constituent elements of critical habitat for *Abutilon sandwicense*, fuelbreak maintenance will result reduced conservation value of this small portion of the critical habitat unit. However, the impacts of fuelbreak implementation will not be substantially different than the impacts of continued exposure to grazing and fire threats already present at the site. Ninety-six percent of *A. sandwicense* critical habitat in the fuelbreak portion of the action area was classified as alien vegetation (Hawaii Gap Analysis Program 2005), the site is currently managed as a pasture for cattle and goats (Cherry 2008) and all of the *A. sandwicense* critical habitat within the fuelbreak area was burned in the 2007 Waialua Fire (see Figure 20).

A total of 128 ha (317 ac) (21 percent) of *Abutilon sandwicense* critical habitat unit A will be protected from fire and grazing within the new Puulu to Alaiheihe Management Unit. Approximately 18 percent (105 ha (269 ac)) of the 604-ha (1,492-ac) *A. sandwicense* critical habitat unit A (13 percent of all *A. sandwicense* critical habitat) was burned in the 2007 Waialua Fire (see Figure 20).



Figure 20. *Abutilon sandwicense* critical habitat occurring within the Puulu to Alaiheihe fuelbreak portion of the action area.

Conclusion

Prescribed intensive grazing management of the proposed Puulu to Alaiheihe fuelbreak will temporarily reduce the establishment of shrubs and trees within less than one percent (4 ha (10 ac)) of *Abutilon sandwicense* critical habitat unit A. However, fuelbreak establishment and Army ungulate exclusion efforts will minimize fire risk to the 21 percent of critical habitat unit A that is within the Puulu to Alaiheihe Management Unit. Without Army management, large portions of critical habitat unit A would continue to lose most of the elements essential to the survival and recovery of the species because of the ongoing threats to this habitat (e.g., ungulates, fires ignited by the public, and invasive plant encroachment). We considered this continued degradation of *A. sandwicense* critical habitat in the evaluation of the effects of the proposed action. Therefore, we have determined the development of the proposed fuelbreak will not result in adverse modification of critical habitat for *A. sandwicense*.

Effects of the Action on *Bonamia menziesii* Critical Habitat

A total of 34 ha (83 ac) of *Bonamia menziesii* critical habitat, accounting for approximately two percent of range-wide critical habitat for this species, and five percent of all of critical habitat designated for this species on Oahu, occurs within the two portions of the Makua action area (see Figure 12).

Training Effects Effects of the proposed action on *Bonamia menziesii* critical habitat within the training portion of the action area as described in the Makua Biological Opinion remain valid. In summary, four percent (28 ha (69 ac)) of all *B. menziesii* critical habitat designated on the island of Oahu is located in two units that occur entirely within the training portion of the Makua action area. The eight-ha (20-ac) critical habitat unit B, accounting for one percent of *B. menziesii* critical habitat on Oahu lies entirely within the zone at high risk of training-related wildfire. Three percent of the 20-ha (49-ac) unit A is within the high fire risk zone and the remaining portion is in the low risk fire zone. The edges of unit A appear to have been burned in fires attributed to the military in 1970 and 1984 (Costales 2006). Approximately 33 percent of the 7-ha (18-ac) critical habitat unit B was impacted by the 2003 escaped prescribed burn (Enriques 2003). It is estimated that only one-quarter of the critical habitat within the Makua training action area has a native plant component of more than 75 percent, indicating a high degree of invasive plant encroachment (K. Kawelo 2004; 68 FR 35950). Although degraded, these units still support individuals of *B. menziesii* and provide habitat that is necessary to meet the recovery goals for this species.

The consequence of training-related fire is the loss of vegetative primary constituent elements and encroachment of non-native grasses and shrubs. The loss of vegetative primary constituent elements within these units reduces their ability to provide for the conservation of one population of *Bonamia menziesii* pursuant to recovery goals. The risk of training-related fire is minimized by the Army's implementation of weapons restrictions, improved grass mowing around the interior of the south lobe of the firebreak road, development of two fuelbreaks, and increased fire suppression staffing procedures described in the Makua Biological Opinion. In addition to reducing fire threat, the Army is enhancing the conservation value of critical habitat unit B by excluding ungulates and controlling non-native invasive plant species within approximately 66 percent of the unit occurring within Kaluakauila Management Unit.

Puulu to Alaiheihe Fuelbreak Effects One percent (6 ha (14 ac)), of the 94-ha (232-ac) critical habitat unit C is located in the Puulu to Alaiheihe fuelbreak portion of the action area (Figure 21). Impacts of grazing management of the fuelbreak area are described in the general effects section of this Amendment. In summary, prescribed intensive grazing will minimize hardwood seedlings establishment, deplete the hardwood soil seedbank, and result in an increase in cover of invasive grass.

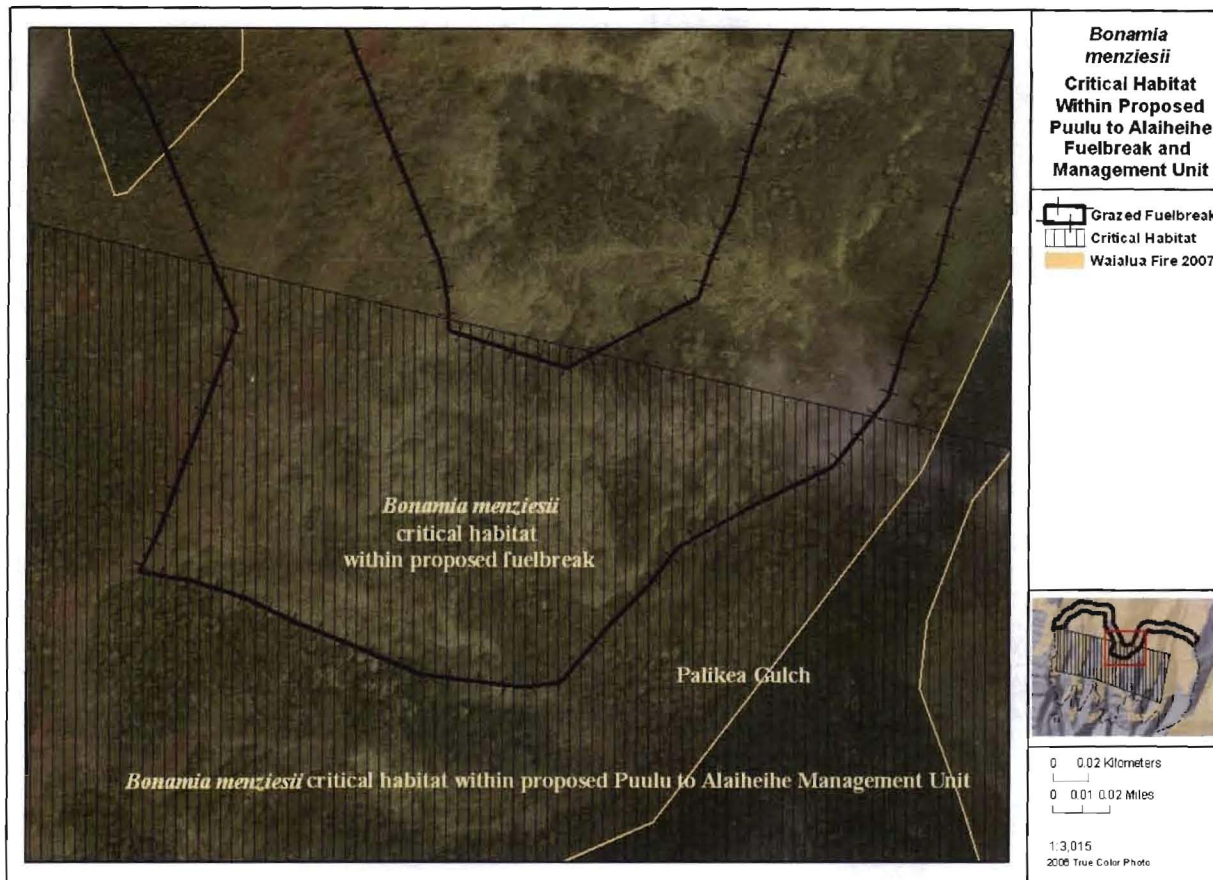


Figure 21. *Bonamia menziesii* critical habitat occurring within the Puulu to Alaiheihe fuelbreak portion of the action area.

Because hardwood species are among the primary constituent elements of critical habitat for *B. menziesii*, fuelbreak maintenance will result reduced conservation value of this portion of the critical habitat unit. However, the impacts of fuelbreak implementation will not be substantially different than the impacts of continued exposure to grazing and fire threats already present at the site. Ninety seven percent of *Bonamia menziesii* critical habitat in the fuelbreak portion of the action area was classified as alien vegetation (Hawaii Gap Analysis Program 2005), the site is currently actively managed as a pasture for cattle and goats (Cherry 2008) and all of the *B. menziesii* critical habitat within the fuelbreak area was burned in the Waialua Fire (see Figure 21).

The fuelbreak will minimize fire risk to the 94 percent (88 ha (218 ac)) of *Bonamia menziesii* critical habitat unit C that occurs within the Puulu to Alaiheihe Management Unit. Approximately 55 percent of the 94-ha (232-ac) *B. menziesii* critical habitat unit C (eight percent of the *B. menziesii* critical habitat on Oahu) was burned in the Waialua Fire (see Figure 21). In addition to reducing fire threat, the Army is enhancing the conservation value of critical habitat unit C by excluding ungulates and controlling non-native invasive plant species within the Management Unit.

Conclusion

Bonamia menziesii critical habitat units A and B are located within areas at high risk of training-related fire in the Makua action area and one percent of critical habitat unit C is located in the Puulu to Alaiheihe fuelbreak portion of the action area. Implementation of all fire suppression measures incorporated into this action and the Army's standard operating procedures will reduce the likelihood that a fire will ignite and travel outside of the firebreak road or that a misfired round will ignite outside of the firebreak road. The risk of training-related fire will be reduced due to the construction of a fuel modification zone between the impact area and the Kaluakauila Management Unit. In addition, fuel reduction within this management unit will further buffer critical habitat units A and B from fire. The portion of critical habitat unit B that is within Kaluakauila Management Unit will be managed to improve its baseline quality pursuant to the Makua Implementation Plan. Most importantly, even though there may be a temporary loss of vegetation due to training-related fire, the restoration of these areas by the Army will provide habitat essential for the conservation of *B. menziesii* and promote long-term recovery of this species. Prescribed intensive grazing management of the proposed Puulu to Alaiheihe fuelbreak will temporarily reduce the establishment of shrubs and trees within one percent of critical habitat unit C. However, fuelbreak establishment and Army ungulate exclusion efforts will minimize fire risk to the 94 percent of critical habitat unit C that is within the Puulu to Alaiheihe Management Unit. Without Army management, critical habitat units B and C would eventually lose most of the elements essential to the survival and recovery of the species because of the ongoing threats to this habitat (e.g., ungulates, fires ignited by the public, and non-native plant encroachment). We considered this continued degradation of *B. menziesii* critical habitat in the evaluation of the effects of the proposed action. Therefore, training-related fire events and development of the proposed fuelbreak will not result in adverse modification of critical habitat for *B. menziesii*.

Effects of the Action on *Eugenia koolauensis* Critical Habitat

Approximately 14 percent (16 ha (40 ac)) of the 113 ha (280 ac) *Eugenia koolauensis* critical habitat unit A (accounting for approximately two percent of all critical habitat designated for this taxa) occurs within the Puulu to Alaiheihe Fuelbreak portion of the Makua action area. Impacts of grazing management of the fuelbreak area are described in the general effects section of this Amendment. In summary, prescribed intensive grazing will minimize hardwood seedlings establishment, deplete the hardwood soil seed bank, and result in an increase in cover of invasive grass.

Because hardwood species are among the primary constituent elements of critical habitat for *Eugenia koolauensis*, fuelbreak maintenance will result reduced conservation value of this small portion of the critical habitat unit. However, the impacts of fuelbreak implementation will not be substantially different than the impacts of continued exposure to grazing and fire threats already present at the site. Ninety nine percent of *E. koolauensis* critical habitat in the fuelbreak portion of the action area was classified as alien vegetation (Hawaii Gap Analysis Program 2005), the site is currently managed as a pasture for cattle and goats (Cherry 2008) and 90 percent of the *E. koolauensis* critical habitat within the fuelbreak area was burned in the 2007 Waialua Fire (Figure 22).

A total of 38 ha (94 ac) (34 percent) of *Eugenia koolauensis* critical habitat unit A will be protected from fire and grazing within the new Puulu to Alaiheihe Management Unit. Approximately 80 percent (90 ha (223 ac)) of *E. koolauensis* critical habitat unit A was burned in the Waialua Fire (see Figure 22).

Approximately 14 percent (16 ha (40 ac)) of *Eugenia koolauensis* critical habitat unit A (accounting for approximately two percent of all critical habitat designated for this taxa) occurs within the Puulu to Alaiheihe Fuelbreak portion of the Makua action area (Figure 22). Impacts of grazing management in the fuelbreak area are described in the general effects section of this Amendment. In summary, prescribed intensive grazing will minimize hardwood seedlings establishment, deplete the hardwood soil seed bank, and result in an increase in cover of invasive grass.



Figure 22. *Eugenia koolauensis* critical habitat occurring within the Puulu to Alaiheihe fuelbreak portion of the action area.

Conclusion

Prescribed intensive grazing management of the proposed Puulu to Alaiheihe fuelbreak will temporarily reduce the establishment of shrubs and trees within approximately 14 percent (16 ha (40 ac)) of *Eugenia koolauensis* critical habitat unit A (accounting for approximately two percent of all critical habitat designated for this taxa). However, fuelbreak establishment and Army ungulate exclusion efforts will minimize fire risk to the 38 percent of critical habitat unit

A that is within the Puulu to Alaiheihe Management Unit. Without Army management, large portions of critical habitat unit A would continue to lose most of the elements essential to the survival and recovery of the species because of the ongoing threats to this habitat (e.g., ungulates, fires ignited by the public, and invasive plant encroachment). We considered this continued degradation of *E. koolauensis* critical habitat in the evaluation of the effects of the proposed action. Therefore, we have determined the development of the proposed fuelbreak will not result in adverse modification of critical habitat for *E. koolauensis*.

Effects of the Action on *Euphorbia haeleeleana* Critical Habitat

Euphorbia haeleeleana critical habitat unit A (4 ha (10 ac)) is located entirely within the high fire risk zone of the training action area and approximately 75 percent of the unit is vegetated by native plants (Kawelo 2004; Service 2004a). Approximately six percent (20 ha (51 ac)) of the 357-ha (881-ac) critical habitat unit B is within the Puulu to Alaiheihe fuelbreak portion of the action area, where vegetation is classified as non-native (Hawaii Gap Analysis Program, 2005), 90 percent of it was burned in the 2007 Waialua Fire, and it is currently managed as pasture for goats (Cherry 2008). The primary constituent elements essential for this species include, but are not limited to, dry forest dominated by *Diospyros* sp. The primary constituent elements that may be affected by a training-related fire and fuelbreak management include those associated native plant species found within dry forest dominated by *Diospyros* sp.

Training Effects Critical habitat unit A is approximately 1 km (0.6 mi) from the impact area and is almost entirely (95 percent) within the Kalaukauila Management Unit where it is at high risk of being burned in fires ignited by the military and the public. Pursuant to the Makua Biological Opinion, the Army will minimize the fire risk to this critical habitat unit by implementing weapons restrictions, installing fuelbreaks, and staffing resources to suppress fires ignited by training and the public. Additional Army management within Kalaukauila Management Unit, including ungulate and weed control, enhances the conservation value of critical habitat unit A.

Puulu to Alaiheihe Fuelbreak Effects Approximately six percent 20 ha (51 ac) of the 357-ha (881-ac) critical habitat unit B is located within the proposed Puulu to Alaiheihe fuelbreak. Impacts of grazing management in the fuelbreak area are described in the general effects section of this Amendment. In summary, prescribed intensive grazing will minimize hardwood seedlings establishment, deplete the hardwood soil seed bank, and result in an increase in cover of invasive grass. Because hardwood species are among the primary constituent elements of critical habitat for *Euphorbia haeleeleana*, fuelbreak maintenance will result reduced conservation value of this portion of the critical habitat unit. However, the impacts of fuelbreak implementation will not be substantially different than the impacts of continued exposure to grazing and fire threats already present at the site. Over 99 percent of *E. haeleeleana* critical habitat in the fuelbreak portion of the action area was classified as alien vegetation (Hawaii Gap Analysis Program, 2005), the site is currently actively managed as a pasture for cattle and goats (Cherry 2008) and 90 percent of the *E. haeleeleana* critical habitat within the fuelbreak area was burned in the Waialua Fire (Figure 23).

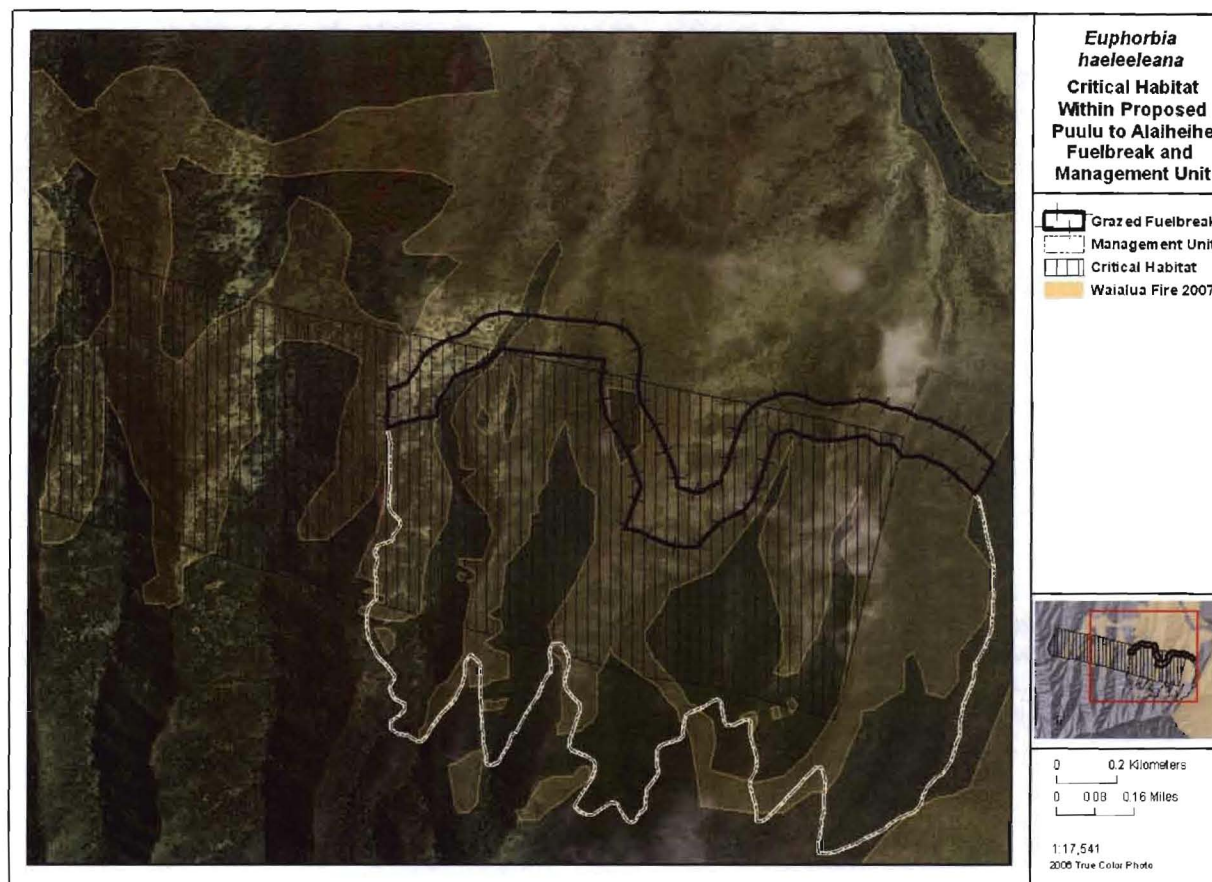


Figure 23. *Euphorbia haelealeana* critical habitat in the proposed Puulu to Alaiheihe fuelbreak and Management Unit.

The fuelbreak will minimize fire risk to the 35 percent (123 ha (304 ac)) of *Euphorbia haelealeana* critical habitat unit B that occurs within the Puulu to Alaiheihe Management Unit. Approximately 52 percent of *E. haelealeana* critical habitat on Oahu (all within unit B) was burned in the Waialua Fire (see Figure 23). In addition to reducing fire threat, the Army is enhancing the conservation value of critical habitat unit B by excluding ungulates and controlling non-native invasive plant species within the Management Unit.

Conclusion

Euphorbia haelealeana critical habitat unit A is located within an area of high risk of training-related fire in the Makua action area and six percent of critical habitat unit B is located in the Puulu to Alaiheihe fuelbreak portion of the action area. The Army will minimize the fire risk to this critical habitat unit by implementing weapons restrictions, installing fuelbreaks, and staffing resources to suppress fires ignited by training and the public. The portion of critical habitat unit A that is within Kaluakauila Management Unit will be managed to improve its baseline quality pursuant to the Makua Implementation Plan. Most importantly, even though there may be a temporary loss of vegetation due to training-related fire, the restoration of these areas by the Army will provide habitat essential for the conservation of *E. haelealeana* and promote long-term recovery of this species. Prescribed intensive grazing management of the Proposed Puulu to Alaiheihe fuelbreak will temporarily reduce the establishment of shrubs and

trees within one percent of critical habitat unit B. However, fuelbreak establishment and Army ungulate exclusion efforts will minimize fire risk to the 35 percent of critical habitat unit B that is within the Puulu to Alaiheihe Management Unit. Without Army management, critical habitat units A and B would eventually lose most of the elements essential to the survival and recovery of the species because of the ongoing threats to this habitat (e.g., ungulates, fires ignited by the public and non-native plant encroachment). We considered this continued degradation of *E. haeleeleana* critical habitat in the evaluation of the effects of the proposed action. Therefore, training-related fire events and development of the proposed fuelbreak will not result in adverse modification of critical habitat for *E. haeleeleana*.

Effects of the Action on *Hibiscus brackenridgei*

Hibiscus brackenridgei is already in a phase of quasi-extinction due to its low numbers and intense range-wide fire, weed, and ungulate threats, in addition to demographic and other stochastic events that can expose populations to local extirpation. We infer from these circumstances, conservation biology principles, and examples from other species that *H. brackenridgei* has a very high background extinction risk in the action area and range-wide. Any additional threats associated with training-related wildland fire and introduction of invasive species would increase the risk of extinction in absence of the implementation of offsetting measures. Additional measures proposed by the Army in this Amendment include actions to minimize adverse impacts as well as increase the likelihood of persistence of plant populations and contribute to the recovery of the species. *Hibiscus brackenridgei* was identified as an expedited stabilization species as a conservation measure to protect this taxon from extinction while full stabilization measures are being implemented. Detailed analyses of training-related fire risk within the Action Area, non-native invasive species impacts, human disturbance, demographic stochasticity, fire suppression, Army conservation and stewardship programs, and expedited stabilization provided in the General Effects section of the Makua Biological Opinion remain applicable and to our analysis in this Amendment.

Species Response to the Proposed Action

The proposed military training and unexploded ordinance disposal, and the fires associated with these actions, could result in direct injury or mortality of *Hibiscus brackenridgei* ssp. *mokuleianus* individuals in the Makua (in situ) and Kaluakauila (reintroduced for genetic storage) population units. *Hibiscus brackenridgei* ssp. *mokuleianus* in the action area also will be exposed to the direct and indirect impacts of competition from non-native plants, particularly alien grasses that spread as a result of wildland fires. In the absence of implementation of the Army's proposed fire risk minimization measures, the population of 104 *H. brackenridgei* ssp. *mokuleianus* in the Makua population unit, located in the Lower Ohikilolo Management Unit and the 35 experimental plants growing in the Kaluakauila Management Unit would be exposed to a high risk of fire resulting from live-fire training (see Figure 17) or those ignited by the public in the vicinity of the installation.

To minimize fire impacts to *Hibiscus brackenridgei* ssp. *mokuleianus* growing in the training portion of the action area, Army Natural Resources Staff will clear grass to less than one percent cover within 3 m (10 ft) of the plants in the Lower Ohikilolo Management Unit to prevent fire spread to the plants. Because of this intensity of vegetation clearing around each

H. brackenridgei ssp. *mokuleianus* individual, the entire area is relatively devoid of grasses (see Figure 3). Although existing grass control has been adequate to protect plants from fire in this area to date, the additional clearing of grass (maintained below 20 percent cover or vegetation is kept mowed shorter than 0.3 m (1 ft)) within the newly expanded Lower Ohikilolo Management Unit weed control area will further minimize fire risk to the plants within this area.

Weapons restrictions, improved grass mowing around the interior of the south lobe of the firebreak road, and improved fire suppression staffing requirements minimize the risk that fires will escape containment by initial attack fire suppression resources. Prior to implementation of Column C weapons restrictions, which permit the use of weapons that are more likely to ignite fires outside the firebreak road, a fuelbreak and firebreak will be established to minimize fire risk to the 35 *H. brackenridgei* ssp. *mokuleianus* plants in the Kaluakauila Management Unit (see Makua Biological Opinion Project Description Section 3.1.4.2). In the event that a fire threatens this site, the fuel treatments installed along the edge of the forested areas of the Kaluakauila Management Unit will provide firefighters, including red-carded Army Natural Resources Staff and fire suppression helicopters, a high likelihood of successfully preventing fire from burning additional forest in this area. No 2.75-caliber rockets or Javelin or TOW missiles will be used until expedited stabilization thresholds are achieved for all four stabilization population units of this species. A second manage for stability population unit will be introduced in the Keaau portion of the action area in accordance with the timelines established by the Makua Implementation Plan (2003) and prior to implementation of Table PD 2 Column D weapons restrictions (see Makua Biological Opinion).

The potential damage to, or loss of *Hibiscus brackenridgei* ssp. *mokuleianus* individuals, due to wildland fires associated with live-fire training will be further offset by the ongoing efforts of the Army to complete stabilization actions for population units outside the action area pursuant to the Makua Implementation Plan Addendum (U.S. Army Garrison 2005). In addition, Army contributions to interagency fire suppression efforts in the vicinity of Pohokuloa Training Area on the island of Hawaii will directly or indirectly benefit those populations of *H. brackenridgei*, which contain between 35 and 54 percent of all known individuals of this species. Stabilization actions include out-planting, ungulate control, off-site Army fuelbreak establishment, fire suppression assistance, and genetic storage are likely to result in increased probability that this species will persist. Four population units will be managed for stability because of the extreme fire threat to this taxon, and because stabilization relies on reintroductions of plants into unoccupied areas. *Hibiscus brackenridgei* ssp. *mokuleianus* is successfully propagated from cuttings and many plants can be quickly propagated. Intensive Army management will benefit two existing population units outside the action area on Oahu (Haili to Kawaiu and Puulu to Alaiheihe). At this time, it is our understanding the owner of the land occupied by the Puulu to Alaiheihe population unit would sell the property at fair market value (Takemoto 2008) and the Army Compatible Use Buffer program funds are available to secure interagency purchase of the site (Yuh 2008). If access to the Puulu to Alaiheihe site is not secured, the effort which would be required to establish a comparable population elsewhere would be substantial.

Interdependent and interrelated effects of the proposed action may result in incidental damage to or loss of *Hibiscus brackenridgei* ssp. *mokuleianus* individuals due to grazing and fence

model (Andrews *et al* 2005) predicts long-range spotting of 1.1 km (0.8 mi), given winds of 18 mph. Therefore, spot fires are likely to ignite above the fuelbreak. Although a number of fire suppression helicopter contractors were grounded and unavailable during the Waialua Fire due to high winds generated by a nearby hurricane (Moller 2007), the Army was able to contribute two fire suppression helicopters to Waialua Fire suppression efforts (Ching 2007). If the fuelbreak had been in place at the time of the Waialua Fire, forest loss would have been minimized within the area currently designated as the Puulu to Alaiheihe Management Unit.

Although the fuelbreak's location, within critical habitat, is not ideal because it impacts critical habitat, the fuelbreak location ensures effectiveness. Approximately 52 percent of the burned management unit area is classified, by the Greenlee and Beavers (2007) pre-fire fuel model map, as forest fuels (see Figure 19). These burned forest areas, in addition to the areas which were not forested, are now dominated by guinea grass (Keir 2008). Because fires burning in cured guinea grass are more intense and spread more rapidly than fires burning in forest fuels, spot fires within these guinea grass areas may grow large (See Table PD 11 in the Makua Biological Opinion for examples of anticipated fire acreage). Plant critical habitat extends 300 to 800 m (984 to 2,625 ft) below the proposed fuelbreak's location, occupying a 92-ha (228-ac) area dominated by guinea grass. However, because multiple spot fires in a large area of guinea grass would more easily exceed the suppression capability of fire suppression resources (as noted on the Waialua Fire (Keir and Cannarella 2007)) the fuelbreak could not be situated farther downslope without sacrificing its effectiveness. The fuelbreak's location minimizes the extent of guinea grass on the upslope side of the fuelbreak, increasing the likelihood of successful spot fire containment, and reducing anticipated fire impacts to listed species and critical habitat. The fuelbreak will provide important conservation benefit to the management unit.

The Army will ensure that the fuelbreak and the ungulate exclusion fencing is constructed within three years and maintained to conserve an otherwise unprotected population of *Hibicus brackenridgei* that occurs in this area. The fencing of the Puulu to Alaiheihe Management Unit and ungulate removal will provide a long-term benefit for the *H. brackenridgei*, along with portions of six critical habitat units. Another option instead of a grazed fuelbreak would be to restore the habitat in this area to slow the spread of fire, however, at this time; the interagency conservation community is not financially equipped to fund fuel type conversion that can be very costly in an area dominated by grass. The adverse effects of grazing will reduce the conservation value of the critical habitat within the fuelbreak area but does not preclude future habitat restoration when funds and technology are available. By reducing fire threat, the proposed Puulu to Alaiheihe fuelbreak increases the suitability of the management unit area for interagency post-fire restoration efforts. The current landowner, Castle & Cooke Hawaii and current lessee Flying R Ranch are supportive of additional interagency efforts to conserve listed species and critical habitat on their land (Takemoto 2008).

General Effects of Fire Retardant and Foam Use

As described in the Project Description of the Makua Biological Opinion, the Army and partner fire suppression agencies may add foam and fire retardant chemicals to water to increase the effectiveness of fire suppression engines and helicopters. Based on a review of the best available scientific literature, most plants are not directly affected by this action. However,

construction. *Hibiscus brackenridgei* ssp. *mokuleianus* seedlings may germinate in the fuelbreak area where grass competition will be reduced, but these plants would not persist due to herbivory from the domestic livestock. However, the loss of the *H. brackenridgei* ssp. *mokuleianus* individuals in the grazed fuelbreak area will be offset by the exclusion of ungulates from the 210-ha (519-ac) management unit that will allow for the natural regeneration of seedlings free from grazing pressure. During fire suppression operations within and outside the action area, chemical fire retardant or foam additives which may be broadcast onto *H. brackenridgei* ssp. *mokuleianus* plants may adversely impact individual plants (see general effects section). Although it is not anticipated because it has not been observed in intensive historic monitoring (U.S. Army Garrison 2005, 2006, 2007), plants in areas where grass is intensively managed either with herbicide or mechanical means may be negatively impacted by the herbicide or may be inadvertently trampled or pulled up by Army Natural Resources Staff.

Conclusion

As a result of the 2007 Waialua Fire, the status of *Hibiscus brackenridgei* ssp. *mokuleianus* substantially declined (see Table 3). Despite the ongoing exposure to the Army's potential wildland fire impacts, Army conservation and stewardship programs will improve the baseline condition for this species in the action area and range-wide. Weapons restrictions, fuel management, fire suppression, invasive species control, and expedited stabilization actions over the next 30 years will increase baseline numbers of *H. brackenridgei* ssp. *mokuleianus* in four population units, including two outside the action area which will not be vulnerable to training-related wildland fire. Reaching expedited stabilization will improve the likelihood that *H. brackenridgei* ssp. *mokuleianus* will attain full stabilization and enhance its probability of persistence over the long-term. The construction of the Puulu to Alaiheihe Management Unit and fuelbreak will benefit this species by reducing the threat of future wildfire in this area and enhancing habitat for natural recruitment of this species. Based on our analysis of the effects of the actions outlined in the Makua Biological Opinion and this Amendment including fire minimization measures, the Service believes that the risks associated with the Army's proposed action are outweighed by the long-term benefits from the Army's expedited *H. brackenridgei* stabilization actions and ecosystem management.

Effects of the Action on *Hibiscus brackenridgei* Critical Habitat

In total, the training and fuelbreak portions of the action area contain two percent of all range-wide critical habitat designated for *Hibiscus brackenridgei*. Critical habitat unit C is a 0.04 ha or 0.1 ac sliver of land within the high fire risk zone at Makua and the Puulu to Alaiheihe fuelbreak portion of the action area contains six percent (35 ha (86 ac) of *H. brackenridgei* critical habitat unit B. In both portions of the action area, the *H. brackenridgei* critical habitat is heavily disturbed and currently dominated by invasive, exotic grasses (Hawaii Gap Analysis Program 2005 and Keir 2008) thereby degrading the vegetative primary constituent elements of the critical habitat.

Training Effects Less than one percent of the total critical habitat for *Hibiscus brackenridgei* is found in one unit within the training portion of the Makua action area (see Figure 17). The small critical habitat sliver is located entirely within the high fire risk area. The primary

constituent elements that may be affected by a training-related fire include those associated native plant species found within a dry shrubland community. It is estimated that critical habitat in this area contains less than 25 percent native plant cover, indicating that this unit is predominantly characterized by non-native vegetation (Kawelo 2004; 68 FR 35950). Portions of this critical habitat may have been impacted by past fire events, which diminishes the conservation value of the habitat by removing the vegetative primary constituent elements. Non-native plant species subsequently out-compete the native plants. In the absence of habitat management, additional fires resulting from future training actions could add to the degradation of this critical habitat unit by removing the remaining vegetative primary constituent elements.

The critical habitat unit is approximately 0.4 km (0.2 mi) from the fire source, and there is a high risk that a fire started in the impact area could move south and impact this unit. Currently, the Army conducts fuel modification in the immediate habitat area of the *H. brackenridgei* var. *mokuleianus* plants, which will reduce the risk of fire and enhance the conservation value of this adjacent critical habitat unit.

To reduce the negative impacts to this critical habitat unit from any fire that escapes the firebreak road, the Army has committed to revegetate burned areas with native plant species to restore the area to pre-burn conditions. While there may be a temporary loss of the conservation value of the critical habitat unit during the revegetation process, the ability of this unit to provide a portion of the habitat essential for the conservation of *Hibiscus brackenridgei* will not be diminished, in the long term, by the proposed action.

Puulu to Alaiheihe Fuelbreak Effects The Puulu to Alaiheihe fuelbreak portion of the action area contains six percent (35 ha (86 ac)) of *Hibiscus 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* (Figure 24).

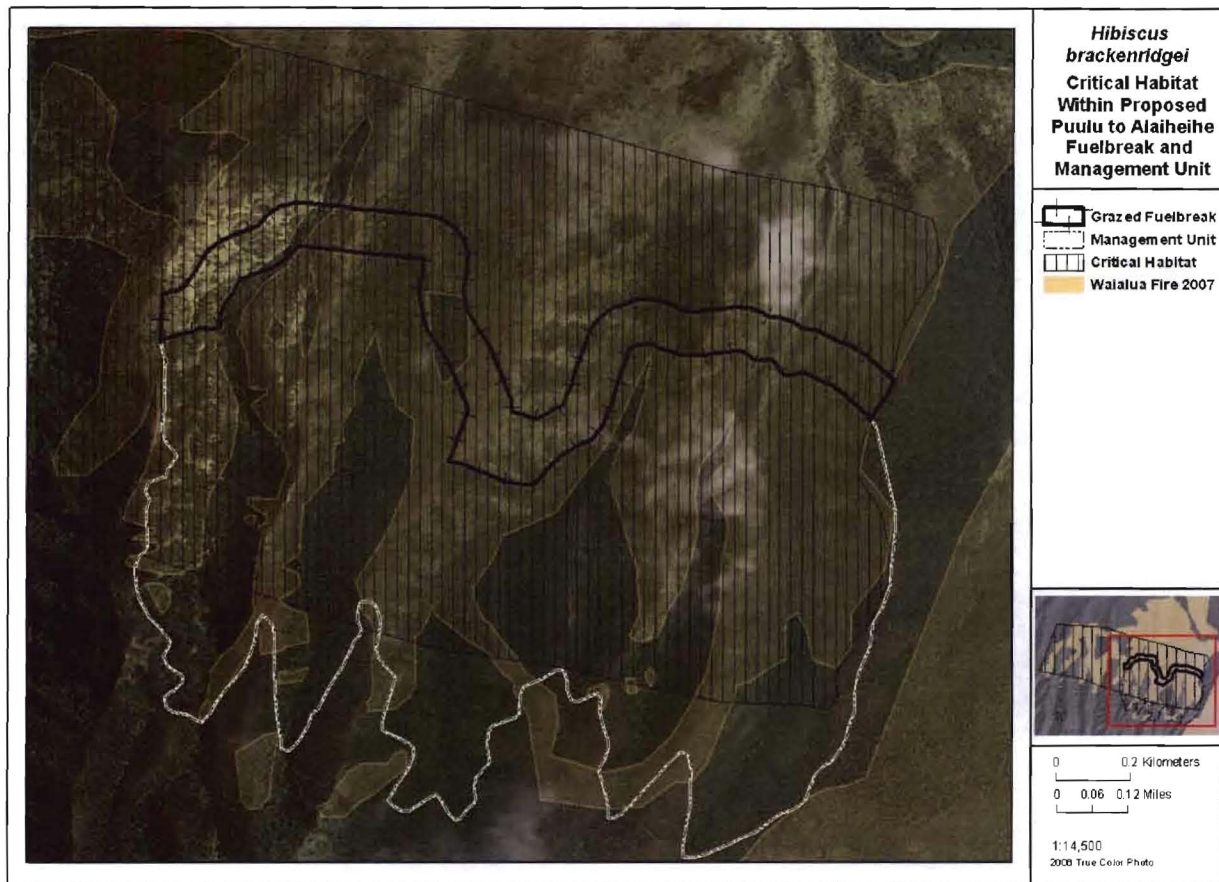


Figure 24. *Hibiscus brackenridgei* critical habitat in vicinity of the Puulu to Alaiheihe fuelbreak.

Like the *H. brackenridgei* critical habitat found in the training portion of the action area the site is dominated by invasive, exotic grasses as a result of historic and ongoing grazing and fire impacts (Gap Analysis Program 2005 and Keir 2008). The proposed fuelbreak will minimize fire risk to the 28 percent (159 ha (392 ac)) of the 560-ha (1385-ac) *Hibiscus brackenridgei* critical habitat unit B that occurs within the Puulu to Alaiheihe Management Unit.

Approximately 44 percent (104 ha (258 ac)) of unit C was burned in the Waialua Fire (see Figure 24). Army fire suppression protection to the Makua, Puulu to Alaiheihe, and Haili to Kawaii *H. brackenridgei* population units will reduce fire impacts to co-occurring areas of critical habitat. In addition to reducing fire threat, the Army is enhancing the conservation value of critical habitat within the Puulu to Alaiheihe Management Unit and in the vicinity of the Haili to Kawaii *H. brackenridgei* population unit by excluding ungulates and, to varying extents, controlling non-native invasive weeds.

Conclusion

In total, the two portions of the action area contains two percent of all range-wide critical habitat designated for *Hibiscus brackenridgei*. In both portions of the action area, the *H. brackenridgei* critical habitat is heavily disturbed and currently dominated by invasive, exotic grasses (Hawaii Gap Analysis Program 2005 and Keir 2008). Implementation of all fire suppression and fuel management measures incorporated into this action and the Army's

project description will reduce the likelihood that a fire will ignite and travel outside of the firebreak road or that a misfired round will ignite outside of the firebreak road. In addition, even though there may be a temporary loss of shrubs within critical habitat unit C due to a training-related fire, the restoration of this area by the Army will prevent the loss, due to Army actions, of habitat essential for the conservation of *H. brackenridgei* var. *mokuleianus* and provide for the long-term recovery goals of this species. The Army's proposed Puulu to Alaiheihe fuelbreak, and ungulate removal and fire suppression protection to the Puulu to Alaiheihe Management Unit will conserve 159 ha (392 ac) of critical habitat unit B. In the absence of proposed Army actions, the primary constituent elements of this portion of the critical habitat unit would continue to be degraded as a result of exposure to threats such as ungulates, fire, and non-native plant encroachment. Therefore, training-related fire events and the proposed fuelbreak will not result in adverse modification of critical habitat for *H. brackenridgei*.

Effects of the Action on *Nototrichium humile* Critical Habitat

The action area contains a total of 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.

Training Effects Effects of the proposed action to the one percent of *Nototrichium humile* critical habitat that occurs within the training portion of the action area as described in the Makua Biological Opinion remain valid. In summary, critical habitat unit A is a total of 5 ha (13 ac), located almost entirely within Kaluakauila Management Unit and 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 overlaps with the very low fire risk zone on the east edge of the training action area. 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). Implementation of all fire suppression measures incorporated into this action and the Army's standard operating procedures will reduce the likelihood that a fire will ignite and travel outside of the firebreak road or that a misfired round will ignite outside of the firebreak road. The risk of training-related fire will be reduced due to the construction of a fuelbreak between the impact area and critical habitat unit A, within Kaluakauila Management Unit. In addition, even though there may be a temporary loss of vegetation due to training-related fire, the restoration of these areas by the Army will provide habitat essential for the conservation of *N. humile* and promote long-term recovery of this species.

Puulu to Alaiheihe Fuelbreak Effects Three percent (7 ha (17 ac)) of the 237-ha (586-ac) *Nototrichium humile* critical habitat unit C is located within the proposed Puulu to Alaiheihe fuelbreak. Impacts of grazing management of the fuelbreak area are described in the general effects section of this Amendment. In summary, prescribed intensive grazing will minimize hardwood seedlings establishment, deplete the hardwood soil seed bank, and result in an increase in cover of invasive grass. Because hardwood species are among the primary constituent elements of critical habitat for *N. humile*, fuelbreak maintenance will result reduced conservation value of this portion of the critical habitat unit. Ninety-seven percent of *N. humile* critical habitat in the fuelbreak portion of the action area was classified as alien

vegetation (Hawaii Gap Analysis Program 2005), it is currently actively managed as a pasture for cattle and goats (Cherry 2008) and all of it was burned in the Waialua Fire (Figure 25).



Figure 25. *Nototrichium humile* critical habitat in the Puulu to Alaiheihe Gulch area.

The proposed fuelbreak will minimize fire risk to the 67 percent (159 ha (392 ac)) of the 237-ha (586-ac) *Nototrichium humile* critical habitat unit C that occurs within the Puulu to Alaiheihe Management Unit. Approximately 44 percent (104 ha (258 ac)) of unit C was burned in the Waialua Fire (see Figure 25). In addition to reducing fire threat, the Army is enhancing the conservation value of critical habitat unit C by excluding ungulates and controlling non-native invasive plant species within the Management Unit.

Conclusion

Nototrichium humile critical habitat unit A and one percent of unit B are located within areas at risk of training-related fire in the Makua action area and three percent of critical habitat unit C is located in the Puulu to Alaiheihe fuelbreak portion of the action area where it will be impacted by grazing. Implementation of all fire suppression and fuel management measures incorporated into this action and the Army's standard operating procedures will reduce the likelihood that a fire will ignite and travel outside of the firebreak road or that a misfired round will ignite outside of the firebreak road. In addition, the portion of critical habitat unit A that is within Kaluakauila Management Unit will be managed to improve its baseline quality pursuant to the Makua Implementation Plan. Most importantly, even though there may be a temporary

loss of vegetation due to training-related fire, the restoration of these areas by the Army will provide habitat essential for the conservation of *N. humile* and promote long-term recovery of this species. Prescribed intensive grazing management of the Proposed Puulu to Alaiheihe fuelbreak will temporarily reduce the establishment of shrubs and trees within one percent of critical habitat unit C. However, fuelbreak establishment and Army ungulate exclusion efforts will minimize fire risk to the 67 percent of critical habitat unit C that is within the Puulu to Alaiheihe Management Unit. Without Army management, critical habitat units A and C would eventually lose most of the elements essential to the survival and recovery of the species because of the ongoing threats to this habitat (e.g., ungulates, fires ignited by the public and non-native plant encroachment). We considered this continued degradation of *N. humile* critical habitat in the evaluation of the effects of the proposed action. Therefore, training-related fire events and impacts of the proposed fuelbreak will not result in adverse modification of critical habitat for *N. humile*.

CUMULATIVE EFFECTS

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur within the area of action subject to consultation. Cumulative effects include the impacts of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Amendment. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Endangered Species Act.

Hibiscus brackenridgei and plant critical habitat in the training and fuelbreak portions of the action area are likely to be exposed to stressors associated with fires ignited by local arson incidents or by public carelessness. Brushfires are common throughout leeward Oahu each summer and are reasonably certain to occur in the future. During June through August 2005, for example, brushfires burned over approximately 2,327 ha (5,750 ac) in the Waianae area (Waianae Valley, Waianae, Maili, and Lualualei) and were attributed to arson or fireworks (*Honolulu Advertiser*, January 2, 2006). Non-military fires of unknown origin burned about 405 ha (1,000 ac) in the Keawaula portion of the action area in July 2006 (*Honolulu Advertiser*, July 14, 2006; U.S. Army Garrison 2006b). Non-military fires also have burned parts of Makua Military Reservation from ignitions along Farrington Highway outside the installation (State of Hawaii Department of Land and Natural Resources 2007). One such fire in July 2006, spread into the Lower Okikilolo Management Unit of Makua, where it burned within 150 m (495 ft) of *H. brackenridgei* ssp. *mokuleianus* plants (U.S. Army Garrison 2006a). Another July 2006, fire burned from along Farrington Highway up to the Kaluakauila Management Unit, where it impacted more than 81 ha (200 ac) that supported genetic storage reintroductions of *H. brackenridgei* ssp. *mokuleianus* (U.S. Army Garrison 2006d). The August 2007 Waialua Fire, burned 2,268 ha (5,606 ac) within and adjacent to the Puulu to Alaiheihe fuelbreak portion of the action area.

Future State actions in the action area include continued management of State lands according to their current designations as Forest Reserves or Natural Area Reserves. The State will continue to manage threatened and endangered species on their lands to the best of their ability. In addition, there will be continued threats to *Hibiscus brackenridgei* in the action area from

feral ungulates as a result of State regulated hunting activities in Forest Reserves and Game Management Areas.

CONCLUSION

After reviewing the current status and environmental baseline of *Hibiscus brackenridgei*, critical habitat for *Abutilon sandwicense*, *Bonamia menziesii*, *Eugenia koolauensis*, *Euphorbia haeleeleana*, *H. brackenridgei* and *Nototrichium humile*, and the effects of military actions in the action area (Makua and the Puulu to Alaiheihē Management Unit/fuelbreak), including the cumulative effects, it is our biological opinion that implementation of the proposed action is not likely to jeopardize the continued existence of *H. brackenridgei* or adversely modify or destroy designated critical habitat for the six plant species addressed in this Amendment.

The non-jeopardy conclusion is based on the following: (1) a risk assessment regarding the potential of a fire igniting and burning plants; (2) Army conservation and stewardship programs that will increase the baseline number of individuals pursuant to the criteria stipulated in the Makua Implementation Plan and the Makua Implementation Plan Addendum; (3) weapons restrictions, fuels management, fire suppression, and construction of fuelbreaks and firebreaks will minimize the risk of wildland fire within and outside the action area; and (4) Army invasive species control including ungulate removal and invasive plant management.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Endangered Species Act (Act) directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The recommendations provided relate only to the proposed action and do not necessarily represent complete fulfillment of the Army's section 7(a)(1) responsibilities for the species. In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

- 1) The Army should develop and implement daily fire suppression helicopter staffing protocols to ensure the interagency and Army-funded fire suppression force is adequate to protect the Army's stabilization population units, particularly when live herbaceous fuel moisture is below 120 percent at the Makua Range weather station.
- 2) The Army should maintain cooperative agreements with Hawaii County and the State of Hawaii to ensure Army fire suppression resources are able to assist with fire suppression efforts, as necessary, on a case by case basis, to protect the *Hibiscus brackenridgei* populations on the island of Hawaii from fire.
- 3) To facilitate communications between Makua and wildland firefighters and cooperators stationed outside Makua valley, the Army should install a new radio repeater within range of Makua Valley.

- 4) To facilitate reintroduction, fire suppression, and fuelbreak planning, Army Natural Resources Staff should add GPS locations of individual plants to their GIS database.
- 5) The Army should hire a fuels management specialist to coordinate the expedited development of Waianae Mountains fuelbreaks, supervise the fire suppression operations of the Army Natural Resource Staff, assist the Army with the development and maintenance of cooperative agreements with interagency fire suppression organizations, and to coordinate fuel moisture and fire behavior research and data collection. This person should be qualified as a National Wildfire Coordinating Group Incident Commander Type 4, should be certified as a single resource boss, and should have completed S-490 (Advanced Fire Behavior) and/or S-491 Intermediate National Fire Danger Rating System.
- 6) The Army should aggressively pursue acquisition and transfer of title to a public or private conservation organization, of the Puulu to Alaiheihe Gulch and Haili to Kawaiu areas to better ensure access for long-term Army stabilization actions. This could be accomplished through the Army Compatible Use Buffer program.
- 7) The Army should establish protocols for hydro-mulching or other large-scale native plant seeding to be used in native habitat restoration efforts.
- 8) The Army should increase nursery facilities with the goal of creating a production-scale facility that is capable of producing large quantities of native plant materials for use in revegetation projects. This native plant stock and seed could be used by the Integrated Training Area Management staff for their revegetation projects. Also, there would be plant materials readily available in case a fire does burn critical habitat and habitat restoration is warranted.
- 9) In order to substantially reduce the fire risk associated with live-fire training, the Army should close Makua to live-fire training (except for short-range training ammunition blanks used in specified areas) when live herbaceous fuel moisture falls below 100 percent at the Makua Range weather station.

REINITIATION STATEMENT

This concludes formal consultation on this action. As required in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operation causing such take must cease pending reinitiation.

The Army will coordinate with the Service if a fire due to military activities or actions occurs outside of any of the firebreak roads established at Makua. No military training activities with live-fire weaponry, except for those that are addressed in this consultation may be used at this installation without coordination with the Service. As stated in the Conclusion (above), the Service's finding of non-jeopardy is based in large part on the conservation measures built into the project by the Army. Should there be a failure to carry out any or all of the described measures, or if the measures are not effective, or if these measures are modified in any way without Service coordination, reinitiation of consultation will be required. References not previously cited in the Makua Biological Opinion are enclosed. If you have any questions regarding this Amendment, please contact Dawn Greenlee at (808) 792-9400.

Sincerely,

A handwritten signature in black ink that reads "Patrick Leonard". The signature is written in a cursive, flowing style.

for Patrick Leonard
Field Supervisor

Enclosure:

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