Informal Consultation and Formal Consultation with a Biological Opinion for the Construction, Maintenance, and Operation of an Infantry Platoon Battle Area and Installation-Wide Impacts of Military Training on Hawaiian Geese (*Branta sandvicensis*) at Pohakuloa Training Area, Hawaii

January 11, 2013
FINAL
2012-F-0241

Kadua coriacea (in bloom)

Photo credit: United States Army Environmental Program

TABLE OF CONTENTS

INFORMAL CONSULTATION **2**

CONSULTATION HISTORY **2**

PROJECT DESCRIPTION **4**

ACTION AREA 5
INFANTRY PLATOON BATTLE AREA PROJECT DESCRIPTION 7
Infantry Platoon Battle Course (IPBC) *7*
Military Operations on Urban Terrain (MOUT) Facility *8*
Live-Fire Shoot House *9*
Travel to Pohakuloa Training Area *9*
Managing Fire Threat Associated with Training in the Infantry Platoon Battle Area *10*
OTHER TRAINING ACTIVITY AT POHAKULOA TRAINING AREA AFFECTING HAWAIIAN GEESE 11
RESTRICTED AIR SPACE 13
DESCRIPTION OF HAZING ACTIVITIES 13

CONSERVATION MEASURES **14**

CONSERVATION MEASURES FOR ASPLENIUM PERUVANIUM VAR. INSULARE 15
CONSERVATION MEASURES FOR KADUA CORIACEA 15
CONSERVATION MEASURES FOR SILENE HAWAIIENSIS 16
CONSERVATION MEASURES FOR SPERMOLEPIS HAWAIIENSIS 16
CONSERVATION MEASURES FOR ZANTHOXYLUM HAWAIIENSE 17
CONSERVATION MEASURES FOR HAWAIIAN GEESE 17

STATUS OF SPECIES **21**

ASPLENIUM PERUVANIUM VAR. INSULARE (FRAGILE FERN) 21
Species Description *21*
Listing Status *22*
Ecology *22*
Historical and Current Distribution *22*
Threats *23*
Conservations Needs of the Species *23*
Ongoing Conservation Actions *23*
KADUA CORIACEA (LEATHER-LEAF SWEET EAR) 23
Species Description *23*
Listing Status *24*
Ecology *24*
Historical and Current Distribution *24*
Threats *24*
Conservation Needs of the Species *24*
Ongoing Conservation Actions *25*
SILENE HAWAIIENSIS (HAWAIIAN CATCHFLY) 25
Species Description *25*
Listing Status *25*
Ecology *25*
Historical and Current Distribution *25*
Threats *26*
Conservation Needs of the Species *26*
Ongoing Conservation Actions *26*

SPERMOLEPIS HAWAIIENSIS (HAWAIIAN PARSLEY) 26
Species Description *26*
Listing Status *27*
Ecology *27*
Historical and Current Distribution *27*
Threats *28*
Conservation Needs of the Species *28*
Ongoing Conservation Actions *28*
ZANTHOXYLUM HAWAIIENSE (HAWAIIAN YELLOW WOOD) 28
Species Description *28*
Listing Status *28*
Ecology *28*
Historical and Current Distribution *29*
Threats *29*
Conservation Needs of the Species *29*
Ongoing Conservation Actions *29*
HAWAIIAN GOOSE (BRANTA SANDVICENSIS) 30
Species Description *30*
Listing Status *30*
Ecology *30*
Historical and Current Distribution *30*
Life History *32*
Habitat Description *32*
Threats *33*
Conservation Needs of the Species *33*
Ongoing Conservation Actions *33*

ENVIRONMENTAL BASELINE (STATUS OF SPECIES IN THE ACTION AREA) 33

ASPLENIUM PERUVANIUM VAR. INSULARE 34
KADUA CORIACEA 34
SILENE HAWAIIENSIS 34
SPERMOLEPIS HAWAIIENSIS 34
ZANTHOXYLUM HAWAIIENSE 34
HAWAIIAN GEESE 34
Recent Distribution of Hawaiian Geese at Pohakuloa Training Area - Range 01 Complex *34*
Hawaiian Goose Sightings at Range 01 Complex in 2009 ..... *35*
Recent Distribution at Pohakuloa Training Area - Impact Area *36*
Recent Distribution at Pohakuloa Training Area - Keamuku Maneuver Area *37*
Recent Distribution at Hakalau Forest National Wildlife Refuge *37*

EFFECTS OF THE PROPOSED ACTIONS 38

MILITARY TRAINING AT THE PROPOSED INFANTRY PLATOON BATTLE AREA 38
Weapons and Ammunition Authorized for Use at the Infantry Platoon Battle Course *39*
Effects on Listed Plant Species *39*
Effects on the Hawaiian Goose *40*
EFFECTS OF MILITARY TRAINING AT POHAKULOA TRAINING AREA TO HAWAIIAN GEESE 40
Direct Mortality to Hawaiian Geese from Training Rounds, Vehicles, and Aircraft Strikes *40*
Noise Impacts to Hawaiian Geese *41*
Specific Impacts to Hawaiian Geese on Direct Fire Ranges *43*
Specific Impacts to Hawaiian Geese on Indirect Fire Ranges *44*
Impacts of Activities on the Keamuku Maneuver Area to Hawaiian Geese *44*
Other Potential Project Impacts to Hawaiian Geese *45*
Effects of Hazing to Non-Breeding Hawaiian Geese *46*
Effects of Hazing to Breeding Hawaiian Geese *47*
Effects of Moving Hawaiian Geese inside the Predator Fences at Hakalau Forest National Wildlife Refuge *47*

CUMULATIVE EFFECTS **48**

CONCLUSION **48**

INCIDENTAL TAKE STATEMENT **48**

AMOUNT OR EXTENT OF ANTICIPATED TAKE 49

REASONABLE AND PRUDENT MEASURES **49**

TERMS AND CONDITIONS **50**

CONSERVATION RECOMMENDATIONS **51**

INFORMAL CONSULTATION **51**

STATUS OF SPECIES 51

Hawaiian Hoary Bat (Lasiurus cinereus semotus) *51*

Hawaiian Petrel (Pterodroma sandwichensis) *52*

AVOIDANCE AND MINIMIZATION MEASURES FOR HAWAIIAN HOARY BATS AND HAWAIIAN PETRELS 53

CONCLUSION FOR INFORMAL CONSULTATION 54

REINITATION STATEMENT **54**

APPENDIX 1 ..... **55**

LITERATURE CITED **56**

PERSONAL COMMUNICATIONS 64

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In Reply Refer To:
2012-F-0241

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Commander, United States Army Garrison- Pohakuloa
Department of the Army
P.O. Box 4607
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Subject: Informal Consultation and Formal Consultation with a Biological Opinion for the Construction, Maintenance, and Operation of an Infantry Platoon Battle Area and Installation-Wide Impacts of Military Training on Hawaiian Geese (*Branta sandvicensis*) at Pohakuloa Training Area, Hawaii

Dear Colonel Shwedo:

This Biological Opinion responds to your request for formal consultation with the United States Fish and Wildlife Service (Service) pursuant to the Endangered Species Act of 1973 (16 USC 1531), as amended (ESA). The Service received your August 17, 2012, request for initiation of formal consultation for the proposed Infantry Platoon Battle Area (IPBA) in the western Impact Area (aka Action Area F), as well as reinitiation of the 2008 Biological Opinion (Service Number 2008-F-0278) to address impacts of military training installation-wide at Pohakuloa Training Area (PTA) to the Hawaiian goose (*Branta sandvicensis*) (Figure 1). Impacts to Hawaiian geese are on-going, while impacts to species affected by the IPBA would begin in October 2013. For reference, the term "installation-wide" refers to effects of military training in both the Pohakuloa Training and Keamuku Maneuver Areas. In addition, requirements of the 2008 Biological Opinion for Hawaiian geese have expired and are replaced by those contained within this Biological Opinion.

The extent of military training and effects on listed species analyzed in the original (2003-F-0002) and secondary (2008-F-0278) PTA Biological Opinions are still applicable and appropriate. All requirements from those Biological Opinions, e.g. Conservation Measures, Terms and Conditions, and Implementation Plans, are still in effect for all species except the Hawaiian hawk (*Buteo solitarius*) and Hawaiian goose. Relative to the Hawaiian hawk, the Service acknowledges receipt of a no effect determination for this species for all anticipated military training at PTA on January 4, 2013. Consequently, Army environmental personnel are no longer required to survey for that species as specified in the 2003 Biological Opinion (USFWS 2003). Relative to the Hawaiian goose, the Service analyzed effects of military training as part of the 2008 Biological Opinion and specified that Biological Opinion should last

three years over which time more information would be collected to better analyze the effects of military training at PTA on the Hawaiian goose (USFWS 2008a). With this subsequent information, such as telemetry data showing Hawaiian geese spending time in the Impact Area, this Biological Opinion quantifies the potential effects of military training installation-wide at PTA, supports the continued use of the Wildlife Enhancement Area at Range 01 Complex established in the 2008 Biological Opinion (USFWS 2008a), and specifies off-site conservation actions funded by the United States Army (Army) to offset effects of military training at PTA on Hawaiian geese.

This Biological Opinion addresses training and conservation-related actions related to new supplementary training proposed in the IPBA, which is located within the area analyzed as the Impact Area for the two previous Biological Opinions. As a result, even though the extent of military training and effects on listed species were previously analyzed across the installation, this proposed project significantly changes the extent and effects within the action area for the proposed IBPA project because that area is no longer part of the Impact Area.

This response represents the Service's Biological Opinion regarding the effects from the proposed project to three endangered animal species: the Hawaiian goose, Hawaiian hoary bat (*Lasiurus cinereus semotus*), and Hawaiian petrel (*Pterodroma sandwichensis*); one threatened plant species (*Silene hawaiiensis*); and four endangered plant species (*Asplenium peruvanium* var. *insulare*, *Kadua coriacea*, *Spermolepis hawaiiensis*, and *Zanthoxylum hawaiiense*). This consultation is based on information obtained from the Army's Biological Assessments (US Army 2012a,b), past Biological Opinions with the Army (Service Numbers 2003-F-0002 and 2008-F-0278), telephone conversations, electronic mail, site visits, biological monitoring, scientific research, subsequent information provided by the Army, and other information available to us. A full administrative record is available at the Pacific Islands Fish and Wildlife Office (see Consultation History).

INFORMAL CONSULTATION

In a letter dated November 7, 2012, you requested our concurrence that the proposed IPBA project may affect, but is not likely to adversely affect the endangered Hawaiian hoary bat and Hawaiian petrel. Following our Biological Opinion, we analyze the effects of the proposed IPBA project on those two species.

CONSULTATION HISTORY

March 21, 2012	The Service received the Biological Assessment from the Army and a request to initiate formal consultation for the IPBA project and to reinitiate formal consultation installation-wide for the Hawaiian goose.
April 20, 2012	The Service sent the Army a deficiency letter to its request for initiation of formal consultation.
June 14, 2012	The Army responded to the Service's letter of April 20, 2012.
June 20, 2012	The Service received another request to initiate formal consultation.

July 11, 2012	The Service (Loyal Mehrhoff, Kristi Young, Patrice Ashfield, Tim Langer, Dawn Greenlee, and Jiny Kim) and the Army (Colonel Eric Shwedo, Bob Eastwood, Robert Rowland, Peter Peshut, and Michelle Mansker) met in Honolulu to discuss the pending formal consultation.
July 16, 2012	Peter Peshut met with Tim Langer and Dawn Greenlee to discuss pending formal consultation.
July 20, 2012	Kristi Young emailed Colonel Shwedo that the Service still lacked sufficient information to initiate formal consultation.
July 25-27, 2012	Tim Langer and Dawn Greenlee met with Army environmental personnel (Peter Peshut, Lena Schnell, Nikhil Inman-Narahari, and Rogelio Doratt) and fire chief Eric Moeller to conduct a site visit.
August 17, 2012	The Service received the Army's third request to initiate formal consultation for the IPBA project and to reinitiate formal consultation installation-wide for the Hawaiian goose.
September 7, 2012	The Army provided the Service all required information to initiate consultation. The Service concurred with initiation of formal consultation and committed to complete the Biological Opinion by December 3, 2012, contingent on timely internal Army approval of conservation actions for the Hawaiian goose.
September 10-13, 2012	Tim Langer and Jiny Kim conducted a site visit at PTA.
September 11, 2012	Service biologists (Tim Langer and Annie Marshall) and PTA environmental personnel (Peter Peshut, Lena Schnell, and Rogelio Doratt) visited Hakalau Forest National Wildlife and meet with Refuge Manager Jim Kraus to discuss conservation actions for the Hawaiian goose.
September-December, 2012	PTA environmental personnel continued to provide pertinent information to the Service, especially regarding off-site conservation actions at Hakalau Forest National Wildlife Refuge. Numerous conference calls were made between the Service (Tim Langer and Jiny Kim) and the Army (Peter Peshut, Lena Schnell, Steve Evans, Rogelio Doratt, and Nikhil Inman-Narahari).
October 31, 2012	Annie Marshall led a site visit by the Hawaiian Goose Recovery Action Group to Hakalau Forest National Wildlife Refuge to discuss possible locations of predator-proof fences for Hawaiian geese with Refuge Manager Jim Kraus.

November 7, 2012	The Army sent a letter requesting concurrence of not likely to adversely affect for effects of the IPBA project on the Hawaiian petrel and Hawaiian hoary bat.
November 21, 2012	Tim Langer, Refuge Manager Jim Kraus, and Army environmental personnel (Peter Peshut, Lena Schnell, Nikhil Inman-Narahari, and Rogelio Doratt) met to discuss off-site conservation for Hawaiian geese at Hakalau Forest National Wildlife Refuge.
November 22, 2012	Colonel Eric Shwedo requested that the Service revise the completion deadline from December 3, 2012, to January 11, 2013.
December 21, 2012	The Service provided the Army the draft Biological Opinion for review.
January 4, 2013	The Service (Loyal Mehrhoff, Kristi Young, Jeff Newman, Jess Newton, Tim Langer, Dawn Greenlee, and Jiny Kim) and the Army (Peter Yuh, Michelle Mansker, Peter Peshut, Lena Schnell, Pamela Sullivan, Steve Evans, Nikhil Inman-Narahari, and Rogelio Doratt) met in Honolulu to discuss the draft Biological Opinion.

PROJECT DESCRIPTION

PTA is located in the saddle region between Mauna Kea, Mauna Loa, and Hualalai volcanoes on the island of Hawaii. In the north central portion of the island, PTA is situated 25 miles south of Waimea and 35 miles west of Hilo. On the north, PTA is bordered by Mauna Kea State Park, Mauna Kea Forest Preserve, and Parker Ranch; on the east and south, PTA is bordered by Hawaii State lands; and on the west, PTA is bordered by Kamehameha School and State lands. PTA is the single largest Army holding in the State of Hawaii at approximately 132,000 acres including a Cantonment Area, Bradshaw Army Airfield, and training areas that include the Keamuku Maneuver Area (KMA) and a centrally located Impact Area (US Army 2012a).

The primary purpose of PTA is to provide training facilities to enhance the combat readiness of military units through a quality joint combined arms facility that offers logistical administrative and service support for up to regiment and brigade-level combat teams. The Army aims to operate and maintain a safe, modernized, major training area at PTA for the Army in the Pacific and other United States Pacific Command units (US Army 2012a).

The United States first used the land at Pohakuloa in 1942 for military maneuvers during World War II and PTA was formally established as an Army installation in 1956. The Army acquired the adjacent 23,000 acres of KMA in 2006. As a multi-functional military training facility for United States Pacific Command units, PTA serves as a primary tactical training area for Mission Essential Task List skills development, as the installation is the only training area in the Pacific where military units can use all weapons systems at maximum capabilities. PTA contributes to the Army's mission by providing resources and facilities for active and reserve component units that train on the installation throughout the year (US Army 2012a).

PTA assets are geared toward live-fire and maneuvers at ranges, dismounted maneuvers, and artillery live-fire. Artillery units use PTA to conduct the majority of their live-fire training in

preparation for deployment. The 25th Infantry Division is the principal live-fire and maneuver user of the installation; other users include the Hawaii National Guard, United States Marine Corps, United States Navy, United States Air Force, and various other Allied Forces. Some 180 civilian and four military personnel are assigned to PTA on a permanent basis, while up to 2,000 troops can be deployed to the installation at any one time (US Army 2012a).

The installation has 23 training areas with 22 live-fire and four, non-live-fire, fixed ranges, seven airborne drop zones, and over 100 field artillery/mortar firing points. Approximately 20 ranges and artillery points are oriented to discharge munitions into the Impact Area. In addition, two non-dud producing rifle ranges are currently oriented east, away from the Impact Area, along Redleg Trail on the eastern side of PTA (US Army 2012a).

The construction of the proposed IPBA will not increase the number of troops training annually at PTA. The impetus for the project is the co-location of the MOUT, IPBC, and Live-fire Shoot House, the width of the IPBC, and enhanced training options and flexibility (US Army 2012a).

Action Area

The action area includes all areas to be affected directed or indirectly by the Federal action, not merely the immediate area involved in the action [50 CFR § 402.02]. The action area for the IPBA project is Action Area F in western PTA and roads used to get there from the Cantonment Area (Figure 1). The action area for Hawaiian geese is the entire PTA installation (including the KMA) and the Hawaiian goose habitat at Hakalau Forest National Wildlife Refuge (Refuge) (see Figure 1), because the project description includes off-site conservation work proposed at the Refuge by the Army. The Refuge is located on Keanakolu Road on the eastern flanks of Mauna Kea between 6,500 and 8,000 feet elevation about 15 miles east of the Pohakuloa Cantonment area. The Refuge is easily accessible via a 90 minute drive in a four-wheel-drive vehicle from PTA.

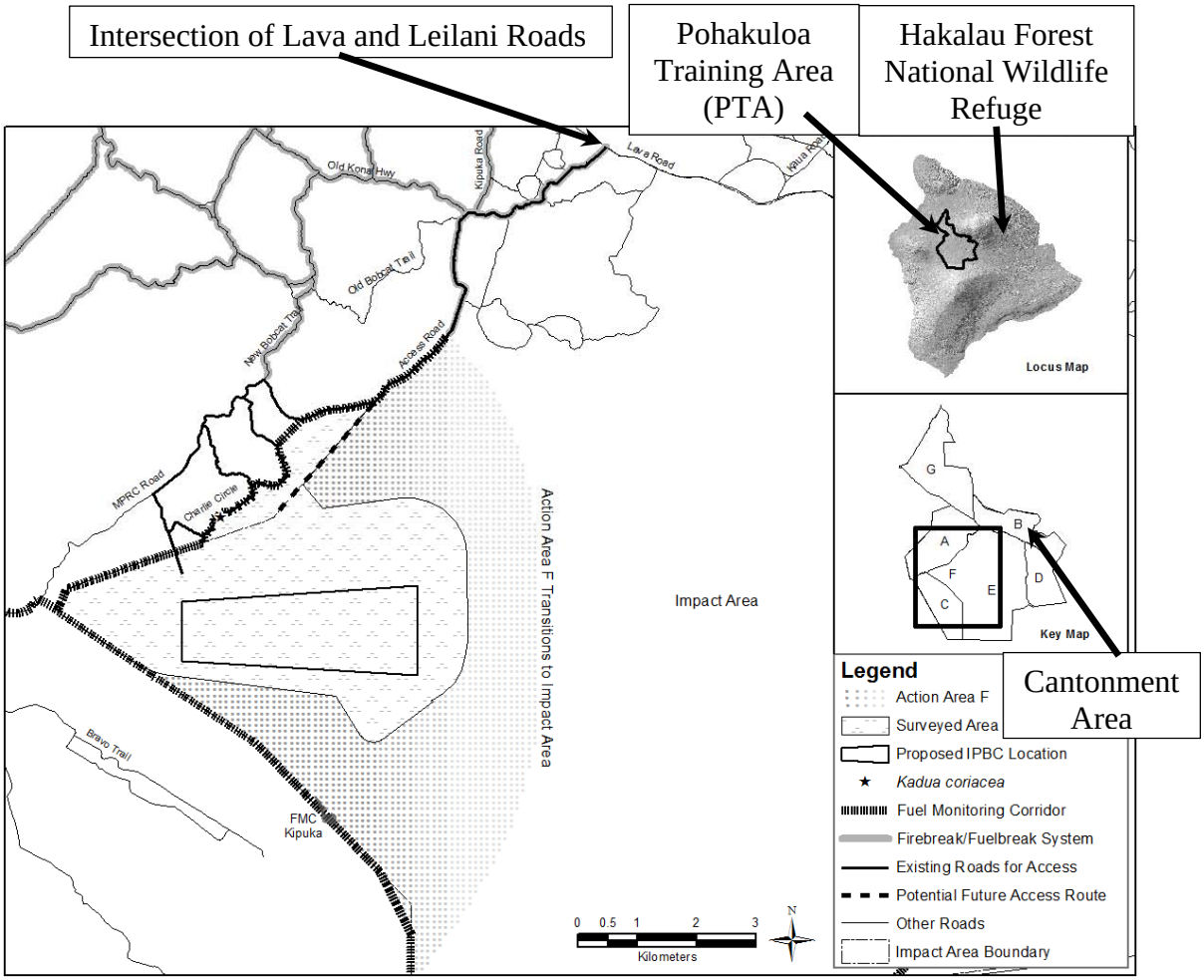

Figure 1. Action Area F is the proposed Infantry Platoon Battle Area (IPBA) on the island of Hawaii. The proposed IPBA includes three training elements: a Live-fire Shoot House, a Military Operations on Urban Terrain facility, and an Infantry Platoon Battle Course (IPBC). For the formal consultation on training effects on the Hawaiian goose, the covered area includes all of PTA, designated as Action Areas A through G, and Hakalau Forest National Wildlife Refuge. For the informal consultation on the Hawaiian hoary bat and Hawaiian petrel, the covered area is only Action Area F. Existing access roads are designated, as well as potential future access routes to the IPBA. Fuel monitoring corridors are indicated to monitor the risk of wildfire spreading from Action Area F to western areas of PTA and plant conservation.

Infantry Platoon Battle Area Project Description

PTA is the only training area in the Pacific Basin where training units can use weapon systems at maximum capabilities and complete all mission essential tasks. PTA is also the only Pacific training facility that can accommodate larger than company-sized units for live-fire and maneuver exercises without degradation of training quality. The proposed IPBA will enhance training at PTA by providing modernized training facilities within a centralized location for military units that eliminates current logistical and training challenges. A part of a series of range modernization projects, the proposed IPBA at PTA will improve the interoperability, standardization, targetry, digital capability, and multipurpose utility for visiting military units.

Within the IPBA, the Army plans to co-locate an automated Infantry Platoon Battle Course (IPBC), a Military Operations on Urban Terrain (MOUT) facility, and a Live-fire Shoot House. Co-locating these facilities will enable infantry companies to maximize valuable training time and resources through simultaneous training of platoons. The collective features of the IPBA will allow infantry platoons to conduct live-fire training necessary for tactical movement techniques in a variety of live-fire or simulated live-fire environments. The improved training capabilities will allow infantry platoons to deploy with the best possible training for combat operations. Currently, the only projected funded for the IPBA is the IPBC. The MOUT and Live-fire Shoot House are only conceptual at this time, but are included in this consultation to account for future implementation.

The proposed IPBA is over 6,000 acres and may ultimately consist of three major training facility components. Although the IPBA is geographically extensive, land disturbance for this range complex is expected to be only 200 to 300 acres: 120 acres for the IPBC, 15 acres for the MOUT, five acres for the Live-fire Shoot House, and the remaining acreage for associated interconnecting roads, trails, and parking areas. To make the most efficient use of each facility of the IPBA (IPBC, MOUT, and Live-fire Shoot House), the Army is planning to construct the MOUT facility and Live-fire Shoot House west of the IPBC (see Figure 1).

Infantry Platoon Battle Course (IPBC)

The Army will construct an automated IPBC to train and test infantry platoons (mounted or dismounted) on the skills necessary to conduct tactical movement techniques to detect, identify, engage, and defeat stationary and moving infantry and armored targets in a tactical array (US Army 2012a). The IPBC is scheduled to begin construction in fiscal year 2013 and will be 3,281 feet wide at the initial entry point, 4,921 feet wide at the final engagement point, and 13,123 feet long. The IPBC will include objectives, helicopter landing areas, a range operations center, vault latrine, and other support facilities. Target arrays will include stationary and moving armor targets, stationary and moving infantry targets, trench obstacle(s), machine-gun bunkers (with sound effects simulator) and an assault/defend house. Target locations will be site adapted to meet established training requirements. All trenches, bunkers, and target emplacements will simulate typical threat scenarios and will also contain battle/sound effects simulators. Mortar simulation device emplacements will be located in areas from where unfriendly mortar fire will be simulated (US Army 2012a).

The IPBC will have associated range operations and control facilities. Supporting facilities may include: a range operations center/tower; an operations/storage building; a classroom; bleachers; a covered dining (mess) area; and an ammunition breakdown point/building. The IPBC will

support a variety of light infantry training events both day and night (e.g., reconnaissance and security, movement to contact, attack, raid, ambush, defend, and retrograde). Infantry platoon training on the IPBC will move dismounted from objective to objective while engaging the targets with rifles (5.56 millimeter (mm) ammunition), machine guns (5.56 mm, 7.62 mm and 0.50 caliber ammunition), and grenade launchers (practice ammunition only). An infantry platoon will normally conduct several practice runs without live ammunition prior to conducting a live-fire exercise (US Army 2012a).

The IPBC will be equipped with the necessary information and telecommunications technologies to safely manage the training events and participating units. To simulate a realistic training environment, the range will incorporate the use of thermal targets, night illumination devices, and visual flash simulators. However, no parachute flares or other pyrotechnics, such as those shot up into the air to illuminate an area, will be used due to risks of igniting a fire (US Army 2012a).

To complete a training event, each platoon will require up to six hours of daylight and six hours of reduced visibility at night. When combined with the time required to set up and close down the IPBC, safety briefings, and after action reviews, the proposed project will include training events equivalent to one platoon per day on the IPBC (US Army 2012a).

Military Operations on Urban Terrain (MOUT) Facility

The Army will build a MOUT facility to prepare military personnel for combat in urban areas. Conceptually, the MOUT is scheduled for construction in fiscal year 2015 or later. The MOUT will replicate an urban environment and will be designed to conduct full-spectrum operations training up to the company level. The MOUT training facility will consist of 370 acres of urban sprawl with 24 modular pre-fabricated structures or intermodal shipping containers sited to replicate small villages for units to complete training tasks in an urban/semi-urban training environment. The MOUT will also include roads, alleys, parking areas, underground sewers, parks, athletic fields, and a command and control building. The core facility will be approximately 800 feet by 800 feet. There is no standard design for a MOUT. The structures that comprise a MOUT are meant to be modular (moveable within the range footprint) so that the range may be redesigned as needed for units to experience variation in target identification and engagement and to conduct a variety of tasks in a simulated urban or semi-urban environment (US Army 2012a).

The MOUT site will be used to train small units, such as patrolling, security, and attack and defend. Friendly and enemy targets may be placed temporarily in the MOUT site (i.e., force-on-target training) or the unit may conduct force-on-force exercises. Only blank, Special Effect Small Army Marking System (aka paint ball), or frangible ammunition will be used. Live-fire ballistic ammunition will be prohibited on this facility and pyrotechnics will not be authorized for training (US Army 2012a).

To complete a normal training event, each platoon will require up to four hours of daylight and four hours of reduced visibility at night. Complex missions require longer time periods. When combined with the time required to set up and close down the MOUT site, safety briefings, and after action reviews, the proposed action will include training events equivalent to one platoon per day at the MOUT (US Army 2012a).

Live-Fire Shoot House

The Army will build a Live-fire Shoot House as part of the IPBA to train and evaluate individual troops and squads on tasks necessary to move tactically (e.g., enter and clear a room, enter and clear a building, engage targets, conduct breaches, and practice target discrimination in a live-fire environment). Conceptually, the Live-fire Shoot House is scheduled for construction in fiscal year 2015 or later. Soldiers will use pistols (9 mm and 0.45 caliber), rifles and light machineguns (5.56 mm), and 12 gauge shotguns. Soldiers and squads will complete several walk-through and practice exercises before conducting a live-fire exercise (US Army 2012a).

The Shoot House will be a two-story building of approximately 4,700 square feet with a roof and stairways. The building will be divided into separate rooms, hallways, target/camera outlets, and precision human urban targets. All vertical surfaces will be covered with bullet absorbing wall panels. The roof will provide weather protection to the building, enhanced realism, reduced light, and provide a superstructure for an overhead crane needed for construction and maintenance of the Shoot House. The PTA Commander will annually review, update, and approve a deviation that restricts the Surface Danger Zone to the interior of the Live-Fire Shoot House (US Army 2012a).

To complete a training event, each platoon will require up to four hours of daylight and four hours of reduced visibility at night. When combined with the time required to set up and close down the Live-fire Shoot House, safety briefings, and after action reviews, the proposed action will include training events equivalent to one platoon per day at the Live-fire Shoot House (US Army 2012a).

Travel to Pohakuloa Training Area

Travel to PTA for the use of the IPBA will not be different in scope or magnitude from current travel to the installation. In addition, the movement of troops and equipment to and from PTA for the use of the IPBA will not be different in scope or magnitude from the current movements of troops and equipment to and from the installation. Effects from these interrelated and interdependent actions on listed species and critical habitat were analyzed by the Service in Biological Opinions completed in 2003 (Service number 2003-F-0002) and 2008 (Service number 2008-F-0278).

Access to the proposed IPBA will be via existing roads. The main access route begins where Lava Road intersects Leilani Road (see Figure 1). The route continues south along Leilani Road to the junction with the Multi-Purpose Range Complex Access Road. The route continues south on the Multi-Purpose Range Complex Access Road to Charlie Circle before turning east to Action Area F. The road will be improved as needed to allow for military traffic. In addition, the Army proposes the construction of a new access route in the future to improve access to the IPBA. The Proposed Future Access Route will begin where the Multi-Purpose Range Complex Access Road emerges from the impact area in Training Area 22. This route will be constructed south along the impact area boundary. Interconnecting roads within the IPBA will be situated to minimize disturbance of listed plant species. In total, dust will be controlled as needed along sections of the access route and interconnecting roads associated with the IPBA project using palliatives over a distance of six to eight miles (US Army 2012a).

Managing Fire Threat Associated with Training in the Infantry Platoon Battle Area

The Army will adhere to the fire threat minimization measures in the most recent version of the Integrated Wildland Fire Management Plan (IWFMP), which is currently the 2003 version. Toward this end, the Army will implement a system of fuel monitoring corridors (FMCs) to monitor and manage fuels adjacent to Action Area F to minimize threats from wildland fire. In addition to the fuel management corridors in the 2003 IWFMP, new FMCs will be developed and maintained that are 328 feet wide and will delineate Action Area F (as shown in Figure 2). Within each FMC, the Army will monitor fuel loads every five years, beginning in 2015, to ensure fuels do not exceed 20 percent total herbaceous aerial cover based on standing vegetation such that a fire would not burn across a FMC. Quantitative specifics for FMCs will be mutually agreed upon by the Service and the Army within one year of the signed Biological Opinion and incorporated into the next version of the IWFMP.

In any length of a FMC where surface fuel load exceeds the 20 percent total aerial cover standard, fuels will either be controlled so the standard is met, or alternatively, be controlled within a 148-foot wide area according to the following standards: 1) on the side of the FMC furthest from the fire threat area, live and dead fine fuels will be eliminated to a width of 15 feet. Scattered trees and shrubs may be allowed to grow; 2) fine fuels within the 67-foot wide area next furthest away from the fire threat area will be reduced and maintained to less than one foot in height and less than 20 percent total herbaceous aerial cover based on standing live and dead vegetation, such that a ground fire burning in this area would not breach the 15-foot wide fine fuel-free area; and 3) to minimize short-range spot fires, fuels will be managed within a 66-foot wide area nearest the fire threat area to ensure that woody vegetation does not burn or torch under 97th percentile fire weather conditions (see Figure 2). Woody vegetation within this outer zone may be limbed or removed. In addition, grass fuel may be removed from the vicinity of the woody vegetation to prevent its involvement in a fire.

Live fire training will not occur unless the standards of 20 percent total aerial cover over the 328-foot wide FMC or those of the 148-foot wide fuels management alternative are met.

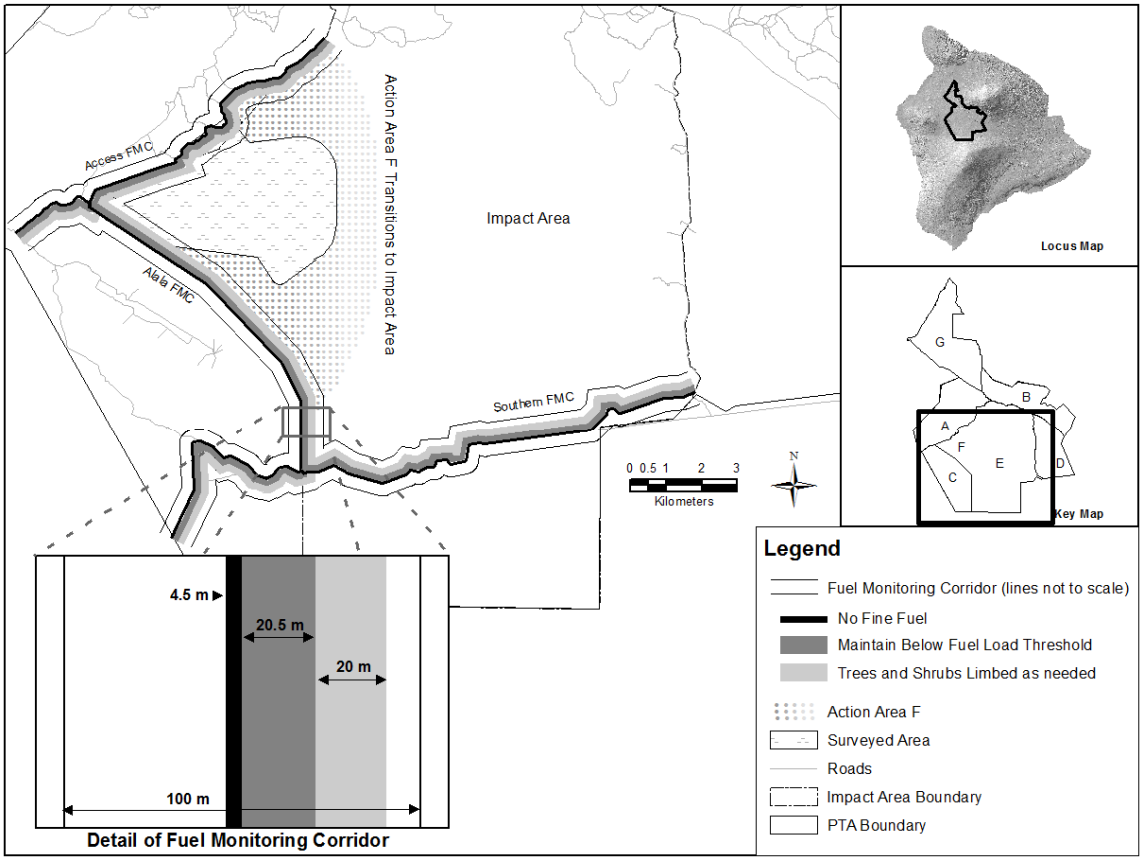

Figure 2. Within each fuel monitoring corridor (FMC), the Army will monitor fuel loads every five years, beginning in 2015, to ensure fuels do not exceed 20 percent total herbaceous aerial cover based on standing vegetation such that a fire would not burn across a FMC.

Other Training Activity at Pohakuloa Training Area Affecting Hawaiian Geese

PTA has 23 training areas encompassing 57,200 acres with 22 live-fire and four non-live-fire fixed ranges, seven airborne drop zones, and 113 surveyed field artillery and mortar firing points. A centrally located Impact Area comprises 51,050 acres and defines the physical location where all munitions lose ballistic energy and descend to earth. Some munitions fail to detonate upon impact and potentially create perilously unstable unexploded ordnance (UXO). The Impact Area at PTA is designated high hazard due to accumulated UXO. See US Army (2012a) for detailed information describing how each training range at PTA is used.

Attempting to reduce the UXO hazards in the Impact Area is generally not feasible at this time and there are hazards beyond what may be taken into account (or reduced) by training and safety measures (USAG-HI 1995). Access to high hazard areas is prohibited at PTA except when specifically authorized by the Range Officer, per 25th Infantry Division (Light) and United States Army Hawaii Regulation Number 210-6 (USAG-HI 1999). Authorization to enter high hazard

areas may only be granted to accomplish a specific maintenance or safety-related task. In addition, a safety plan and risk assessment must be completed, the individual must have UXO awareness training or be accompanied by an Explosive Ordnance Technician, and entry must be done in teams of at least two people with communication maintained at all times with Range Division. The ranges for PTA are arranged so that the range firing lines and target mechanisms are outside the dudded Impact Area wherever possible. For these reasons and given the size of the Impact Area, monitoring take of Hawaiian geese and Hawaiian goose nests within this area is not realistically practicable.

A Surface Danger Zone is the ground and airspace designated within the training complex (to include associated safety areas) for vertical and lateral containment of projectiles, fragments, debris, and components that result from the firing, launching, or detonation of weapon systems to include explosives and demolitions (USAG-HI 1995). The Surface Danger Zone is a depiction of the mathematically predicted area a projectile will impact upon return to earth, either by direct fire or ricochet (Figure 3). The Surface Danger Zone is the area that extends from a firing point to a distance downrange based on the projectile fired. All Surface Danger Zones for ranges and firing points at PTA terminate within the Impact Area, except two Surface Danger Zones for east-facing rifle ranges in Training Area 21 located on Redleg Trail. No dud producing munitions are permitted for use at these east-facing ranges.

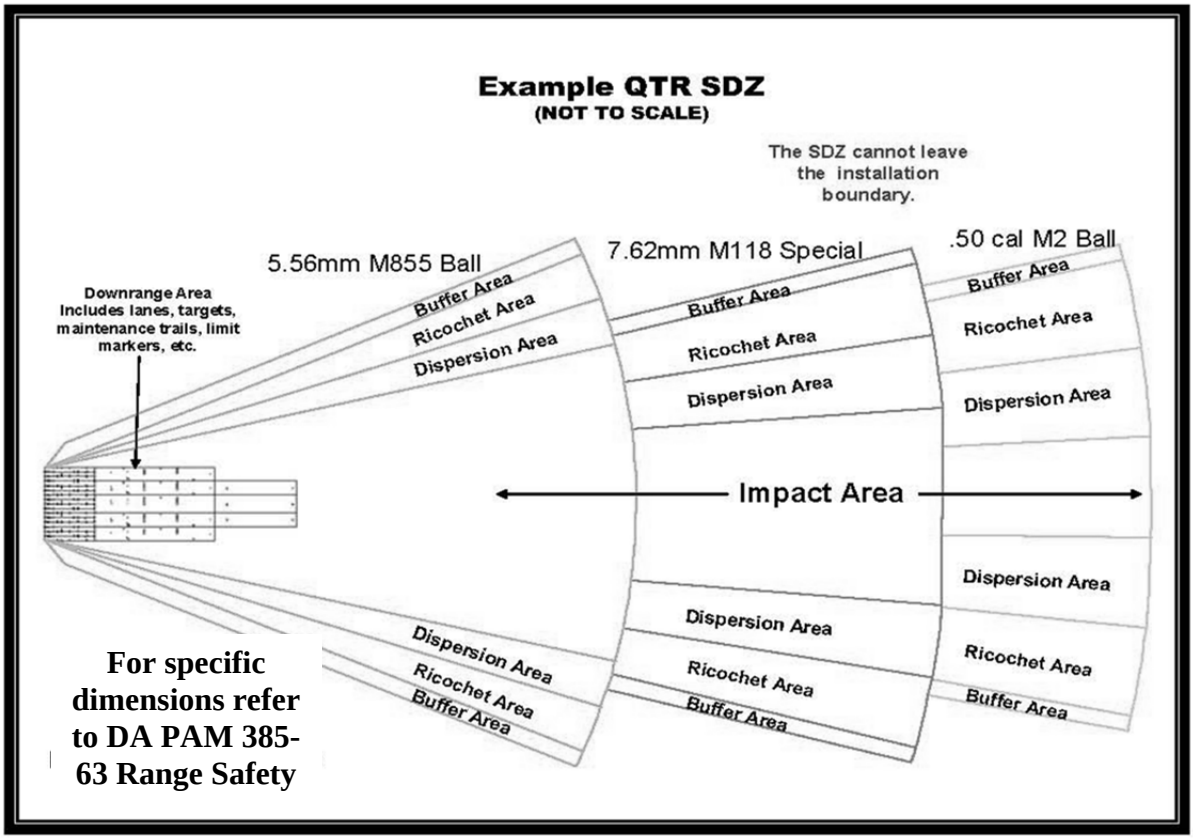

Figure 3. Example of a Surface Danger Zone (SDZ) at a United States Army Qualification Training Range (QTR).

Artillery units need a number of firing points to practice various training scenarios. Range safety policy and Surface Danger Zones for direct and indirect fire modes are described in Army Regulation 385-63 Range Safety (May 19, 2003) and Department of the Army Pamphlet 385-63 Range Safety (August 4, 2009). The Range Facility Management Support System listed the following indirect-fire (artillery and mortars) data for PTA in 2010 (USAG-HI 2011a, 2011b, 2011c):

- Artillery: 105 mm and 155 mm;
- Mortars: 60 mm, 81 mm, and 120 mm;
- 61 firing points were used;
- Of the 14,762 firing-point days available (full capacity is 242 days per year at each of 61 firing points), 2,017 days were scheduled (13.7%);
- Of the 2,017 firing-point days that were scheduled, 1,097 days were used (54.4%);
- The firing points were used 7.4% of the days that were available;
- 37,619 rounds were fired in 2010; and
- A review of Serious Incident Reports indicated that there were zero rounds that landed short or outside of the Impact Area.

PTA records indicate only four confirmed short round incidents: two in 1995 and two in 1996. In October 2001, an illumination round may have been fired short or drifted from the Impact Area into the fenced area of the Kipuka Kalawamauna East Fence Unit and was presumed the cause of a wildland fire, but no official report was filed for this incident. Use of illumination rounds is restricted on the western side of PTA and illumination rounds will not be used on the IPBA due to risks of igniting a fire.

Restricted Air Space

Airspace above PTA is Restricted Area (R-3103). This special use airspace is under the control of the Range Office at PTA. R-3103 extends from surface upward to 30,000 feet according to an agreement with the Federal Aviation Administration. While the Federal Aviation Administration is the controlling agency of the airspace over Hawaii, a letter of procedure establishes the PTA Range Office as the using agency. During typical operations, R-3103 is available for military use. Use encompasses airspace for firing small arms, firing field artillery projectiles, and flying military aircraft.

Description of Hazing Activities

If appropriate and the Army chooses to do so, PTA environmental personnel may conduct hazing to deter Hawaiian geese from foraging, loafing, and nesting on or near any training range installation-wide at PTA. The goal of the program would be to haze Hawaiian geese to such an extent that they are not present in areas where they could otherwise be harmed as a result of training activities. Only the techniques outlined in this document may be used to haze Hawaiian geese.

Authorized hazing actions consist of non-lethal, auditory and visual techniques confined to vehicle horns, human vocalizations, hand clapping, foot stomping, or flashing vehicle lights. Hazing may only be conducted with the on-site direction, supervision, and participation of qualified PTA environmental personnel. PTA environmental personnel will be qualified to

direct and supervise hazing operations after having received training from the Service or United States Department of Agriculture – Wildlife Services (USDA-WS) personnel. USDA-WS is currently allowed to conduct hazing of federally listed species pursuant to an Agent Designation Letter (WSHAWAII-AGENT-16).

Hazing actions will not include touching or handling of Hawaiian geese. Vehicles will be allowed to approach Hawaiian geese to use the horn or lights for hazing, but moving vehicles are not authorized to herd, push, or otherwise harass Hawaiian geese. All hazing operations will be documented by PTA environmental personnel, who will submit a summary of hazing operations and outcome of related actions to the Service annually at the end of each fiscal year.

Hawaiian geese may be hazed from any training area at PTA installation-wide. However, Range 01 Complex is the primary area where conflict occurs between military training and Hawaiian geese. In the area adjacent to the three sub-ranges at Range 01 Complex and the Wildlife Enhancement Area, Hawaiian geese have often been documented feeding and loafing over the past several years. In this area, before selecting hazing as an option to minimize impacts to Hawaiian geese, the Army will first attempt to make the habitat less attractive to Hawaiian geese by herbiciding food plants that attract Hawaiian geese to this area. However, the Service is not requiring that the Army herbicide vegetation on a training range because doing so would degrade the quality of habitat for training. Also, herbicide treatment is not required prior to conducting hazing activities at any other training range at PTA.

During the Hawaiian goose nesting and breeding season (September through March), PTA environmental personnel will observe Hawaiian geese prior to hazing actions to determine whether a nest or goslings are present. Brooding adults (i.e., adults with an active nest or goslings) will generally not be hazed; however, if nests or goslings are interfering with training, PTA will notify the Service. With prior approval and direction from the Service, PTA environmental personnel may relocate nests and goslings to a safe area, such as the Wildlife Enhancement Area at Range 01 Complex. PTA environmental personnel may also haze molting Hawaiian geese found on a training range to a safe area, such as the Wildlife Enhancement Area at Range 01 Complex.

CONSERVATION MEASURES

When used in the context of the ESA, “conservation measures” represent actions proposed by the Federal action agency that are intended to further the recovery of and minimize or compensate for project effects on the listed species under review. Because conservation measures are part of the Project Description and committed to by the action agency, their implementation is required under the Terms of this section 7 consultation.

In addition to the MOUT, IPBC, and Live-Fire Shoot House, the Army will need to construct and maintain infrastructure, such as roads and associated buildings, within Action Area F. Because the location of training has not been finalized within the IPBA, the Army has committed to locating infrastructure to avoid listed species whenever possible. To control invasive plants, construction areas and roads in Action Area F will be surveyed quarterly during construction activities and annually after completion of IPBA construction (US Army 2012a). Furthermore, all new weed introductions will be prioritized and target species will be ranked for management (US Army 2012a). When appropriate, chemical and mechanical control techniques will be implemented (US Army 2012a).

If absolute avoidance is not possible for *Kadua coriacea* and *Zanthoxylum hawaiiense*, PTA environmental staff will attempt to minimize potential impacts from infrastructure construction and maintenance by creating buffer zones around listed plants and fencing them to reduce the potential for mechanical damage. Specifically, prior to infrastructure construction and after UXO has been cleared from the area, PTA environmental personnel will place protective hog-wire exclosures around individual plants, demarcate locations using a 5-foot PVC pipe with Siebert markings or similar, and will provide contractors, maintenance personnel, and troops maps and briefings to avoid plant locations.

Conservation Measures for Asplenium peruvanium var. insulare

The conservation measures that are in place, such as large-scale fence units and ungulate control, have been effective in increasing the distribution of many species that were not commonly detected at PTA previously. These include common natives, such as *Dianella sandwicensis, Carex wahuensis, and Cyperus hillebrandii*. In addition, species of concern, such as *Eragrostis deflexa,* and the candidate species *Festuca hawaiiensis* have become abundant. *Asplenium peruvianum var. insulare* has also benefitted from Army actions and increased its abundance and distribution. All known locations of *A. peruvianum* var. *insulare* in low hazard UXO areas are protected within approximately 28,100 acres of fence units. Beyond the requirement to build five fence units totaling 850 acres in Training Area 21 (USFWS 2003), the Army enlarged them to a single fence unit of 11,500 acres (USFWS 2008a) to conserve this species.

One individual of *Asplenium peruvianum var. insulare* has the potential to be impacted by the proposed IPBA project. Once the final design footprint within the IPBA is determined, if that individual is outside of the UXO cleared area, no further conservation action for this species will be taken. However, if that individual is within the UXO cleared area, Army environmental personnel will compensate for the potential loss of that individual by collecting genetic material prior to construction, if possible, and propagating, out-planting, and maintaining at least one additional individual to reproductive maturity. Out-planted in an established Army out-planting site that is fenced and ungulate-free, the individual(s) will be supplementally watered and weeded as necessary and as determined by Army environmental personnel. In addition, if at some point in the future Army environmental personnel determine that Army actions may impact that individual even given its location outside of the UXO cleared area, then at that point in time Army environmental personnel will follow this same process to compensate for its potential loss.

Conservation Measures for Kadua coriacea

To offset impacts to *Kadua coriacea* from military training actions and related activities within Action Area F, the Army will address propagation and out-planting needs of this species to increase abundance and distribution at PTA. Prior to construction and after UXO clearance of the proposed IPBC, PTA environmental personnel will make site visits to collect any available seeds from all *K. coriacea* within the UXO cleared portions of the IPBC. In addition, as many cuttings as possible will be taken from all of those individuals, propagated in the PTA Rare Plant Facility, and seeds will be collected once those individuals become reproductive. The Army proposes to use the *K. coriacea* cuttings and seed collected from the UXO cleared portions of the IPBC as source material from which seeds will be collected, propagated, and out-planted. For at least as many plants located in the UXO cleared area, additional individuals from their genetic stock beyond pre-IPBA project plans will be out-planted and maintained until they reach reproductive maturity (see USFWS 2003, 2008a). These additional individuals will preserve

genetics that may have otherwise been lost and will be out-planted in established Army out-planting sites that are fenced and ungulate free. Out-planted individuals will be supplementally watered and weeded, as necessary and as determined by Army environmental personnel. No site visits will be conducted to *K. coriacea* individuals outside of UXO cleared areas due to concerns for human health and safety. The destruction of these 10 plants and subsequent compensation via additional seed collection, cuttings, propagation, out-planting, and maintenance of up to 10 additional individuals to reproductive maturity is covered by this Biological Opinion and not the Army's permit for Native Endangered and Threatened Species Recovery (Permit Number TE40123A-0).

Conservation Measures for Silene hawaiiensis

Installation-wide and in low hazard UXO areas, *Silene hawaiiensis* is protected within large-scale ungulate-free fences totaling approximately 18,435 acres. Beyond the requirement to build five fence units totaling 850 acres in Training Area 21 (USFWS 2003), the Army enlarged them to a single fence unit of 11,500 acres (USFWS 2008a) to conserve this species. These fence units protect approximately 95% of the known locations for this species outside of the Impact Area. In addition, other large-scale fence units protect approximately 37,750 acres of suitable habitat into which *S. hawaiiensis* may continue to increase its abundance and distribution at PTA.

One individual of *Silene hawaiiensis* has the potential to be impacted by the proposed IPBA project. Once the final design footprint within the IPBA is determined, if that individual is outside of the UXO cleared area, no further conservation action for this species will be taken. However, if that individual is within the UXO cleared area, Army environmental personnel will compensate for the potential loss of that individual by collecting genetic material prior to construction, if possible, and propagating, out-planting, and maintaining at least one additional individual to reproductive maturity. Out-planted in an established Army out-planting site that is fenced and ungulate-free, the individual(s) will be supplementally watered and weeded as necessary and as determined by Army environmental personnel. In addition, if at some point in the future Army environmental personnel determine that Army actions may impact that individual even given its location outside of the UXO cleared area, then at that point in time Army environmental personnel will follow this same process to compensate for its potential loss.

Conservation Measures for Spermolepis hawaiiensis

Spermolepis hawaiiensis has also benefitted from the large-scale ungulate-free fence units at PTA and has increased its distribution at PTA from 10 acres in the 1990s to 550-600 acres in 2012 (US Army 2012a). Installation-wide and in low hazard UXO areas, *S. hawaiiensis* is protected within large-scale ungulate-free fences totaling approximately 10,220 acres. This species has also recently been recorded in new fence units and has approximately 2,700 acres of suitable habitat within other large-scale fences into which the species may further increase its distribution. Plants monitored within the IPBA action area at PTA have persisted despite the presence of ungulates, wildland fires, and military training. In 2010, the Service determined that *S. hawaiiensis* had stabilized state-wide (USFWS 2010b).

If the Army selects the preferred alternative for the IPBC, *Spermolepis hawaiiensis* will not be affected by the proposed IPBA project. On the other hand, the non-preferred alternative for the IPBC overlaps with about half of the 26 acres of *S. hawaiiensis* in the IPBA. Once the location

for the IPBC is determined, if *S. hawaiiensis* only occurs outside of the UXO cleared area, no further conservation action for this species will be taken. However, if *S. hawaiiensis* occurs within the UXO cleared area, Army environmental personnel will compensate for the potential loss of individuals by collecting a large and representative sample of available seeds from as many plants as possible, even if plants have senesced. Army environmental personnel will then hand broadcast the seeds over a comparable area of suitable habitat in an established Army out-planting site that is fenced and ungulate-free. *S. hawaiiensis* seeds naturally remain dormant for extended periods of time and will be allowed to germinate naturally at an environmentally appropriate time. This effort will conserve genetics that may have been lost by augmenting the seed bank of the out-planting site. In addition, if at some point in the future Army environmental personnel determine that Army actions may impact individuals of *S. hawaiiensis* in the IPBA even though they are outside of the UXO cleared area, then at that point in time Army environmental personnel will follow this same process to compensate for their potential loss.

Conservation Measures for Zanthoxylum hawaiiense

To offset impacts to *Zanthoxylum hawaiiense* from military training actions and related activities within Action Area F, the Army will address propagation and out-planting needs of this species to increase abundance and distribution at PTA. Prior to construction and after UXO clearance of the proposed IPBC, PTA environmental personnel will make site visits to collect any available and realistically accessible pollen from males or seeds from females from all individuals within the UXO cleared portions of the IPBC. Army environmental personnel will cross-pollinate, if possible, and use seeds from the IPBC-area genetic stock to propagate additional individuals to reproductive maturity beyond pre-IPBA project plans for at least as many plants as located in the UXO cleared area (see USFWS 2003, 2008a). Collection of pollen and cross-pollination will be conducted only when the height of plants is appropriate for collection and the terrain and presence of UXO does not pose an undue risk to human health and safety. These additional individuals will preserve genetics that may have otherwise been lost and will be out-planted in established Army out-planting sites that are fenced and ungulate free. Out-planted individuals will be supplementally watered and weeded, as necessary and as determined by Army environmental personnel. No site visits will be conducted to *Z. hawaiiense* individuals outside of UXO cleared areas due to concerns for human health and safety. The destruction of these 15 plants and subsequent compensation via additional pollen or seed collection, cross-pollination or propagation, out-planting, and maintenance of up to 15 individuals to reproductive maturity is covered by this Biological Opinion and not the Army's permit for Native Endangered and Threatened Species Recovery (Permit Number TE40123A-0).

Conservation Measures for Hawaiian Geese

To avoid and minimize impacts to Hawaiian geese on PTA, Army environmental personnel will use the 60-day and 45-day briefs to keep unit leaders (e.g., Commanders, Officers in Charge, Range Safety Officers, and Non-commissioned Officers) informed of their responsibilities to protect Hawaiian geese at PTA, especially while driving and conducting live-fire exercises.

To benefit Hawaiian geese off-site of PTA, the Army is funding a conservation partnership project for Hawaiian geese at Hakalau Forest National Wildlife Refuge (Refuge). This project includes construction and maintenance of two 20-acre predator-proof fences at the Refuge, as well as personnel necessary to maintain the fences, control predators inside and outside of the fences, monitor Hawaiian geese inside and outside of the fences, improve vegetation within the

fences, and encourage use of the fenced areas by Hawaiian geese both passively and aggressively. The goal is to produce an average of 21 adult Hawaiian geese per year over the 20-year term of this Biological Opinion. Of the 35 Hawaiian goose nests monitored in 2012 at the Refuge, 30 nests did not produce young (one nest was abandoned and 29 nests failed, likely due to predators) (Hakalau Forest National Wildlife Refuge, unpublished data). From the other five nests, nine fledglings survived from the initial 14 goslings (Hakalau Forest National Wildlife Refuge, unpublished data). As a result, there is considerable potential for conservation benefit for this species at the Refuge with effective predator management, vegetative enhancement within fenced areas, and use of fenced areas by breeding Hawaiian geese.

Given that Hawaiian geese may first breed at two years of age and annual survivorship after fledging is about 90% (Banko *et al.* 1999), the number of fledglings produced inside the fences will target a minimum average of 26 per year. Goslings hatched outside of the fences and moved inside a fence that survive and fledge will count towards this total. Hawaiian geese will be banded to document survivorship and refine information regarding the success of Army conservation measures. The Service anticipates that this conservation program will take several years to refine. As a result, we do not anticipate achieving the goal of 26 fledglings in a single year until the 5th breeding season after the fences are constructed (i.e., the 2017-2018 breeding season). Additionally, the Service does not expect the *average* production for all years to reach 26 fledglings until the 10th breeding season after the fences are constructed (i.e., the 2022-2023 breeding season). However, if either of these goals is not achieved, the Army will work with the Service to identify additional conservation measures that the Army will implement to benefit Hawaiian geese and offset the Army's annual incidental take.

The type of predator-proof fence with habitat requirements for Hawaiian geese, including specific plant species to out-plant for food and cover (nesting and foraging), is shown in Figure 4 and described in a Technical Note by the Natural Resources Conservation Service (NRCS 2007). The fence design is currently being used successfully at Hawaii Volcanoes National Park and is designed such that cats and mongooses cannot climb over them, a buried two-foot skirt prevents predators from burrowing beneath the fence, and special gates prevent predator ingress (NRCS 2007). The personnel funded by the Army will be dedicated to this conservation project and will be responsible for coordinating and implementing habitat improvements inside the fences; monitoring the fences; controlling predators inside and outside of the fences; moving and monitoring Hawaiian geese inside and outside of the fences, and potentially feeding Hawaiian goslings inside the fences. PTA environmental personnel will retain some responsibility for this project, including mowing one to two times per year inside the fences and repairing the fences, as necessary. PTA environmental personnel will also propagate native vegetation to be used as food plants or escape cover within the fences and cooperate with the personnel funded specifically by the Army for this project regarding out-planting site preparation and weeding. All personnel working on this project will contribute to data collection and analysis relative to fledging production, annual survivorship of Hawaiian geese, and sightings of Hawaiian geese banded on the Refuge.

Figure 4. Example of a predator-proof fence designed to exclude cats, rats, dogs, pigs, and mongooses. The United States Army is funding construction, operation, and maintenance of two 20-acre fences for 20 years to offset impacts to Hawaiian geese at Pohakuloa Training Area by benefitting Hawaiian geese at Hakalau Forest National Wildlife Refuge.

After the predator fences are built, Hawaiian geese will not necessarily use them. Hawaiian geese exhibit philopatry, which is the tendency of a migrating animal to return to a specific location to breed or feed. The personnel funded by the Army will be responsible for encouraging use of the pens passively by: mowing, out-planting native plants used by Hawaiian geese for nesting and food, and providing water and food judiciously for goslings. Information on the appropriate type of food to provide is available from Hawaiian goose biologists at the Refuge, Hawaii Volcanoes National Park, and the State of Hawaii, Division of Forestry and Wildlife (DOFAW). Shade structures will also be built inside each of the predator fences. In the long-term, this will be achieved via native vegetation propagated in the PTA greenhouse and out-planted inside the fences. In the short-term, temporary shade may be constructed using tarps, shade cloth, or sheets of plywood and maintained by the personnel funded by the Army. Similarly, in the long-term, once the vegetation is optimal for Hawaiian geese inside each fence there will be sufficient water available to Hawaiian geese from food plants. In the short-term, the Army will construct a permanent water source inside each fence, e.g. a water catchment. This supplemental water will be available to personnel funded by the Army to provide to Hawaiian geese, as well as maintain out-plantings.

In addition to passively encouraging use of the habitat by Hawaiian geese inside predator fences, the personnel funded by the Army will also move adult Hawaiian geese with goslings inside the fences, as well as move adult Hawaiian geese who nest in problem areas (e.g., under Refuge buildings) inside a fence prior to nesting and wing-clip them for a breeding season. Once properly trained, the personnel funded by the Army will coordinate these actions and adaptively determine how many Hawaiian geese to move each year, trying a few families and pairs the first year, implementing lessons learned, and adjusting the numbers of moved Hawaiian geese over time, if necessary. Personnel capturing Hawaiian geese need to have bird capture and handling experience, including animal husbandry and wing-clipping, to minimize the risk of harming birds. They must also be listed on the Refuge's ESA section 10(a)(1)(A) permit. Army environmental personnel are encouraged to participate and will coordinate with the personnel funded by the Army for this specific conservation project.

The personnel funded by the Army will walk the perimeter of each fence and pen at least once every seven days. They will also constantly monitor predators inside the fences (e.g., tracking tunnels and motion-sensor cameras) and maintain a zero tolerance policy for rats (*Rattus* spp.), cats (*Felis catus*), dogs (*Canis lupus familiaris*), pigs (*Sus scrofa*), and mongooses (*Herpestes auropunctatus*). Though dogs, pigs, cats, rats, and mongooses will be excluded, Hawaiian goose eggs and goslings are still vulnerable inside the fences to avian predators, such as the Hawaiian hawk. The personnel funded by the Army will coordinate vegetative habitat improvements within the fences to enhance escape cover over time and minimize that source of mortality. In the short-term, the personnel funded by the Army will use the 50 foot x 50 foot x 7 foot pen within each fence to protect Hawaiian goslings and adults from avian predators, as necessary. Because the Army will benefit from goslings hatched outside of the fences as well that are subsequently moved inside the fences to fledge, the personnel funded by the Army will also trap predators around the fences within the range of nesting Hawaiian geese at the Refuge. This trapping outside of the fences will also benefit the control within the fences by providing a buffer of fewer predators around the fenced areas.

Appendix 1 provides more details of timing benchmarks to meet the objective of both fences constructed by the next Hawaiian goose breeding season, which begins in early September 2013. There is a level of effort equivalent to at least one Full-Time-Equivalent necessary to complete tasks for this Hawaiian goose conservation project at the Refuge. This project will require a Memorandum of Understanding between the Army and the Refuge, as well as a Special Use Permit from the Refuge. In coordination with the Refuge's Project Leader, Army funded personnel will be provided equipment and supplies by the Army to accomplish various tasks associated with this project. The financial commitment by the Army to implement this project will include personnel at the Refuge, a dedicated project vehicle and associated costs, and predator traps, weed trimmers, and other equipment and services to achieve project-related tasks. The specific methods of how Army resources will be provided will be embodied in a Memorandum of Understanding approved by both Army and Refuge managers and due to the Service 75 days from the date of this signed Biological Opinion (see Appendix 1).

Beyond the initial construction of the two fenced areas, which will each have a pen, water source, and shade structures built within them, these tasks include (1) monitoring, maintaining, and repairing each fence, pen within each fence, permanent water source, and shade structures, as necessary; (2) controlling predators inside and outside of the fences within the Refuge; (3) propagating food and cover plants for Hawaiian geese; (4) out-planting vegetation to improve

habitat inside of fences for Hawaiian geese; (5) monitoring and maintain out-planted vegetation; (6) mowing grass within fences areas as necessary to encourage use of the fenced areas by Hawaiian geese; (7) moving and monitoring Hawaiian geese inside and outside of the fences; (8) providing food and water to Hawaiian goslings inside the fences, as necessary; (9) herding Hawaiian geese inside the pens to protect them from avian predation, as necessary; (10) banding Hawaiian geese; (11) moving pairs of Hawaiian geese that are preparing to nest too close to Refuge buildings inside a fence; (12) monitoring nests and moving goslings at the appropriate time inside a fence; (13) monitoring the survivorship of eggs, goslings, and fledglings; (14) collecting band sightings of Hawaiian geese banded in a previous year(s); (15) maintaining a database with fate information for all banded geese to calculate survivorship rates; and (16) completing any necessary National Environmental Policy Act or other federal legislative requirements.

The Full-Time-Equivalent personnel funded by the Army and dedicated to this project at the Refuge each year for the 20-year duration of this Biological Opinion will include at least one person with the following academic and experience qualifications. Additional details regarding the services and equipment that will be provided by the Army on an annual basis for the 20-year duration of this Biological Opinion to accomplish the tasks outlined in the previous paragraph will be specified in the Memorandum of Understanding between the Army and Refuge due within 75 days of the signed Biological Opinion (see Appendix 1).

1. Academic requirement: Degree in a biological science that includes at least nine semester hours in wildlife subjects, such as mammalogy, ornithology, animal ecology, wildlife management, or research courses in the field of wildlife biology; at least 12 semester hours in zoology subjects, such as general zoology, invertebrate zoology, vertebrate zoology, comparative anatomy, physiology, genetics, ecology, cellular biology, parasitology, entomology, or research courses in such subjects; and at least nine semester hours in botany or related plant sciences. Excess courses in wildlife subjects may be used to meet the zoology subject requirement when appropriate.

2. Experience requirement: One year of specialized experience conducting inventory and monitoring activities for wildlife species in remote locations to document and assess animal and plant presence, abundance, reproduction, management issues, and population dynamics using established protocols and standard scientific equipment.

STATUS OF SPECIES

Asplenium peruvanium* var. *insulare (Fragile fern)

Species Description

Asplenium peruvanium var. *insulare*, a fern in the Aspleniaceae or spleenwort family, is a perennial, delicate, terrestrial plant. Its rhizomes are decumbent and 0.1 to 0.5 inches in diameter. Six to 18 inches long and 0.4 to 1.2 inches wide, the fronds are often proliferous with one to many proliferations on the upper stipes and lower rachises. The species is distinguishable by its habitat; its narrow, long-linear, pale green fronds; dull gray or brown stipes with two greenish ridges on the upper surface; and plantlets on the upper stipes and lower rachises (Palmer 2003).

Listing Status

The Service listed *Asplenium peruvanium* var. *insulare* as endangered in 1994 (USFWS 1994a).

Ecology

On Maui, *Asplenium peruvanium* var. *insulare* is found within streamside hollows and grottoes that occur in mesic to dry subalpine shrubland dominated by *Leptecophylla tameiameiae* and *Sadleria cyatheoides* with scattered *Metrosideros polymorpha. A. peruvanium* var. *insulare* has also been observed in montane wet ohia forests in rocky gulches at 5,518 and 7,897 feet elevation.

On Hawaii, *Asplenium peruvanium* var. *insulare* grows in moist and dark areas in pits, large lava tubes, and deep cracks on varying ages of lava that have moderate soil or ash accumulation. The species is associated with mosses and liverworts and can occasionally be found growing in the interface between young aa and older pahoehoe lava flow deposits. At PTA, the species is found in sparse or open *Metrosideros* treeland with shrub understory or *Myoporum-Dodonaea, Myoporum-Sophora, Sophora-Myoporum-Chamaesyce, Leptecophylla-Dodonaea* shrublands. Associated native plant species include *Dryopteris wallichiana* and *Grammitis hookeri*. Plants are frequently found growing in white mineral deposits of caves without any soil or ash accumulation. Reproductive cycles, longevity, specific environmental requirements, and limiting factors are unknown. No gametophytes (gamete-producing life stage) have been found, as the age-class structure of all populations sampled at PTA is entirely reproductive adults (Shaw 1992, US Army 2003a).

Historical and Current Distribution

Asplenium peruvanium var. *insulare* was historically known from East Maui and Hawaii. Currently on east Maui, *A. peruvianum* var. *insulare* is known from five occurences at Waikamoi Stream, at Puu Luau, east of Hosmer Grove, north of Kalapawili Ridge, and in Hanawi Natural Area Reserve. These occurrences total as many as 100 individuals in the montane wet, montane mesic, and subalpine ecosystems (USFWS 2012). On Hawaii, seven sites have been documented in the Mauna Loa Special Ecological Area: clumps of 10 to 30 individuals were documented in four sites in the openings of lava tubes between Kipuka Kulalio and Kipuka Maunaiu; five individuals were found near the base of a dark and damp wall in an adjacent lava tube system just northwest of upper Kipuka Kulalio; an unknown number of individuals exists at a sixth site near Hawaii Volcanoes National Park's western boundary with Kapapala Ranch; and a seventh site is located at "Three Trees Kipuka" within the Central Lava Flow (Belfield and Pratt 2002; USFWS 2012). This seventh site was first vouchered in 1943, so the taxon has persisted at this site for over 65 years. L. Pratt (United States Geological Survey, Pacific Island Ecosystems Research Center, *pers. comm.* as cited in USFWS 2012) confirmed the population was still vigorous and too abundant to count in 2010. Benitez *et al.* (2008) also discovered four new lava tube sites in the Kahuku addition to Hawaii Volcanoes National Park between 2004 and 2006 with an unspecified number of *A. peruvanium* var. *insulare* individuals. Numerous lava tubes have yet to be surveyed in the high-elevation subalpine habitat at Kahuku on Hawaii and may provide additional suitable habitat (Benitez *et al.* 2008; USFWS 2012). At PTA, survey data from 2009 documented a significant decline in numbers of individuals and PTA environmental personnel noted very dry conditions within the caves (CEMML 2011). The current estimate of

individuals on Army-owned lands at PTA is between 440 and 828 individuals (US Army 2012a, p. 98).

Threats

Asplenium peruvanium var. *insulare* is threatened by fire; browsing by feral sheep (*Ovis aries*) and goats (*Capra hircus*); competition for light, space, and nutrients with *Pennisetum setaceum*; and habitat degradation or destruction when lava tubes or caves fill with debris and are subsequently invaded by non-native plants. Due to the small remaining number of occurrences and individuals, the species is also threatened by a natural or human-caused, environmental disturbance that could be catastrophic to the species (US Army 2003a,b). Though ungulates generally cannot access individuals growing in caves with skylights, individuals growing on the ground at cave entrances can be trampled or browsed (US Army 2003a, USFWS 2012).

Conservations Needs of the Species

The most important conservation need for this species is to protect high elevation lava tubes by constructing fences around all known occurrences and eradicating feral ungulates within them. The areas that are most important for protection are found at PTA, Keauhou and Kulani forests, and portions of the Kapapala and Kau Forest Reserves. Other conservation needs for the species include: propagation and maintenance of genetic stock *ex situ*; augmentation of extant occurrences and establishment of new occurrences within the species' historical range; control or eradication of non-native plants; protection from fire and human disturbance; implementation of a comprehensive monitoring and management program; and surveys to identify individuals and occurrences that may exist in former habitats (USFWS 2012).

Ongoing Conservation Actions

First, PTA environmental personnel control ecosystem-altering invasive plants (*Pennisetum setaceum* and *Senecio madacascariensis*) as their highest priority of invasive plant control (USAG-HI 2009). Second, fertile fronds from several individuals and occurrences at PTA have been collected for seed-banking. The Harold L. Lyon Arboretum on Oahu has successfully propagated this species and provided individuals back to PTA for out-planting (US Army 2012a). Lastly, 11,500 acres and at least 54 caves with potential habitat for *A. peruvanium* var. *insulare* in Training Area 21 will be fenced by the end of 2013 and protected from ungulates by the end of 2015. This fence unit complements other fenced units protecting this species' habitat at PTA, including the Kipuka Kalawamauna West, Naohuleelua, Mixed Tree, and Kipuka Alala South fence units. Collectively, the eight contiguous fence units in western and southern PTA enclose about 26,250 acres that are already ungulate-free or will be by the end of 2015 (US Army 2012a).

Kadua coriacea (Leather-leaf sweet ear)

Species Description

Kadua coriacea, of the Rubiaceae or coffee family, is a small, many-branched, erect shrub with leathery oval-shaped leaves. Leaves are 1.2 to 3.2 inches long with sheath-like petioles. Stipules are reduced and attached to the petiole base. Flowers are clustered, trumpet-shaped, cream colored, and fleshy (see cover photograph). Fruits are cup or top-shaped and contain dark-

brown, irregularly angled seeds. The species is distinguishable by small flowers with triangular leaf-like appendages (calyx lobes) that do not enlarge when the fruit develops (US Army 2003a).

Listing Status

The Service listed *Kadua coriacea* as endangered in 1992 (USFWS 1992).

Ecology

On Maui, *Kadua coriacea* is found on steep rocky slopes in dry *Dodonaea* shrublands and forests. On Hawaii, the species occurs on pahoehoe lava flows in sparse *Metrosideros* treelands and open *Metrosideros* treelands with sparse to dense shrub understories. Associated species include *Metrosideros polymorpha*, *Leptecophylla tameiameiae*, *Ayxia oliviformis*, *Bidens menziesii*, *Gouania hillebrandii*, *Sida fallax*, *Melanthera lavarum*, *Myoporum sandwicense*, and *Schiedea menziesii*. Life history information regarding pollination vectors, seed dispersal agents, longevity, and environmental requirements is unknown. Immature and mature fruits have been observed in August, flowers in September, vegetative growth in December, and immature fruits and flowers in January (US Army 2003a).

Historical and Current Distribution

Historically known from Oahu, Maui, and Hawaii, *Kadua coriacea* is not presently known from Oahu or Maui (USFWS 2008b). In 2005, the first seedling of *K. coriacea* in the wild was recorded at PTA (US Army 2012a). Nine natural populations with approximately 167 individuals (five juveniles, 162 adults) of *K. coriacea* currently occur at PTA at 4,921 to 5,577 feet elevation (US Army 2003a, 2012b pp. 98-99; USFWS 2008b). The recent increase in numbers of plants is a result of increased survey effort and all known plants at PTA are protected by large-scale fence units sans ungulates (US Army 2012a).

Threats

Threats to *Kadua coriacea* include habitat degradation and herbivory by feral ungulates; military exercises igniting fires that degrade habitat and subsequent invasion by non-native plants; susceptibility to scale insects at out-planting sites where there is also a high ant infestation; a lack of natural recruitment, which may be due to a loss of an insect pollinator(s); and a single natural or human-caused environmental disturbance that could be catastrophic due to the limited numbers and distribution of this species (Shaw 1997; US Army 2003a,b; USFWS 2008b; Wood 2001). Currently at PTA, a prolonged drought is placing increased stress on the entire ecosystem (CEMML 2010a,b; US Army 2012a).

Conservation Needs of the Species

The following conservation actions are needed: additional populations of *Kadua coriacea* should be established across the species' range to increase the number of individuals; invasive non-native plants species should be controlled, especially *Cenchrus setaceum*; and research should be conducted on pollinators and reproductive biology affecting recruitment and survivorship, including susceptibility to damage from ants. In addition, a State-wide management plan that identifies areas and landscapes for the long-term conservation of all known occurrences of *K. coriacea* is needed. As part of this management plan, landowners and managers should delineate

management units to conserve this species and other native species through threat control and habitat restoration (USFWS 2008b).

Ongoing Conservation Actions

There are 16 plants in cultivation at the DOFAW baseyard on Maui. Ten of those plants are from seeds collected from the Lihau Section of West Maui Natural Area Reserve on Maui and six are cuttings from some of those 10 seedlings (USFWS 2008b). In addition, thousands of seeds are in long-term genetic storage (Center for Conservation and Research Training Seed Storage Laboratory, unpublished database; Harold L. Lyon Arboretum Micropropagation Laboratory, unpublished database; USFWS 2008b). Although germination is not a problem, seedling survival remains low and seedling growth is very slow, requiring at least 12 months from seeding to out-planting (USFWS 2008b). Lastly, mortality of out-planted individuals remains high (Evans *pers. comm.* 2012). Current efforts are to improve survivorship of propagated individuals (US Army 2012a).

Silene hawaiiensis (Hawaiian catchfly)

Species Description

Silene hawaiiensis, of the Caryophyllaceae or pink family, is a sprawling short-lived shrub with slanting or climbing stems approximately six to 16 inches long that arise from an enlarged root and are generally covered with short sticky hairs. Leaves are slender, often recurved, and stalkless. Flowers are borne in loosely arranged, elongate, sticky clusters. The calyx is fused, five-toothed, purple-tinged, and 0.02 to 0.03 inches long. Each petal is divided into two parts: a two-lobed expanded blade and a long narrow stalk-like base (US Army 2003a).

Listing Status

The Service listed *Silene hawaiiensis* as threatened in 1994 (USFWS 1994b).

Ecology

Silene hawaiiensis typically grows in montane and subalpine dry shrublands on decomposed lava and ash, as well as on all ages of lava and cinder substrates, at 2,953 to 4,265 feet elevation. The species is found on barren lava, on disturbed sites, and a variety of tree, shrub, and grass lands. The species is considered short-lived; however, the plant may be longer-lived than originally thought because individuals can sprout from a large woody taproot. *S. hawaiiensis* has also been documented re-sprouting following a fire (US Army 2003b). Flowering has been observed in August and September, but appears to be dependent upon precipitation more than time of year (CEMML 2006a).

Historical and Current Distribution

Silene hawaiiensis is endemic to the island of Hawaii. There were 22 populations of *S. hawaiiensis* in 2009 containing a total of approximately 8,360 individuals: one population of 100 individuals at Crater Rim in Hawaii Volcanoes National Park; 15 populations of 1,844 individuals at PTA; and six populations outside of PTA that contained a total of 6,416 individuals at Kau Desert (one population), Puu Keanui (one population), Hualalai (two populations), and Mauna Loa (two populations) (USFWS 2010a). At PTA, *S. hawaiiensis* is

found on Puu Koli on the east range, along the northern boundary, in western PTA, in Kipuka Alala (Shaw 1997), and in the proposed IPBA (CEMML 2011; US Army 2012a). There are currently approximately 2,800 known individuals of *S. hawaiiensis* at PTA (US Army 2012a).

Threats

Threats to *Silene hawaiiensis* include sheep, goats, and pigs browsing and trampling (browsing can be severe to the base of the plant, as feral pigs and sheep are known to root up and consume the fleshy taproot); competition by non-native plant species such as *Cenchrus setaceum*; disturbances associated with military exercises; property development; and fire (US Army 2003a,b). However, fire does not pose a threat to populations in Hawaii Volcanoes National Park and is a minimal threat in the sparsely vegetated habitat on the high slopes of Mauna Loa (Beavers and Burgan 2002; USFWS 2010a). In fact, a 2002 fire study at PTA documented that *S. hawaiiensis* is fire tolerant and able to re-sprout due to its development of large fusiform roots that also help protect plants from frequent browsing by ungulates (USFWS 2010a). However, fire still poses a threat to *S. hawaiiensis* in areas where vegetation is dense or where introduced fire resistant species are present, such as near Puu Keanui, on Hualalai, and on PTA, because fire adapted species will grow quicker and outcompete a fire tolerant species following a fire (USFWS 2010a).

Conservation Needs of the Species

Important conservation actions needed for *Silene hawaiiensis* include: construction of fenced exclosures around important occurrences to reduce impacts from feral ungulates; control of non-native plants, particularly *Cenchrus setaceum*; fire; and habitat degradation. In addition, a State-wide management plan that identifies areas and landscapes for long-term conservation of all known occurrences of *S. hawaiiensis* is needed (USFWS 2010a).

Ongoing Conservation Actions

The Volcano Rare Plant Facility has 13 plants in cultivation and 100 seeds still germinating from a population at the Mauna Loa Radio Facility (USFWS 2010a). The Army, the State of Hawaii, and Hawaii Volcanoes National Park have or are currently constructing fences that will protect large areas of native habitat where *Silene hawaiiensis* occurs. The Army is currently completing construction of ungulate-proof fencing and eradication of ungulates for 37,750 acres, of which 18,435 acres are occupied or suitable habitat for *S. hawaiiensis*. Construction of five proposed fence units on State of Hawaii and Kamehameha Schools lands would protect an additional 1,900 plants. Many populations of this species remain unprotected by fences. Though *S. hawaiiensis* continues to survive in areas where evidence of browsing by feral ungulates is ubiquitous, natural recruitment has not been documented in these grazed populations (CEMML 2006a, USFWS 2010a).

Spermolepis hawaiiensis (Hawaiian parsley)

Species Description

Spermolepis hawaiiensis, a member of the Apiaceae or parsley family, is a slender annual herb, has few branches, and grows to a height of two to eight inches. Leaves are dissected into narrow lance-shaped divisions and are oblong to somewhat oval with approximately one-inch long petioles. Each inflorescence consists of two to six flowers with white elliptic to ovate petals.

Fruits are oval, laterally compressed, 0.2 inches long and 0.1 inches wide, and covered with curved bristles. The species is distinguishable by being a non-succulent annual with an umbrella-shaped inflorescence (Constance and Affolter 1999).

Listing Status

The Service listed *Spermolepis hawaiiensis* as endangered in 1994 (USFWS 1994b).

Ecology

Spermolepis hawaiiensis grows in open areas and sometimes in cultivated fields (Wagner *et al.* 1999). Little is known about germination, but large numbers of *S. hawaiiensis* have been observed after heavy rainfall (US Army 2007). On Hawaii, *S. hawaiiensis* is known from shady spots in *Dodonaea viscosa* dry shrubland on pahoehoe lava at 3,721 and 7,021 feet elevation. Associated native plant species include *Myoporum sandwicense*, *Osteomeles anthyllidifolia*, and *Sophora chrysophylla*. At PTA, *S. hawaiiensis* occurs on lava, in ash, and in soil pockets where moisture accumulates, typically in open Metrosideros treelands with sparse shrub understory, *Myoporum-Sophora* mixed shrublands, and *Myoporum-Sophora* shrublands with forb understory (US Army 2003a).

Historical and Current Distribution

The species was historically known from Kauai, Oahu, Lanai, and Hawaii and has expanded its range to include Molokai and Maui. In 1999, there were 12 populations on those six islands representing up to 6,000 individuals (USFWS 1999). Currently, there are 14 populations statewide with as many as 10,600 individuals, but this number is highly dependent on recent rainfall (USFWS 2010b).

Assessing abundance of *Spermolepis hawaiiensis* is more difficult than for persistent species due to its episodic life cycle. Presence and detectability are influenced by resource availability, primarily available water. The species can be absent from an area for years at a time due to lower than needed rainfall. When environmental conditions are suitable, there may be high recruitment from the seed bank. Plants are detectable for various lengths of time due to variability in life cycle duration driven by variability in resource availability. In addition, detectability can also be affected by densities of surrounding non-native vegetation. In areas such as Kipuka Alala at PTA, the density of non-native *Senecio madacascariensis* can make the detection of *Spermolepis hawaiiensis* extremely difficult. Therefore, the more robust indication of this species' status is its known spatial distribution and tracking whether known distributions are increasing or decreasing (CEMML 2012).

There are four known disjunct groups of plants on PTA: Puu Papapa in the KMA, the western portion of Training Area 22, older substrates of Kipuka Alala in Training Area 23, and the recently documented group in Action Area F. *Spermolepis hawaiiensis* was originally found in naio-mamane (*Myoporum-Sophora*) dominated communities and was recently recorded in the transition zone between the naio-mamane communities and ohia (*Metrosideros*) communities. Surveys conducted in the Kipuka Alala during 2004-2011 documented 250-300 acres of *Spermolepis hawaiiensis;* surveys in 2012 documented that *S. hawaiiensis* distributions had expanded by approximately 300 acres for a current total of at least 550 to 600 acres at PTA. Suitable habitat exists for *S. hawaiiensis* in additional 2,400 acres of naio and mamane habitat

that has yet been adequately surveyed. The increase in *S. hawaiiensis* distributions is due to both an increase in survey effort and protection from ungulate herbivory provided by recently completed large-scale fence units (CEMML 2012).

Threats

Spermolepis hawaiiensis is threatened by browsing from feral sheep and goats; habitat degradation and competition from various non-native plants, such as *Melinis minutiflora* and *Cenchrus setaceum*; degradation and loss of habitat resulting from mounted and dismounted military maneuvers, maintenance activities, and construction of helicopter landing zones; fire; and trampling by ground troops (USFWS 1999).

Conservation Needs of the Species

Augmentation of small populations and re-establishment of new populations within the historical range of the species would benefit *Spermolepis hawaiiensis* (USFWS 1999). Research on basic life history characteristics, such as seed ecology, growth, reproduction, phenology, and pollination biology, is also needed (USFWS 1999). In addition, a State-wide management plan that identifies areas and landscapes for long-term conservation of all known occurrences of *S. hawaiiensis* is needed. As part of this management plan, landowners and managers should delineate management units to conserve this species and other native species through threat control and habitat restoration (USFWS 2010b).

Ongoing Conservation Actions

The Army has constructed fences and eradicated ungulates in western PTA that provides an additional 2,700 acres of suitable naio and mamane habitat in the Kipuka Alala North and South fence units (CEMML 2012).

***Zanthoxylum hawaiiense* (Hawaiian yellow wood)**

Species Description

Zanthoxylum hawaiiense, a member of the Rutaceae or citrus family, is a tree that grows 10 to 26 feet tall with trunks up to 10 inches in diameter. Leaves are alternate and comprised of three leaflets: 1.3 to 3.9 inches long, 0.6 to 2.0 inches wide. Trees have either male or female flowers with inflorescences of 15 to 20 flowers, each with four triangular sepals. Fruits are sickle-shaped, 0.3 to 0.4 inch long follicles. The species is distinguishable by its leaves, presence of only one joint on some leaflet stalks, and length and shape of follicles (US Army 2003a).

Listing Status

The Service listed *Zanthoxylum hawaiiense* as endangered in 1994 (USFWS 1994b).
Ecology

Zanthoxylum hawaiiense typically grows in Metrosideros-dominated lowland dry or mesic forests, in montane dry forests, and on lava at 1,804 to 5,709 feet elevation. The species is associated with *Antidesma platyphyllum* and *Streblus pendulinus* on Maui and with *Myrsine lanaiensis, Sophora chrysophylla*, and *Myoporum sandwicense* on Hawaii. Individuals of this species are widely scattered and rarely will more than a few plants be found in proximity to one

another. At PTA, *Z. hawaiiense* is found on lava and in a variety of plant community types including sparse *Metrosideros* treelands, open *Metrosideros* treelands with dense shrub understory, intermediate *Metrosideros* mixed treelands, *Myoporum* shrublands, and *Myoporum-Dodonaea* shrublands (US Army 2003a).

Historical and Current Distribution

Historically known from Kauai, Molokai, Lanai, Maui, and Hawaii, *Zanthoxylum hawaiiense* has been extirpated from Lanai and is relatively rare everywhere except at PTA. On Kauai, one individual each was seen in two locations in 2000 or 2007 (Tangalin 2008; Wood 2008). On Maui, three locations had a total of 10 mature and 10 immature individuals in 2006 (Starr 2008, Wood 2008). On Molokai, one mature individual and 25 seedlings were seen in 2005 (Hawaii Biodiversity and Mapping Program 2008; Perlman 2008; Tangalin 2005). On Hawaii, 65 widely scattered individuals were counted within the Puu Waawaa Forest Reserve or Puu Anahulu Game Management Areas in 2006 (Hawaii Department of Land and Natural Resources 2008). *Z. hawaiiense* is relatively abundant and widely distributed at PTA; the most recent surveys reported 650 individuals (US Army 2012d).

Threats

Threats to *Zanthoxylum hawaiiense* include browsing, trampling, and habitat degradation by feral animals; competition from non-native plant species; seed predation by rodents; fire; drought; and effects of military activities (US Army 2003a,b). Eighty percent of the plants at PTA grow in single occurrences and reproduction in this species has become problematic. The widely scattered distribution and dioecious behavior of this species may suggest that larger areas are required to maintain viable populations for the survival and recovery of *Z. hawaiiense* (CEMML 2006b, US Army 2012a, USFWS 2010c).

Conservation Needs of the Species

Control of non-native plant species, feral ungulates, and rodents would benefit *Zanthoxylum hawaiiense,* as well as fire suppression and research on habitat requirements, population structure, reproductive biology, and seed biology. Furthermore, additional populations should be established across the species' range to increase the number and occurrences of individuals. Rodent control in existing and reintroduced populations is necessary to allow for successful recruitment. In addition, a State-wide management plan that identifies areas and landscapes for long-term conservation of all known occurrences of *Z. hawaiiense* is needed. As part of this management plan, landowners and managers should delineate management units to conserve this species and other native species through threat control and habitat restoration (USFWS 2010c).

Ongoing Conservation Actions

Army environmental personnel are currently required to implement rodent control and ungulate exclosures around this and other listed plant species (CEMML 2011; USFWS 2003, 2008a). There are thousands of seeds in storage, but there are difficulties with low viability and slow sporadic germination over a period of several years. Consequently, PTA environmental personnel are continually working to improve storage and propagation efforts (USAG-HI 2009, US Army 2012a).

Hawaiian Goose (Branta sandvicensis)

Species Description

The Hawaiian goose is the only remaining endemic goose species in the Hawaiian Islands. Hawaiian geese, including the three to five extinct species of geese that occurred in Hawaii, are related most closely to the large-bodied lineage of the Canada goose (*Branta canadensis*) (Olson and James 1982; Paxinos *et al.* 2002, p. 1,827). The Hawaiian goose is a medium-sized goose with an overall length of approximately 25-27 inches. The plumage of both sexes is similar (USFWS 2004, p. 4). This species is adapted to a terrestrial and largely non-migratory lifestyle in the Hawaiian Islands with limited freshwater habitat (USFWS 2004). Adaptations to a terrestrial lifestyle include increased hindlimb size, decreased forelimb size, more upright posture, and reduced webbing between the toes compared to other species of *Branta* (Banko *et al.* 1999, Miller 1937, Olson and James 1991). Compared to the related Canada goose, Hawaiian goose wings are reduced by about 16% in size and their flight is weak (USFWS 2004, p. 21). Hawaiian geese are capable of inter-island and high altitude flight, but they do not migrate from the archipelago (Banko *et al.* 1999, p. 9).

Listing Status

The Service listed the Hawaiian goose as endangered in 1967 (USFWS 1967).

Ecology

Hawaiian geese currently use shrublands and grasslands and human-altered habitats ranging from coastal to alpine environments (Banko 1988, Banko *et al.* 1999). On Hawaii and Maui, Hawaiian geese nest, raise their young, forage, and molt in grassy shrublands and sparsely vegetated lava flows. Hawaiian geese on these islands move seasonally from more montane foraging grounds to lowland or mid-elevation nesting areas. On Kauai, Hawaiian geese are primarily found utilizing lowland habitat, such as coastal wetlands at Hanalei and Huleia National Wildlife Refuges, with the exception of the Na Pali Coast (USFWS 2004, pp. 15-19) and areas near and in the Makaha Ridge Tracking Station located near release sites (Marshall *pers. comm.* 2012). The current distribution of wild Hawaiian geese has been highly influenced by the location of release sites for captive-bred birds (Banko *et al.* 1999).

Historical and Current Distribution

Hawaiian geese were widely distributed among the main Hawaiian Islands (Hawaii, Maui, Lanai, Molokai, Kauai, and Kahoolawe); however, sub-fossil evidence has not been found on Oahu (USFWS 2004, p. 6). The fossil record indicates the prehistoric (prior to 1778) range of Hawaiian geese was much greater than was observed after colonization by Europeans (Banko *et al.* 1999). However, estimating Hawaiian goose population numbers both pre-Polynesian and pre-European contact is difficult because there is a limited understanding of species composition, or even the gross structure, of the vegetation prior to the arrival of the Polynesians (USFWS 2004, p. 7). By 1952, approximately 30 Hawaiian geese remained on the island of Hawaii only (Smith 1952). Hawaiian goose populations on the higher islands (Hawaii and Maui) may have persisted into the historical periods due to the availability of larger tracts of habitat in remote rugged upland areas, where hunting and predation by introduced mammals were less intense (Banko *et al.* 1999, p. 3). The release of captive-bred Hawaiian geese, which began in 1960, helped save the species from imminent extinction (USFWS 2004, pp. 2-3). As a result of such

programs, wild populations of Hawaiian geese now occur on four of the main Hawaiian Islands. The 2012 statewide population of wild Hawaiian geese was estimated to be 2,457-2,547 individuals comprised of 543 on Hawaii, 416 on Maui, 77 on Molokai, and 1,421-1,511 on Kauai (Marshall *pers. comm.* 2012). The majority of birds on Hawaii Island occur at Hawaii Volcanoes National Park, followed by Hakalau Forest National Wildlife Refuge and the Puu Waawaa area of west Hawaii (Figure 5).

In April 2011, Hawaii Governor Neil Abercrombie issued an emergency proclamation (referred to as the "Governor's Proclamation") suspending State endangered species and environmental compliance laws for Hawaiian geese at the Kauai Lagoons Resort. The Governor's Proclamation allowed DOFAW to act quickly in translocating the Hawaiian goose population at Kauai Lagoons to sites on other islands to reduce the potential for aircraft collisions at the adjacent Lihue Airport. This translocation effort is being conducted under a regulation (50 C.F.R. § 17.21(c)(3)(iv)) that allows State employees to take listed species if that species constitutes a "demonstrable but non-immediate threat to human safety". The Governor's Proclamation is effective for five years from April 2011 to April 2016, during which time DOFAW plans to translocate all Hawaiian geese at Kauai Lagoons, estimated to be more than 400 individuals and over 26% of the Hawaiian goose population on Kauai. If successful, this translocation effort may dramatically change the density and distribution of Hawaiian geese across the Hawaiian Islands. The Service anticipates that about 250 Hawaiian geese will be translocated to the island of Hawaii. More information regarding the translocation effort can be found in the Hawaiian Goose Translocation Plan developed by DOFAW (DOFAW 2012).

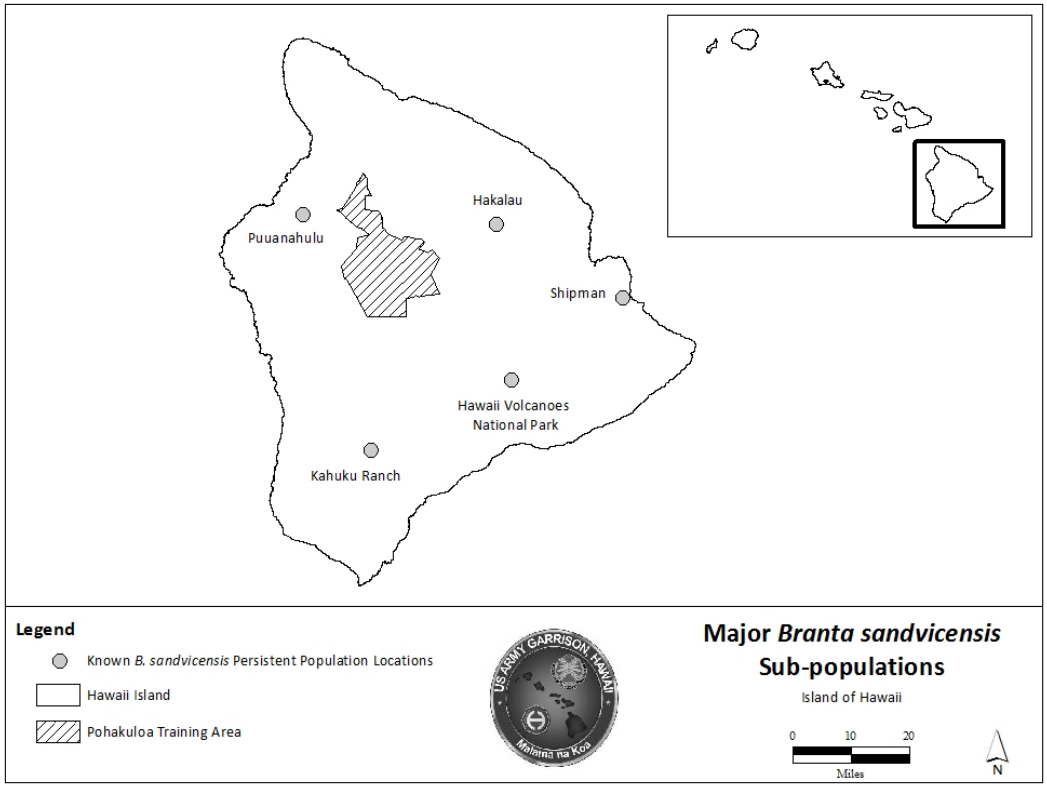

Figure 5. Spatial location of the five sub-populations of Hawaiian geese on the island of Hawaii in relation to Pohakuloa Training Area.

Life History

Hawaiian geese have an extended breeding season with eggs reported from all months except May, June, and July, though the majority of birds in the wild nest between October and March (Banko *et al.* 1999, USFWS 2004). Nesting peaks in December and most goslings hatch in December and January (Banko *et al.* 1999, p. 12). However, Hawaiian geese on Kauai frequently nest earlier than October (Marshall *pers. comm.* 2012). Hawaiian geese nest on the ground in a shallow scrape in the dense shade of a shrub or other vegetation. A clutch typically contains three to five eggs and incubation lasts 29 to 31 days. Once hatched, young remain in the nest for one to two days (Banko *et al.* 1999, pp. 16-17). Fledging of captive birds occurs at 10 to 12 weeks, but may be later in the wild. During molt, adults are flightless for a period of four to six weeks and generally attain their flight feathers around the same time as their offspring. Flightless goslings and adults are extremely vulnerable to predators, such as cats, dogs, and mongoose. From June to September, family groups join others in post-breeding flocks often far from nesting areas. Hawaiian geese reach sexual maturity at one year of age, but usually do not form pair bonds until their second year. Females tend to nest near their natal nesting area, while males are more likely to disperse (Banko *et al.* 1999). Captive-released Hawaiian geese generally nest in areas associated with release sites and wild females tend to be more philopatric than released ones (Banko 1988, Banko and Manuwal 1982).

Habitat Description

Hawaiian geese currently occupy various habitats and vegetation community types ranging from coastal dune vegetation and non-native grasslands (e.g., golf courses, pastures, and rural areas) to sparsely vegetated low- and high-elevation lava flows, mid-elevation native and non-native shrubland, cinder deserts, native alpine grasslands and shrublands, and open and non-native alpine shrubland-woodland community interfaces (Banko *et al.* 1999, pp. 4-6). On Kauai, Hawaiian geese also utilize a number of coastal wetland areas including taro loi (Marshall *pers. comm.* 2012). Hawaiian geese are browser-grazers and the composition of their diet depends largely on the vegetative composition of their surrounding habitats. They appear to be opportunistic in their choice of food plants as long as they meet nutritional demands (Banko *et al.* 1999, pp. 6-8; Woog and Black 2001, p. 324). Adaptability in their use of food items may have allowed Hawaiian geese to survive in marginal habitats to which they were relegated as more traditional habitats were lost to humans (Banko *et al.* 1999; Black *et al.* 1994b, 1997). However, Hawaiian geese may require a diverse suite of foods that includes non-native vegetation due to the loss of traditional foraging habitats (Banko *et al.* 1999, Black *et al.* 1994b). Concerns have been raised about whether breeding females and goslings receive adequate nutrition in highly altered habitats as productivity is low in many populations on Hawaii and Maui (Baker and Baker 1999, Banko 1992, Banko *et al.* 1999, Black and Banko 1994a, Black *et al.* 1994b). Hawaiian geese may exhibit seasonal movements to grasslands in periods of low berry production and wet conditions that produce grass with a high water content and resulting higher protein content.

The sites currently used by Hawaiian geese for nesting range from coastal lowland to subalpine zones and demonstrate considerable variability in physiognomic features (Banko *et al.* 1999, pp. 4-5). However, the distribution of nesting sites has also been influenced by the location of release sites of captive-bred individuals (Banko 1988). Historical reports from Hawaii Island indicated that Hawaiian geese bred and molted primarily in the lowlands during winter months and moved upslope in the hotter and drier summer months after goslings fledged (Banko 1988,

Henshaw 1902, Munro 1944). Reproductive success is relatively low in upland habitats on Hawaii and Maui and higher in lowland habitat on Kauai (Telfer 1995, 1996; Banko *et al.* 1999).

Threats

Current threats to Hawaiian geese include predation of eggs and goslings by introduced mammals (cats, rats, dogs, pigs, and mongooses); limited availability of suitable habitat due to habitat loss, fragmentation, and degradation, especially low-land breeding habitat; insufficient nutritional resources due to habitat degradation; and human-caused disturbance (including habituation to humans) and mortality (especially deaths due to collisions with vehicles). Most nesting failures of wild Hawaiian geese on Hawaii and Maui are due to mongoose predation (Baker and Baker 1999, Banko 1992, Black and Banko 1994a, Hoshide *et al*. 1990). Mongooses kill incubating females (Banko 1992) and rats are also a significant predator of Hawaiian goose eggs (Baker and Baker 1999).

Conservation Needs of the Species

A predator-free place to breed is the most significant conservation need for Hawaiian geese. Productivity of Hawaiian geese nesting in upland and mid-elevation habitats on Maui and Hawaii has been low for decades. For the time period of 1958-1988, only 33 fledglings were produced from 257 monitored nests with a known outcome (Banko and Elder 1990); one fledgling was produced from 70 monitored nests with a known outcome during 1978-1981 (Banko 1992), and six fledglings were produced from 36 monitored nests with a known outcome during 1994-1996 (Banko *et al.* 1999).

Ongoing Conservation Actions

PTA environmental personnel set traps for predators with guards and housing around traps to exclude Hawaiian geese. In fact, there has not been a single occurrence of injury or death from incidentally catching a Hawaiian goose while predator trapping at PTA (Schnell *pers. comm.* 2012). PTA environmental personnel also currently manage the Wildlife Enhancement Area at Range 01 Complex for Hawaiian geese per requirements of the 2008 Biological Opinion (USFWS 2008a) by providing grass plots and shaded areas inside the 13 fenced acres. Additionally, whenever molting geese will be hazed into there, PTA environmental personnel will intensively trap the perimeter of the Wildlife Enhancement Area to increase the survivorship of those molting geese.

ENVIRONMENTAL BASELINE (Status of Species in the Action Area)

All five plant species in the proposed IPBA action area have the same threats: mortality during ground softening activities and trampling from foot or vehicle traffic associated with the construction, maintenance, and operation of the proposed IPBA (i.e. bivouac, live-fire training, and mounted and dismounted maneuvers); dust from vehicle traffic along newly created roads within the IPBA; competition with non-native plants; and risk of fire, habitat fragmentation, and dispersal of non-native plant seeds from foot or vehicle traffic and other activities associated with military training. A total of 26 acres of *Spermolepis hawaiiensis* and 27 individuals of the four other listed plant species were found during 2010 and 2012 surveys in the action area for the proposed IPBA (CEMML 2011, p. 11; 2012, p. 4).

Asplenium peruvanium var. insulare

Survey results in 2010 documented one individual of *Asplenium peruvanium* var. *insulare* at the entrance of a lava tube within the proposed IPBA. This individual represents less than 1% of approximately 440 to 828 known individuals at PTA (US Army 2012a, p. 98).

Kadua coriacea

Survey results in 2010 documented 10 individuals of *Kadua coriacea* in nine locations within the proposed IPBA. All individuals had been browsed by ungulates, but most plants appeared healthy. The distribution of the species across the IPBA was in a narrow north-south band that approximately bisected Action Area F. These 10 plants represent 6% of the PTA population of approximately 167 known individuals (US Army 2012a, p. 98).

Silene hawaiiensis

Survey results in 2010 documented one individual of *Silene hawaiiensis* in the far eastern portion of the proposed IPBA. The plant was heavily browsed, in poor health, and only 1.2 inches tall. This occurrence represents less than 1% of the approximately 2,800 known individuals at PTA (US Army 2012a, p. 98).

Spermolepis hawaiiensis

Surveys results in 2012 documented *Spermolepis hawaiiensis* in the southern portion of the proposed IPBA. All detected individuals were senesced because surveys were conducted during a dry period and plants were found after having completed their life cycle. Plants were distributed across approximately 26 acres of a heavily degraded, 65-acre, naio and mamane kipuka, which represents about 5% of the approximately 550-600 known acres of *S. hawaiiensis* at PTA (US Army 2012d). Significantly, the preferred alternative for placement of the IPBC is not sympatric with the area occupied by *S. hawaiiensis* and this species may actually be unaffected by the proposed IPBA project.

Zanthoxylum hawaiiense

Survey results in 2010 documented 15 individuals of *Zanthoxylum hawaiiense* in 13 widely distributed locations across the proposed IPBA. This occurrence represents 2% of the approximately 650 known individuals at PTA (US Army 2012a, p. 100).

Hawaiian geese

Recent Distribution of Hawaiian Geese at Pohakuloa Training Area - Range 01 Complex

Hawaiian geese have primarily been detected at the Range 01 Complex and occurrence even there varied by year. PTA environmental personnel recorded 828 Hawaiian geese there in 2009, 71 in 2010, and 279 in 2011 (US Army 2012a). PTA environmental personnel defined flocks using several criteria, including the proximity of individual birds to one another, the level of interaction between birds, and known history between birds (i.e., familial/mate relationships). For birds considered as comprising a flock, PTA environmental personnel recorded key attribute data, such as the time the flock was first observed, its spatial coordinates, identification band status/information, and the number of birds in the flock. Data indicated a marked drop-off in the

number of flocks with greater than six birds, as 130 of 158 total flocks (> 82%) recorded in 2009 had six or fewer birds (Figure 6) (US Army 2012a). Based on these results, the Service used six as the size of a Hawaiian goose flock that could be impacted from any singular incident related to military training on PTA ranges.

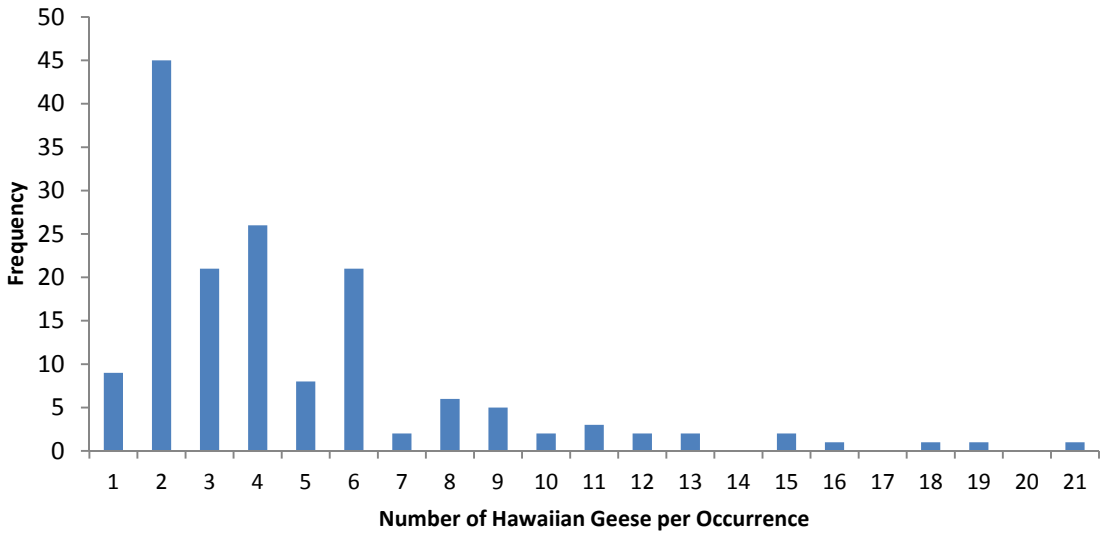

Figure 6. Frequency distribution of the number of Hawaiian geese per occurrence at Range 01 Complex in 2009 observed by environmental personnel at Pohakuloa Training Area, Hawaii.

Hawaiian Goose Sightings at Range 01 Complex in 2009

PTA environmental personnel mapped locations of Hawaiian geese in 2009 on each of Range 01 Complex's three "sub-ranges". The Modified Record Fire Range ("MRF", Range 01a, Figure 7) is a range that consists of 10 elevated shooting platforms with targets every 82 feet out to 984 feet in front of each shooting platform. The Known Distance Range ("KD", Range 01b) is a sniper range with a fixed firing line and targets set out up to 3,280 feet away from fixed firing positions. The Squadron-Infantry Attack Course (SIAC, Range 01) is a range of variable use that soldiers move through differently depending on training objectives. Of 471 total Hawaiian goose occurrences recorded in 2009 at the Range 01 Complex, 384 occurred on one of the three training sub-ranges: 381 (81%) occurred on the SIAC, three (< 1%) occurred on the MRF Range 01a, and none occurred on the KD Range (see Figure 7). Hawaiian geese are most likely to be incidentally taken as a result of training on the SIAC sub-range because soldiers are not firing from stationary and elevated positions, but rather walking or crawling along the ground and moving through a natural environmental with limited visibility due to terrain and vegetation.

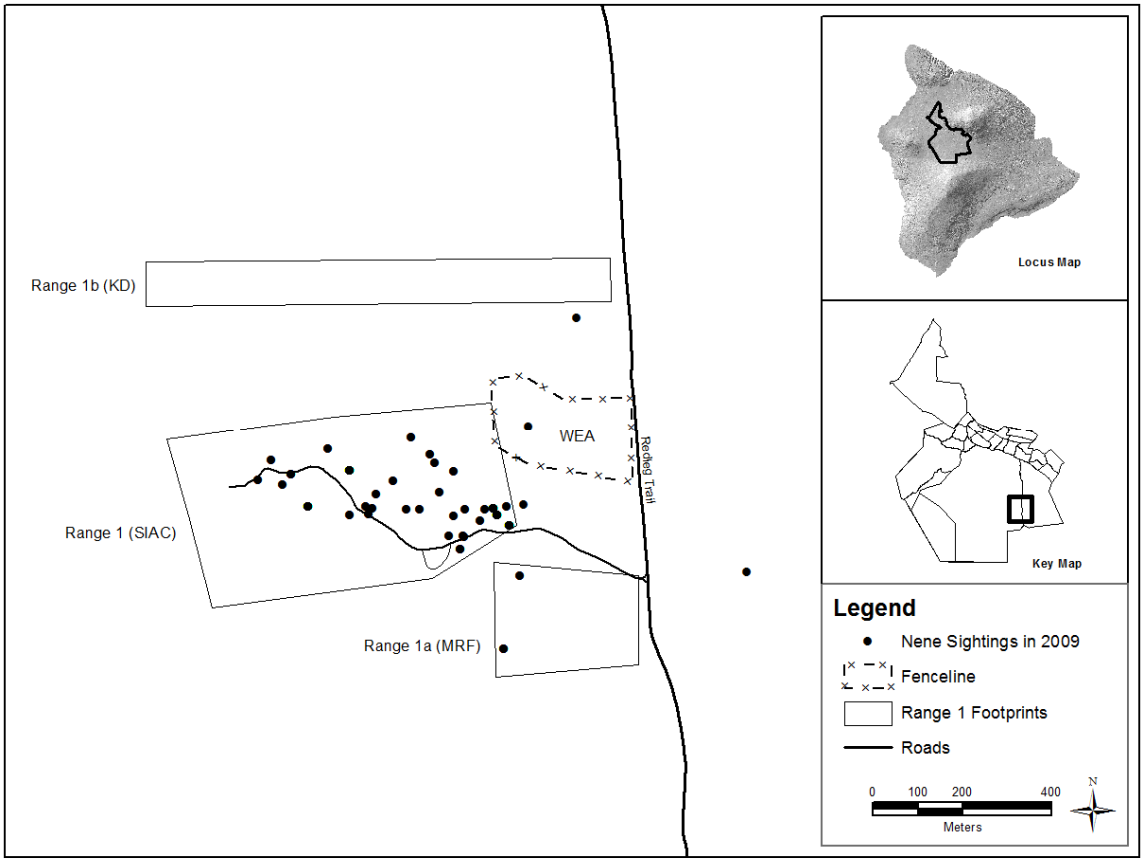

Figure 7. Hawaiian goose occurrences recorded in 2009 at Range 01 Complex on Pohakuloa Training Area, Hawaii. Range 01b is the Known Distance sniper range; Range 01 is the Squadron-Infantry Attack Course (SIAC), Range 01a is the Modified Record Fire (MRF) range, and the Wildlife Enhancement Area (WEA) is fenced and currently managed for Hawaiian geese.

Recent Distribution at Pohakuloa Training Area - Impact Area

As required by the 2008 Biological Opinion (USFWS 2008a), the Army purchased seven Global Positioning System (GPS) tracking harnesses to support research of movement patterns of male Hawaiian geese conducted by the United States Geological Survey and Hawaii Volcanoes National Park. Monitoring for Hawaiian goose movements within the Impact Area by means other than telemetry harnesses is unfeasible due to unsafe conditions associated with UXO. In 2010 and 2011, all four birds with transmitters from the western side of the island (Puu Waawaa) made a stopover in the Impact Area while traveling east. Birds roosted overnight, spending between a few and 24 hours at PTA. Limited data show west-side birds traveling east in late March or early April to join east-side birds for flocking season. Although only four west-side birds were fitted with transmitters, the Army assumes most west-side birds (estimated at 130 individuals) traveling east to summer flocking grounds transit PTA and make stopovers because

they are flying uphill and against the prevailing trade winds. Conversely, at the end of the 2010 flocking season (October thru December), the western-side birds journeying westward to their breeding areas did not stop in the Impact Area. PTA environmental personnel assume that they traverse PTA as they return westward to breed, but do not need to stop as they are flying downhill with prevailing trade winds at their tails. Unfortunately, this is a sample size of only four individuals from one year, as the transmitters quit by the end of flocking season in the second year (Hess *et al.* 2012, US Army 2012c).

No eastern-side birds with transmitters made west-bound trips across PTA (Hess *et al.* 2012). However, some eastern-side birds have been observed visiting western-side breeding areas for a few weeks during the post-breeding season (March to April) and pre-breeding season (October to November). During 2008-2012, Polhemus (*pers. comm.* 2012) incidentally observed four flocks (comprised of six, seven, 11, and 14 individuals) of eastern-side birds from the Refuge on the west side of the island. These birds potentially land in the PTA Impact Area when transiting between eastern and western population centers (US Army 2012c).

Recent Distribution at Pohakuloa Training Area - Keamuku Maneuver Area

A few Hawaiian geese use portions of KMA seasonally (November to March) and within season visitation is sporadic, unpredictable, and limited in distribution. Army environmental personnel surveyed for Hawaiian geese on 66 favorable days over a three-year period since the Army purchased KMA in 2006. Detections did not always result in positive identification of individuals, but four birds were recorded regularly on the 29 days when Army environmental personnel observed Hawaiian geese and these Hawaiian geese (two pairs) constituted all confirmed sightings at KMA. After a failed nesting attempt in 2008 by one pair in KMA, no additional Hawaiian goose nests have been discovered in KMA and both pairs have since successfully bred in more suitable nesting areas of Puu Waawaa and the Big Island Country Club (DOFAW, unpublished data; US Army 2012a).

Recent Distribution at Hakalau Forest National Wildlife Refuge

In 2011, the total population of Hawaiian geese estimated at Hakalau Forest National Wildlife Refuge was 142 individuals (Hakalau Forest National Wildlife Refuge, unpublished data). During the four-year period of 2009-2012, 22 Hawaiian geese from the Refuge visited the Range 01 Complex during exactly one year and 40 additional Hawaiian geese from the Refuge were observed at the Range 01 Complex in more than one year (US Army 2012a). Little is known about large-scale movements of Hawaiian geese across the island of Hawaii. Three of eight Hawaiian geese in the 2010-2011 USGS GPS study that carried transmitters on the east side of Hawaii visited the Refuge: two birds were located almost exclusively at the Refuge, while the other bird flew throughout the east side of the island (Figure 8) (Hess *et al.* 2012).

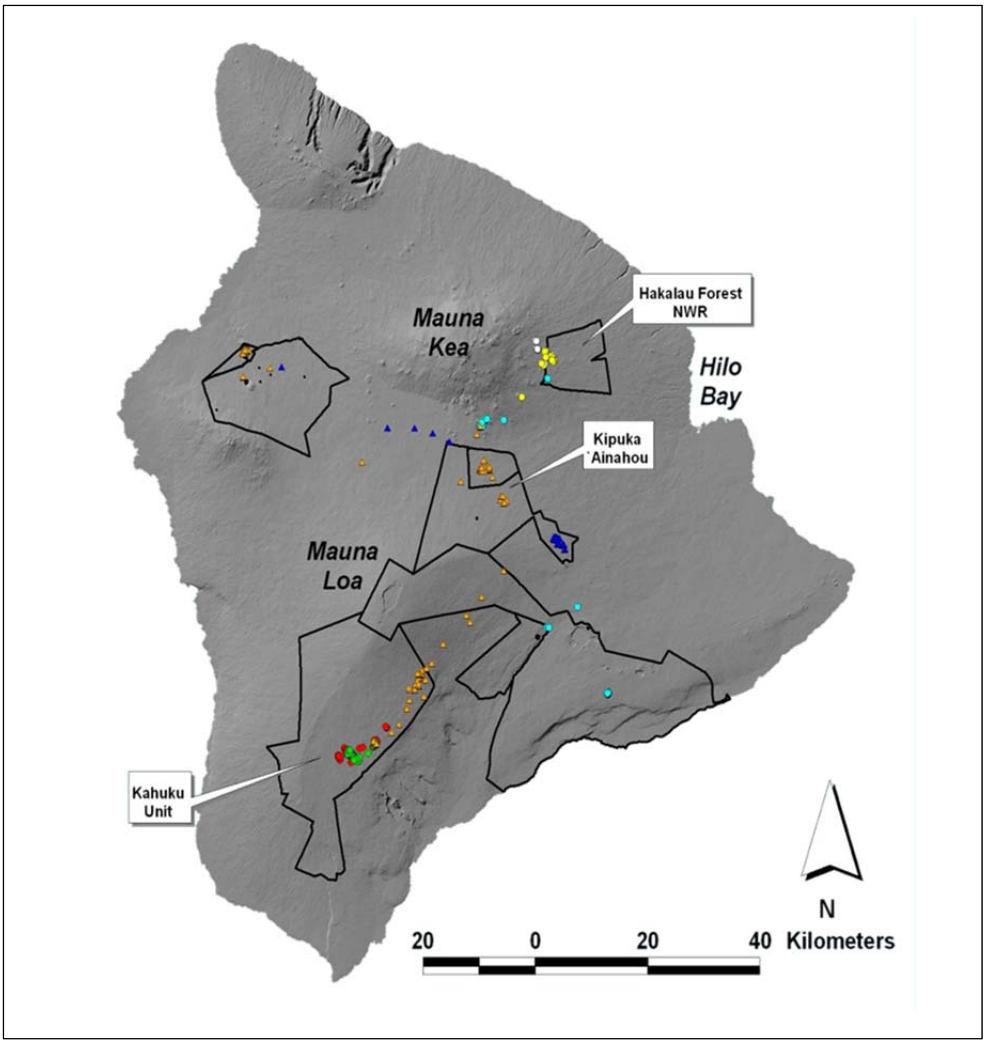

Figure 8. Data from 12 Hawaiian geese with Global Positioning System transmitters in 2010-2011 on the island of Hawaii (Hess *et al.* 2012).

EFFECTS OF THE PROPOSED ACTIONS

Military Training at the Proposed Infantry Platoon Battle Area

The proposed IPBA is being designed to be used in several ways to make training more realistic and challenging. For example, one platoon could use the IPBC while the two other platoons of a company train at the MOUT and Shoot House simultaneously. This type of scenario would simulate units of the same company maneuvering through an urban or semi-urban area, while a third unit conducts field operations outside the city or town limits. Another example scenario may include all platoons ready to use the IPBC in sequence; or, given the proposed entranceway width of 3,300 feet, up to two platoons entering the IPBC simultaneously with one platoon waiting in reserve and following behind the others (US Army 2012a).

Over the course of a training year, units of the 25th Infantry Division (Light) may fire as many as 627,000 total rounds of ammunition while training at the IPBA. Of that approximate total, 374,000 rounds will be blank ammunition, which may have lead primers, and 253,000 rounds will be live ammunition. Live ammunition fired on the IPBC will be directed towards the Impact Area. Because live ammunition fired in the Live-fire Shoot House will be contained within the facility and no live ammunition will be fired at the MOUT facility, only the effects from weapons and ammunition authorized for use at the IPBC is analyzed (Refer to US Army (2012b) for more information regarding the weapons and ammunition authorized for use at the MOUT and Live-fire Shoot House).

Weapons and Ammunition Authorized for Use at the Infantry Platoon Battle Course

The primary weapons authorized for use on the IPBC are M16 and M4 rifle series; M21 and M24 sniper weapons; M107 long-range sniper rifle; M240 and M249 squad automatic weapon machineguns; M2 0.50 caliber machine gun; and M203 40 mm grenade launcher (Target Training Practice only). The ammunition authorized for use on the IPBC is 5.56 mm, 7.62 mm, 0.50 caliber, and M203 40 mm grenade (Target Training Practice only) (US Army 2012a).

- Each infantry squad rifleman and weapons squad rifleman is allocated 280 rounds of 5.56 mm per year for six live-fire events, or 45 rounds per event. Estimated use is 40 rounds per event for the infantry squad rifleman and 20 rounds for the weapons squad riflemen;
- The infantry squad light machine gunner (M249) is allocated 600 rounds of 5.56 mm per year for six live-fire events or 100 rounds per event. Estimated use is 100 rounds per event;
- The M203 gunner is allocated 18 40-mm target practice rounds per year for four live-fire events. Estimated use is four rounds per IPBC event;
- The weapons squad light machine gunner (M240) is allocated 600 rounds of 7.62 mm per year for six live-fire events or 100 rounds per event. Estimated use is 100 rounds per event; and
- The company may attach the M2 machine gun (0.50 caliber) and MK 19 grenade machine gun (40 mm) to the platoon during the IPBC exercise. Estimated use is 75 rounds for the M2 machine gun and five rounds for the MK 19 grenade machine gun per exercise.

Effects on Listed Plant Species

Because the positions of the IPBC, MOUT, and Live-fire Shoot House have not been finalized, the Service conservatively assumes that all individuals of listed plant species within the proposed IPBA will be killed. Only one individual of two species (*Silene hawaiiensis* and *Asplenium peruvanium var. insulare*) is present in the proposed IPBA and thus the impacts of the proposed IPBA project to those species are minor. *Spermolepis hawaiiensis* was declared stabilized statewide by the Service in 2010 (USFWS 2010b) and the proposed IPBA project is not affecting a large percentage of its spatial distribution. Similarly, the 15 individuals of *Zanthoxylum hawaiiense* present in the proposed IPBA represent less than 2% of the total estimated individuals for the species combined on Maui and Hawaii.

One plant species, *Kadua coriacea*, may be impacted significantly by the proposed IPBA project. The preferred orientation of the IPBC includes four of the 10 individuals present at the IPBA within its perimeter and the non-preferred orientation includes all 10 individuals (US Army 2012d). Though the actual ground disturbance from the IPBC is small, those 10 individuals in the IPBA project area may all be killed and they represent 6% of the total population of this species (US Army 2012a, p. 98). The Army's conservation measure to collect seeds and cuttings from these 10 individuals, propagate and out-plant more than 10 individuals is significant in the Service's consideration of the overall impacts to this species from the proposed IPBA project.

Effects on the Hawaiian Goose

Many of the entire west side population of 130 Hawaiian geese from Puuanahulu (see Figure 5) are assumed to make a stopover on PTA once a year for several and up to 24 hours (US Army 2012a). While feeding or loafing, Hawaiian geese may be injured or killed by training activities while they are present in a Surface Danger Zone at the IPBA, or by vehicles transiting between the IPBA and the Cantonment Area while they are present on roadways (see Figure 1).

Effects of Military Training at Pohakuloa Training Area to Hawaiian Geese

Direct Mortality to Hawaiian Geese from Training Rounds, Vehicles, and Aircraft Strikes

More than a million rounds of ammunition may be fired on PTA each year in implementation of the training exercises described in the project description of the 2003 Biological Opinion (USFWS 2003), in addition to the proposed military training exercises described in this project description. Small arms, demolitions, grenades, mines, simulators, mortars, artillery, bombs up to 2,000 pounds, and ground- and air-based missiles and rockets are among the weapons proposed at PTA. Hawaiian geese traversing the impact area in flight or loafing undetected within the Impact Area could be killed by a direct hit of a round, shrapnel or fragments from a detonation, or by compression due to blast overpressure resulting from detonation of rounds from these weapons (USFWS 2008a).

Flying Hawaiian geese may be struck and killed by helicopters, fixed wing aircrafts, or rounds as they are shot into the impact area on PTA. Helicopters training at PTA fly at an altitude of approximately 500 feet. Flights are closer to terrain during landing and takeoff exercises and, particularly in the vicinity of dip tank sites, fire suppression operations increase the risk of avian collisions. An existing helicopter landing zone, generally used fewer than 14 hours per year, is adjacent to an area near Range 01 Complex (i.e., the Wildlife Enhancement Area) that the Army has enhanced to attract Hawaiian geese, which means Hawaiian geese could be present on the landing zone. Fixed wing aircraft conduct up to 30 flights over PTA each year. They are generally thousands of feet in the air above Hawaiian geese making short flights across the island and therefore there is probably no exposure of fixed wing aircraft to flying Hawaiian geese (US Army 2012a). To date there has never been a documented air collision by a helicopter or fixed wing aircraft with a Hawaiian goose in Hawaii (FAA 2008). Therefore, the Service concludes that while Hawaiian geese may be struck by a helicopter or a fixed wing aircraft, the risk is minimal due to Hawaiian geese behavior and the locations of landing zones. If a Hawaiian goose is killed by a helicopter or collision with a fixed-wing aircraft, the take will be reported to the Service and we will work with the Army to determine if this risk can be avoided in the future (USFWS 2008a).

Hawaiian geese may be hit by vehicles on improved and unimproved roads on the installation. Support vehicles and Stryker vehicles, which are an integral component of training, could strike Hawaiian geese. Hawaiian geese have been documented foraging along roadsides and have been struck by non-military passenger vehicles on Saddle Road near PTA (Command 2008). Hawaiian geese may unexpectedly walk into the path of a vehicle during a training exercise and the driver may not have sufficient time to respond and avoid hitting the Hawaiian geese resulting in death or injury of a Hawaiian goose. To minimize the impacts to Hawaiian geese from vehicular strike at PTA, vehicles will be driven at speeds no greater than 15 miles per hour, day and night, unless the PTA Commander and PTA Range Operations have approved a waiver for a legitimate training need (US Army 2010). Waivers have been requested about twice per year (Schnell *pers. comm.* 2012). To date, speeds over 25 mph have not been allowed, multiple days may be needed to complete the training scenario for all vehicles within a unit, and six to 10 vehicles maneuver together at speeds greater than 15 mph during a typical training event (Schnell *pers. comm.* 2012, US Army 2010). When troops are present within the immediate vicinity of vehicles, the speed limit is five miles per hour. All soldiers training on any portion of PTA will be provided briefings by Army environmental personnel that detail measures they are required to implement to avoid and minimize potential impacts to Hawaiian geese. Given the low vehicle speeds and general lack of food along roadways, we expect the likelihood of vehicles striking Hawaiian geese at PTA is low, though possible.

Noise Impacts to Hawaiian Geese

The proposed live-fire training and associated use of helicopters, fixed wing aircraft, and construction equipment will result in loud noises. Hawaiian geese within PTA may be located less than 50 feet from detonations of demolitions, grenades, mortars, artillery, tube-launched wire-guided missiles, bombs, fire suppression, training-related helicopters and fixed wing aircraft, and loud voices. Potential consequences of exposure to the noise associated with live-fire training at PTA could include increased metabolism, discomfort, and temporary damage to auditory cells (Table 1).

Table 1. Noise levels of live-fire training compared with familiar noise levels.

Noise Source	Decibels at 50 feet from source	References
Rustling leaves, idling car, normal conversation	35 to 55	National Institute for Deafness and other Communication Disorders 2008; Resource Systems Group 2006, p. 3
Beginning of human hearing damage	85	Hamby 2004
Helicopter	95 to 112	Federal Aviation Administration 2004, pp. 4-7; Hughes *et al.* 2008, p. 1,521
Human body begins to perceive vibration	116	Hamby 2004
Rifle, handgun, and shotgun firing	139 to 142	Clark and Bohne 1999, p. 1,658; Ylikoski *et al.* 1995, p. 3
Extremely damaging to human hearing	140	Hamby 2004
Fatal to insects and mice with sufficient exposure	160 to 165	Allen *et al.* 1948, p. 62
Artillery, 55 pound HE Detonation, M1 Grenade Detonation	168 to 173	Albert 2002, p. 203

The noise generated from Army actions is expected to increase startle, alarm, and alert behavior of Hawaiian geese at PTA. Hawaiian geese may take flight to avoid the noise associated with training activities, increasing their risk of being struck by the live-fire rounds and increasing energetic demands from flying. Hawaiian geese in close proximity to detonations are expected to respond to loud noises and vibration with increased activity and therefore their food demands are expected to increase (USFWS 2008a).

In humans, sound levels over 85 dBA are considered harmful to inner ear hair cells, 95 dBA is considered unsafe for prolonged periods, and extreme damage occurs as a result of brief exposure to 140 dBA (Hamby 2004). Hearing loss in birds is difficult to characterize because birds, unlike mammals, regenerate inner ear hair cells even after substantial loss (Corwin and Cotanche 1988, pp. 1,772-1,774; Stone and Rubel 2000, pp. 11,714-11,721). Therefore, we do not expect permanent hearing loss in Hawaiian geese to result from the proposed action (USFWS 2008a).

Studies on the impacts of aircraft overflights to Hawaiian geese have not been conducted, though several studies have examined the impacts to birds of prey (Andersen *et al.* 1989, pp. 296-299; Delaney *et al.* 1999, pp. 60-76; Palmer *et al.* 2003, pp. 499-509; Trimper *et al.* 1998, pp. 122-130; Watson 1993, pp. 171-178), and waterbirds (Conomy *et al.* 1998a, pp. 1,127-1,134; Conomy *et al.* 1998b, pp. 1,135-1,142; Ward *et al.* 1999, pp. 373-381). These studies have reported a wide range of reactions to overflights depending on the biology of the species, its previous exposure to overflights, whether the species is breeding, the type of aircraft, the altitude of the aircraft, and the lateral distance between aircraft and the species. Birds habituate to noises and may not respond to stimuli when they do not perceive a direct threat. This habituation, however, may be individual or species specific. For example, individuals with previous exposure to aircraft overflights may display less reaction to overflights than individuals without previous exposure (Andersen *et al.* 1989, p. 296; Conomy *et al.* 1998b, pp. 1,135-1,142). For water birds, American black ducks (*Anas rubripes*) reacted to 39% of military aircraft overflights on their first day of exposure, but after two weeks they responded only 6% of the time. However, wood ducks (*Aix sponsa*) in the same study did not habituate to the aircraft noise (Conomy *et al.* 1998b, pp. 1,135-1,142). Incubating herring gulls (*Larus argentatus*) and great black-backed gulls (*Larus marinus*) habituated to the continual presence of humans by modifying their responses, but would continue to be disturbed when they perceived direct approach by a human walking directly toward their nests (Burger and Gochfeld 1981, pp. 242-267).

In addition, the degree of disturbance to which a species can habituate may also be limited (National Park Service 1994, p. 518). If the Hawaiian geese at PTA are returning adults, these Hawaiian geese would have been previously exposed to training noises and may be habituated. Habituated Hawaiian geese may remain in the area during training exercises and could experience little to no stress as a result of the noise associated with training. However, Hawaiian geese that are from a new cohort may react differently and may take flight during a training exercise. Because Hawaiian geese have been observed loafing in the vicinity of Range 01 Complex during live fire exercises in the past, some individuals may have habituated to noise associated with training. We assume when noise is too loud or disruptive, Hawaiian geese will either leave the area or they are not losing any metabolic resources (USFWS 2008a).

Specific Impacts to Hawaiian Geese on Direct Fire Ranges

The following types of activities occur on Range 01 Complex and other direct fire ranges: small arms fire, pyrotechnics fire, mortar fire, attack helicopters firing 2.75 rockets, and vehicle traffic. In the vicinity of Range 01 Complex, Hawaiian geese are known to occur in small flocks (generally six or fewer birds) with the largest flock observed to be 33 birds (US Army 2012a). The area used by Hawaiian geese is within the Surface Danger Zones for weapons fired from Range 01 Complex, as well as other firing points utilized for Convoy Live-Fire training. If Hawaiian geese are not hazed off of a range prior to training, live-fire ammunition, compression, or shrapnel resulting from detonation of these rounds could injure or kill Hawaiian geese. Live-fire training will also result in increased noise, smoke, risk of mortality from increased stress, a direct strike, or shrapnel. The Army will incorporate into training that Hawaiian geese will not directly be targeted and will have an appropriate leader observing performance on the range during training. Therefore, take of Hawaiian geese should be limited at any time and should not exceed the typical flock size of six individuals. Once a take is observed, training will cease to provide further instructions to troops and minimize the chance of additional take. The Army may haze Hawaiian geese to temporarily exclude them from training ranges.

Training actions on direct fire ranges are also likely to result in Hawaiian geese being startled during pre-training area sweeps due to increased noise and movement during training exercises. Hawaiian geese may respond to the presence and activity of troops, increased noise, and live-fire training in a number of ways as described above, including physiological changes that increase metabolism, increased activity, and taking flight to avoid noxious stimuli. Monitoring by biologists may provide sufficient information to quantify these responses. Given that Hawaiian geese are present on the Range 01 Complex regularly and the Army may train there every day of the year, the Service anticipates that two flocks of six Hawaiian geese each year may be injured or killed as a result of the ability to train with an unlimited number of Hawaiian geese in Surface Danger Zones. Hazing may not always be a practical solution and individuals or flocks of Hawaiian geese may habituate to Army environmental personnel, thus making hazing ineffective and resulting in training with Hawaiian geese in a Surface Danger Zone. Furthermore, the rolling topography and abundant vegetation at Range 01 Complex makes tracking the location of Hawaiian geese on the ranges difficult. As a result, Hawaiian geese may be harmed incidental to military training.

Range 04 is the only other direct firing range currently known with frequent presence of Hawaiian geese. However, the Hawaiian geese detected in the Range 04 Surface Danger Zone loaf in an area over 6,000 feet down range of the targets and are protected by a large hill that is between the range footprint and the loafing area. Because of the distance and topography between the firing location and the area generally used by Hawaiian geese, the Service anticipates that a Hawaiian goose is unlikely to be struck by live fire on Range 04. Furthermore, the Service expects Hawaiian geese this far down range of targets and behind topographical features to not be startled or possibly even aware of training activities on Range 04.

Specific Impacts to Hawaiian Geese on Indirect Fire Ranges

The Impact Area is an example of an indirect fire range, because the soldier firing a weapon cannot see the target. As a result, the soldier is unaware if a Hawaiian goose is occupying a targeted area. Larger weapons that make larger impact craters, expel more shrapnel, and create more noise and percussion are used on indirect fire ranges. The potential for one round to take an entire flock of Hawaiian geese is greater on an indirect range, especially the central Impact Area at PTA. Monitoring the impact of a fired round on Hawaiian geese is not possible, as the explosion occurs miles away from firing positions. US Army (2012a) provided detailed information regarding the number and size of rounds fired at PTA on all ranges. Though limited telemetry data showed that Hawaiian geese may only spend a 24-hour period per year on PTA (Hess *et al.* 2012), Hawaiian geese may be injured or killed as a result of military training. Hazing is not a practical option for an indirect fire range, especially the Impact Area due to UXO. Therefore, given the number, frequency, and size of munitions that explode on indirect fire ranges at PTA (see US Army (2012a) for more details), and the size of the Impact Area, the Service anticipates that two nests and one flock of six Hawaiian geese per year may be injured or killed as a result of the ability to train because Hawaiian geese have been documented in Surface Danger Zones.

Impacts of Activities on the Keamuku Maneuver Area to Hawaiian Geese

Hawaiian geese are known to forage, loaf, and nest on KMA. Aviation drop-zone and brigade task force maneuver, construction, and fire suppression are proposed for this training area. Fire management program weather stations and dip tank sites have been installed and utilized within

KMA. Training and construction is expected to alter habitat, increase noise, increase human disturbance, and increase the potential for Hawaiian geese to be struck by vehicles and aircraft.

Potential impacts to nesting Hawaiian geese in KMA include disturbance of nesting pairs and their goslings. Studies of the impacts of military training to nesting Hawaiian geese have not been conducted. However, several studies have examined the impacts of human activity and training near nesting sites of other wildlife taxa. Training and other activities could result in increased gosling mortality and nest abandonment. Numerous bird studies have documented that nestling predation increases when anthropogenic disturbances result in nest abandonment (Anderson 1988; Piatt *et al.* 1990; Tremblay and Ellison 1979).

Goslings and adult birds could be struck by Stryker vehicles. In addition, road construction may potentially lead to habitat fragmentation between nesting sites and areas for rearing of goslings, as areas for nesting are not always ideal for gosling rearing (Banko *et al.* 1999, p. 4). If Hawaiian geese are unable to access prime browsing areas or are required to expend more energy to reach prime browsing areas, habitat fragmentation could lead to decreased food availability and fitness. Furthermore, increased roadways are likely to result in increases in vehicular strike as Hawaiian geese may traverse the roadways more frequently.

Military training activities could potentially increase the risk of fire within the KMA. Fire is especially dangerous during molting when juveniles and adults are flightless. Fire also poses a significant threat to goslings before they are flighted. The Army's Wildland Fire Management Plan has been updated to incorporate fire suppression resource staffing procedures, training restrictions based on calculated fire danger, and installation and maintenance of dip tank sites, fuel modifications, and weather stations within the KMA to minimize fire impacts to Hawaiian geese. Most important, there is no live-fire within the KMA so the risk of fire is greatly minimized. On the other hand, vegetation regeneration after a fire can provide ideal foraging and nesting opportunities for Hawaiian geese (Misajon *pers. comm.* 2012).

In summary, training related activities on KMA could result in disturbance of nesting patterns due to training noise and activity, increased habitat fragmentation from the creation of roads, and increased fire frequency. There have been two pairs of Hawaiian geese documented using KMA and one confirmed nest in four years of limited surveys. Stryker vehicle use will increase over time and nesting areas for Hawaiian geese are likely training areas for driving Stryker vehicles. Breeding geese in the grassland habitat of KMA may be inadvertently run over by troops operating Stryker vehicles, so the Service anticipates take of one nest and one pair of Hawaiian geese (because two is the flock size observed in KMA) per year.

Other Potential Project Impacts to Hawaiian Geese

There is potential that Hawaiian geese might incidentally ingest debris that remains after training, such as bullet casings. However, the potential that Hawaiian geese might encounter these materials is minimized by the Army's requirement that Range Control staff must check the area after each training event is completed to ensure that training sites meet Army clean-up standards. Thus, training areas used by Hawaiian geese are expected to be realistically clear of rubbish. In general, ingestion of foreign material is not known to be a problem for Hawaiian geese. One bird on Kauai was documented as dying because its gizzard was impacted as result of lead poisoning from an unknown source (Banko *et al.* 1999, p. 23).

In addition, pea gravel used in sand bags on training ranges is a documented attractive nuisance on Range 01 Complex (Schnell *pers. comm.* 2012). Using such small gravel increases the likelihood that Hawaiian geese may be present on a range to ingest the gravel and presence on a training range when training is occurring increases the risk of harm to Hawaiian geese.

Effects of Hazing to Non-Breeding Hawaiian Geese

As the Army may choose when to haze, there are no data to indicate how many total birds will be impacted by hazing. In 2009, as many as 42 Hawaiian geese were at Range 01 Complex at any one time and three family groups were regularly present. In 2010 the highest daily visitation rate was 10 Hawaiian geese, presumably because of drought conditions and subsequently less available food plants. The State is currently translocating approximately 240 Hawaiian geese to an area within a few miles of Range 01 Complex and some of these birds may congregate with Hawaiian geese that visit PTA regularly. The Army is also planning to expand use of Range 01 Complex in 2013. During 2009-2010, Hawaiian geese were present 33 of 110 training days (30%) (US Army 2012a). At this rate and if the Army trains 365 days a year at Range 01 Complex, hazing may be expected on as many as 100 days per year. However, as a requirement for the ability to haze Hawaiian geese at Range 01 Complex, the Army will reduce the attractiveness of the site by first herbiciding food plants. This action will presumably reduce the numbers of Hawaiian geese in conflict with Army training and thereby reduce the rate at which hazing operations would be needed in the future.

Hazing operations are designed to reduce the risk of incidental injury or mortality on Hawaiian geese from Army training and remove current restrictions precluding Army training given the Army's off-site production of Hawaiian geese at the Refuge. Hazing activities will be conducted in a manner that will minimize and avoid adverse impacts to Hawaiian geese. The conservation measures outlined in the project description will ensure that hazing operations are directed by an individual trained in non-lethal harassment techniques.

Available foraging and loafing habitat is not a limiting factor for Hawaiian geese in this part of their range and birds that are hazed away from ranges at PTA to facilitate training have adequate foraging and loafing habitat throughout the Saddle area on Hawaii. Therefore, the Service anticipates that hazing is a temporary action and will not result in a decline in adequate foraging or loafing habitat for non-breeding Hawaiian geese. Although there is an energetic cost associated with being forced to fly to other locations to forage or loaf, the Service anticipates that hazing will not result in any reduction in the fitness or survivorship of non-breeding Hawaiian geese.

Despite the requirements of training and use of best management practices when hazing, the Service acknowledges that hazing operations at PTA may result in death or injury to individual Hawaiian geese. Hazed Hawaiian geese may become disoriented or stressed and subsequently collide with fences, cars, or other man-made structures. Such incidents are thought to be rare and have not been documented at Pacific Missile Range Facility - Barking Sands, where Hawaiian geese are hazed off of the airfield to avoid collisions with aircraft. This hazing activity is not conducted to facilitate military training and has no authorized take of nests or individual injury or death of Hawaiian geese. USDA-WS hazed Hawaiian geese at Pacific Missile Range Facility - Barking Sands around 600 times in 2009 and 500 times in 2011 for a total of 1,100 times without incident. The Army may choose to haze Hawaiian geese at PTA perhaps a total of 100 times per year over the 20 years of this Biological Opinion for a total of 2,000 times.

Though the frequency of hazing is solely up to the Army, the Service anticipates that very few, if any, Hawaiian geese may be harmed due to hazing activities at PTA.

Effects of Hazing to Breeding Hawaiian Geese

With prior approval from the Service, PTA environmental personnel may relocate nests and goslings to a safe area, such as the Wildlife Enhancement Area at Range 01 Complex. Handling of the eggs is authorized only to move the eggs from their nest on a training range into another nest off of the training range, preferable into an area such as the Wildlife Enhancement Area at the Range 01 Complex that is fenced and will benefit from Army environmental personnel immediately initiating predator control. Because the training ranges at PTA do not have active predator control, if the adults do not abandon the nest once the nest has been moved, egg survivorship will likely be higher in a managed than unmanaged area. Indeed, even with predator trapping, Haleakala National Park biologists on Maui reported a success rate of only 18 +/- 3% for an average of 55 Hawaiian goose nests per year from 2006 to 2010 located outside of fenced areas (Haleakala National Park, unpublished data). Similarly, Refuge biologists have repeatedly reported poor success rates for Hawaiian goose nests without active predator control. Adults may abandon the nest after the nest has been moved, resulting in loss of that nest. If this event happens early in the breeding season, the adults may attempt to nest again, preferably off of a training range. Though Hawaiian geese are philopatric and nesting has not yet been documented on Range 01 Complex, the Service anticipates that, in years with sufficient precipitation, tens of Hawaiian geese will visit regularly. In addition, the approximately 240 Hawaiian geese released by the State are expected to join the sub-population of which individuals regularly visit Range 01 Complex. As a result, that Hawaiian goose sub-population will triple in size over the next year and pairs of Hawaiian geese may be forced to sub-optimal or previously unused nesting habitat. As a result, the Service anticipates that up to one nest per year may be lost as a result of attempting to move nests unsuccessfully off of a training range.

With prior approval from the Service, PTA environmental personnel may relocate goslings to one of the predator-proof fences on the Refuge. This authorization may also be given by the dedicated Army funded personnel working at the Refuge on the conservation fence project for Hawaiian geese. The adults and goslings will all need to be captured, so a coordinated effort of several personnel would be required. A pen inside one of the fences may be the appropriate release site for such a translocated family. If captured early enough, the goslings may imprint on the fence site as their nesting area. This translocation would simultaneously decrease Hawaiian geese breeding at PTA and bolster survivorship and reproduction of individuals in a predator-free area at the Refuge. With proper travel carriers and coordinated logistics, Hawaiian geese moved from PTA to the Refuge are not expected to be injured or killed during the translocation.

Effects of Moving Hawaiian Geese inside the Predator Fences at Hakalau Forest National Wildlife Refuge

The personnel funded by the Army at the Refuge will facilitate the movement of adult Hawaiian geese and goslings inside the two predator fences to enhance survivorship. While clearly a benefit to Hawaiian geese to be in a predator-free area, the process of re-locating them inside one of the predator fences may result in take. However, the Service anticipates that carefully monitored work performed by dedicated and experienced personnel with proper certifications will not result in take of Hawaiian geese.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur within the area of action subject to consultation. Future Federal actions will be subject to the consultation requirements established in section 7 of the ESA and, therefore, are not considered cumulative for the proposed action. We are not aware of any future State, local, or private action that is reasonably certain to occur within the action area.

CONCLUSION

After reviewing the current status, environmental baseline, effects of the proposed action, and cumulative effects, the Biological Opinion of the Service is that implementation of the proposed actions discussed herein are not likely to jeopardize the continued existence of any species (*Asplenium peruvanium* var. *insulare*, *Kadua coriacea*, *Silene hawaiiensis*, *Spermolepis hawaiiensis*, *Zanthoxylum hawaiiense*, and *Hawaiian goose*) covered in this Biological Opinion. The actions discussed herein included use of every training range installation-wide at PTA for up to 365 days per year and with an unlimited number of Hawaiian geese present on ranges and in Surface Danger Zones while troops are actively training. The Service expects slow progress over several years to the target of *averaging* 26 fledglings produced per year. However, the Army is authorized to haze Hawaiian geese off of training ranges at PTA at its discretion from the signed date of this Biological Opinion, pursuant to requirements for that activity described in this Biological Opinion. This conclusion is based on the following factors:

1. The Service anticipates that the direct and indirect effects of the proposed action will detrimentally affect individuals of listed plant species. However, the adverse effects of the proposed actions will be minimized by avoidance and minimization measures and off-set by additional propagation and out-planting of these species by PTA environmental personnel.

2. The Service anticipates that the direct and indirect effects of the proposed action will result in take of Hawaiian goose nests and injury and mortality of Hawaiian geese. However, the adverse effects of the proposed actions will be minimized by avoidance and minimization measures and offset by off-site conservation actions for Hawaiian geese at the Hakalau Forest National Wildlife Refuge. To off-set the potential loss of 20 adult Hawaiian geese per year, conservation actions at the Refuge will produce an average of 26 fledglings per year, which is one fledgling more than the number of fledglings required to produce 20, 2-year-old, adults if the fledglings average 90% annual survivorship after fledging to two years of age (Banko *et al.* 1999). Nests in areas without predator control are assumed to be unsuccessful and are therefore not considered in this calculation of how many Hawaiian fledglings the conservation efforts at Hakalau Forest National Wildlife Refuge need to produce.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations promulgated pursuant to section 4(d) of the ESA prohibit the take of endangered or threatened species without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. “Harm” is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly

impairing behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. "Harass" is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful action. Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to, and not intended as part of, the agency action is not considered a prohibited taking under the ESA provided that such taking is in compliance with the Terms and Conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Army so that they become binding conditions for the exemption in section 7(o)(2) to apply. The Army has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Army fails to assume and implement the Terms and Conditions, then the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Army must report the progress of the action and its impact on the species to the Service as specified in this Incidental Take Statement [50 CFR § 402.14(i)(3)].

Amount or Extent of Anticipated Take

Based on the analysis presented in this Biological Opinion, the Service anticipates the following take may occur as a result of the proposed action over the 20-year term of this Biological Opinion:

1. As a result of activities related to installation-wide military training at PTA, movement of Hawaiian goose nests and goslings authorized by the Service, optional hazing of Hawaiian geese off of training ranges at PTA, and movement of Hawaiian geese by Army funded personnel at the Refuge to facilitate their use of predator-free fenced areas at Hakalau Forest National Wildlife Refuge, up to four (4) Hawaiian goose nests and twenty (20) Hawaiian geese per year may be incidentally taken in the form of harassment, mortality, or injury.

This Incidental Take Statement allows military training with an unlimited number of Hawaiian geese in Surface Danger Zones and at all ranges installation-wide at PTA as long as soldiers have been educated before training commences to avoid starting wildfires, avoid targeting Hawaiian geese while shooting, and avoid hitting Hawaiian geese while driving vehicles. Hazing may be used to remove Hawaiian geese from ranges prior to training, but is not required. Except for the Impact Area at PTA due to the abundance of UXO, this Incidental Take Statement requires monitoring of Hawaiian geese and Hawaiian goose nests at PTA and at Hakalau Forest National Wildlife Refuge to quantify the level of take. In addition, the Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 USC §703-712), if such take is in compliance with the Terms and Conditions of this Biological Opinion specified herein.

REASONABLE AND PRUDENT MEASURES

The Reasonable and Prudent Measure given below, with its implementing Terms and Conditions, is designed to minimize the impacts of incidental take that might otherwise result from the proposed actions. If, during the course of the action, the level of incidental take is exceeded, this

represents new information requiring reinitiation of consultation and review of the provided reasonable and prudent measure. In addition, the action that caused the taking must cease; the action agency must immediately provide an explanation of the causes of the taking; and the action agency must review with the Service the need for possible modification of the reasonable and prudent measure. The following reasonable and prudent measure is necessary and appropriate to minimize the effect of take on Hawaiian geese in this consultation. The measures described below are non-discretionary and must be implemented.

1. The Army shall minimize the potential for injury or mortality of Hawaiian geese and Hawaiian goose nests.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Army must comply with the following Terms and Conditions, which implement the Reasonable and Prudent Measures, described above and specified reporting requirements. These Terms and Conditions are nondiscretionary to be in compliance with the requirements of this Biological Opinion.

1.1 The Service shall be notified within one (1) business day of a take incident. In addition, a report describing the incident shall be submitted to our office in writing within three (3) business days of the incident.

1.2 Hawaiian geese in good condition with an unknown cause of death will be sent to Dr. Thierry M. Work (or current authority) at the National Wildlife Health Center, Honolulu Field Station (United States Geological Survey-Biological Resources Discipline) for a necropsy. The method of shipment and preservation will be determined in coordination with Dr. Work (or current authority).

1.3 A report summarizing the hazing techniques used, number of hazing events, numbers of Hawaiian geese or nests affected by hazing, and overall results of hazing operations will be provided to the Service in an annual report at the end of each fiscal year. This report will include the frequency and total numbers of Hawaiian geese at ranges where hazing was conducted that year.

1.4 To maintain the validity of the Incidental Take Statement for Hawaiian geese and the non-jeopardy effects analyses of this Biological Opinion, the Service assumes the Army will implement the project as described above in the Project Description. Expected actions by the Army include, but are not limited to, adherence to fire monitoring standards; genetic conservation, out-planting, and maintenance actions for listed plant species; and off-site conservation for Hawaiian geese at Hakalau Forest National Wildlife Refuge. The conservation project at Hakalau Forest National Wildlife Refuge is a partnership with the Refuge that must be funded completely and in a timely manner every year by the Army for the entire duration of this 20-year Biological Opinion because the success of that project depends on continuity and consistency in efforts to achieve the multitude of tasks that vary in seasonality (e.g. habitat improvements, monitoring of nests and gosling survival) and will reverse direction without constant attention (e.g. predator control efforts). The Refuge will not continue this project in the absence of complete and timely annual funding by the Army, as will be specified in the pending Memorandum of Understanding between

the Refuge and the Army that is required by the Refuge before issuing the Army a Special Use Permit to conduct the conservation project on the Refuge.

If complete implementation of the project as described above in the Project Description does not occur, military training installation-wide at PTA will cease immediately because the Army will be out of compliance with this Biological Opinion.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs all Federal agencies to utilize their authorities to further the purposes of the ESA by implementing 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 Service provides the following conservation recommendations:

- PTA environmental personnel should evaluate additional means of predator control, such as an efficacy trial of repeater-style traps. These traps can kill up to 24 rats or mongoose without needing to be re-baited or re-visited to replace the CO_2 canister. For these reasons, this type of trap may potentially provide a dramatic increase in efficacy and efficiency of predator control efforts.
- At the Range 01 Complex, the Army should use larger size gravel for sand bags. The pea gravel currently used is attractive to Hawaiian geese and is available to Hawaiian geese on the training range after sand bags used to fortify the infrastructure of targets or build temporary fighting positions have been shot up. The current size of gravel used in sand bags creates an attractive nuisance on this training range for Hawaiian geese.

INFORMAL CONSULTATION

Status of Species

Hawaiian Hoary Bat (Lasiurus cinereus semotus)

The Hawaiian hoary bat is a medium-sized (0.5 to 0.8 ounce), nocturnal, insectivorous bat with a wing span of 10.5 to 13.5 inches. The Hawaiian hoary bat is believed to be related to the North American hoary bat and is the only terrestrial mammal native to Hawaii. The Service listed the species as endangered in 1970 (USFWS 1970).

Menard (2001) reported that presence of Hawaiian hoary bats at PTA varies seasonally with lowest occurrence prior to breeding in winter (January to March), increasing occurrence during the breeding season in spring and summer (April to August), and peak occurrence during post-breeding in the fall (September to December). The extent of breeding activity by Hawaiian hoary bats at PTA remains unknown. Cooper *et al.* (1996) detected Hawaiian hoary bats during June and July most frequently in the second hour after sunset, possibly indicating that Hawaiian hoary bats arrive to PTA from distant roosts (US Army 2012b).

Based on Geographic Information Systems analysis by the Service and information collected by PTA environmental personnel, there is potential Hawaiian hoary bat roosting and foraging

habitat within the action area for the proposed IPBA project (Action Area F) (US Army 2012b). Available roosting habitat includes treeland vegetation communities or shrubland vegetation communities with either *Sophora chrysophylla* or *Myoporum sandwicense* as a dominant or co-dominant component. Because tree density tends to be lower in dryland forests than windward forests, roost sites are limited by the number of trees and high shrubs. *Metrosideros polymorpha* is the dominant tree species within Action Area F with the majority of trees between 13 and 16 feet tall (Bern 1995). The majority of high shrubs (*M. sandwicense* and *S. chrysophylla*) measured in similar vegetation types in the adjacent Kipuka Alala were between three and 10 feet tall (Jacobi 2003). Overall, roosting habitat for Hawaiian hoary bats in Action Area F is sparse, open, and is generally not considered to be preferred roosting habitat (Uyehara and Wiles 2009).

There is no population estimate for Hawaiian hoary bats at PTA, few historical or current records of abundance from specific locations, and the population at PTA is an unknown proportion of the overall population, which is also unknown. However, on-going research suggests the density of Hawaiian hoary bats in the saddle region of the island of Hawaii is very low (F. Bonaccorso, United States Geological Survey - Biological Resources, unpublished data). Existing data for Hawaiian hoary bats at PTA includes one year of auditory monitoring data (1992-1993) in Training Area 23, a two-month installation-wide radar survey in 1995, and one year of auditory monitoring data from a study conducted in 2005 along the Multi-Purpose Range Complex Access Road (adjacent to Action Area F). Results indicated Hawaiian hoary bats are present year-round in low numbers at PTA and peak in abundance from September to December (US Army 2012b).

IPBA construction may disturb 200 to 300 acres of treeland habitat and removing trees can disturb roosting bats causing them to abandon daytime roosts. Site preparation for construction activities is expected to begin in October 2013 and be completed within 10 months. All ground softening and tree removal is expected within the first six months of the construction project.

Hawaiian Petrel (Pterodroma sandwichensis)

The Hawaiian petrel is a large, nocturnal, gadfly petrel that is endemic to Hawaii. Hawaiian petrel colonies are typically located in high elevation xeric habitats or wet dense forests. Nests are located in burrows, crevices, or cracks in lava tubes. Adults arrive and depart at night from the colony during the breeding season (March-October) and are at sea the remainder of the year. Due to predator depredation and habitat degradation, Hawaiian petrel colonies in Hawaii currently are confined to elevations above 8,200 feet (Mitchell *et al.* 2005). The Service listed the species as endangered in 1967 (USFWS 1967).

Overall, island-wide movement patterns and potential flyways for Hawaiian petrels are poorly understood. Hawaiian petrels access inland colonies from February to November with a small period of absence around March and April (Simons 1985). A Hawaii, island-wide, seabird movement study detected no inland flights originating from the west coast (Kona), suggesting that the majority of Hawaiian petrels access Mauna Loa colonies from other directions (Day *et al.* 2003). Low numbers of seabirds (2.4 birds per hour) were recorded traversing inland at Kawaihae Harbor (northwest of PTA) and Day *et al.* (2003) speculated that these birds likely nest in Kohala.
Surveys for Hawaiian petrels at PTA have been on-going since 1992. A 1992-1993 study adjacent to Action Area F did not aurally detect Hawaiian petrels. In 1995, three Hawaiian

petrels were detected (two aurally and one visually) flying over the eastern portion of PTA. Aural surveys in Training Area 21 (eastern PTA) and Training Area 23 (western PTA, just south of Action Area F) during 1997-2009 did not detect any Hawaiian petrels. Suitable Hawaiian petrel habitat at PTA has been defined as open pahoehoe lava with lava tubes and blisters suitable for nesting sites. Though approximately 48% (eight square miles) in Action Area F has been identified as potential habitat, the presence of feral cats, feral dogs, mongoose, and rodents throughout PTA makes the likelihood of a Hawaiian petrel colony occurring within the area extremely unlikely (Banko *pers. comm.* 2012, David *pers. comm.* 2012, Hu *pers. comm.* 2012, US Army 2012b).

When traveling between the ocean and breeding colonies, bright lights can disorient and blind Hawaiian petrels causing them to collide with objects and fall to the ground where they are susceptible to predators. No such fallout has been reported at PTA to date at other similarly-lighted range buildings in Training Area 21 or the Cantonment Area. No colonial activity by Hawaiian petrels has been detected at PTA and extremely low levels of movement activity have been observed at PTA (Cooper *et al.* 1996, Day *et al.* 2003). In conclusion, surveys and accumulated data by PTA environmental personnel indicate there is no significant presence or habitat use by Hawaiian petrels within the action area. The Hawaii County ordinance to minimize light pollution to benefit users of the Mauna Kea telescope also limits the amount of ambient light that could attract Hawaiian petrels. Therefore, very few Hawaiian petrels are likely to encounter lights of the proposed IPBA project (US Army 2012b).

Avoidance and Minimization Measures for Hawaiian Hoary Bats and Hawaiian Petrels

Exterior lighting associated with IPBA buildings will be minimal and restricted to illuminating areas, such as stairwells and doorways, necessary for human life, health, and safety. Additionally, lighting within the IPBA is expected to be minimal because bright lights are counter to realistic training conditions. Army concept planning anticipates that three to five command and control buildings may ultimately be constructed within the IPBA for observing, monitoring, and controlling training, in addition to a MOUT and Live-fire Shoot House facility. Each building could potentially have three to five lights. Additionally, no permanent exterior lights will be installed at the proposed bivouac area, within the IPBC range footprint, MOUT, or Live-fire Shoot House. Furthermore:

- IPBA lighting will be amber, low-wattage lights down-shielded to minimize disorientation of flying animals;
- IPBA lights will only be used when night training is scheduled;
- PTA environmental personnel will complete on-going studies of Hawaiian hoary bats and Hawaiian petrels in an attempt to describe each species' temporal and spatial patterns of occupancy at PTA;
- IPBA construction will not involve any tree trimming or tree removal work between June 1 and September 15;
- Training by military units will be preceded with instruction to avoid impacting or cutting native vegetation to minimize the effects of training maneuvers within treeland and shrubland habitats within Action Area F;

- A 15 miles per hour speed limit will be strictly enforced day and night, except when a waiver has been approved by the PTA Commander and PTA Range Operations (US Army 2010);
- Troops will receive instruction prior to driving at PTA to avoid hitting Hawaiian hoary bats and Hawaiian petrels;
- Use of smoke and obscurants in the IPBA will be excluded within 165 feet of trees;
- Military targets in the IPBA will be placed away from trees where possible; and
- Permanent barbed wire will not be used in the IPBA.

Conclusion for Informal Consultation

Therefore, based on the above avoidance and minimization measures, the Service concurs with your biological determination that the proposed IPBA project may affect, but is not likely to adversely affect the Hawaiian hoary bat and Hawaiian petrel. Should project plans change, or if additional information on the distribution of listed species becomes available, we recommend you contact our office so that we may assist you in re-assessing project impacts.

REINITATION STATEMENT

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

If you have any questions, please contact Dr. Tim Langer at (808) 792-9462.

Sincerely,

Loyal A. Mehrhoff
Field Supervisor

Appendix 1

Timeline for Construction of Predator-Proof Fences at Hakalau Forest National Wildlife Refuge

Within 60 days of Signed Biological Opinion:

1. Site visit to Hawaii Volcanoes National Park to inspect in-place Hawaiian goose pens and fences by Service and Army environmental personnel.

Within 75 days of Signed Biological Opinion:

2. Preparation and execution of a final Memorandum of Understanding between Refuges and the United States Army Garrison, Hawaii, written by PTA environmental personnel.

Within 90 days of Signed Biological Opinion:

3. Final site selection for two fences at Hakalau Forest National Wildlife Refuge.

Within 120 days of Signed Biological Opinion:

4. Preparation and execution of a final Program Plan for fence construction, operation, and maintenance written by PTA environmental personnel.
5. Special Use Permit written by Refuges for PTA environmental personnel to accomplish their roles and responsibilities for Hawaiian goose fences.

Within 210 days of Signed Biological Opinion:

6. Construction of fences, pens, shade, and water structures shall commence and is the responsibility of Army environmental personnel to complete on schedule.

Within 240 days of Signed Biological Opinion:

7. Predator control shall commence.
8. Habitation improvements shall commence.

Within 255 days of Signed Biological Opinion:

9. Construction of fences, pens, shade, and water structures shall be completed.
10. Mowing shall be completed within both fences.

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In Reply Refer To:
2013-TA-0273
2012-F-0241

MAY 10 2013

Eric P. Shwedo
Lieutenant Colonel, Special Forces
Commander, United States Army Garrison- Pohakuloa
Department of the Army
P.O. Box 4607
Hilo, Hawaii 96720-0607

Subject: Amendment to the 2013 Biological Opinion for Pohakuloa Training Area, Hawaii

Dear Colonel Shwedo:

This letter responds to an April 30, 2013, email request to amend the *2013 Informal Consultation and Formal Consultation with a Biological Opinion for the Construction, Maintenance, and Operation of an Infantry Platoon Battle Area and Installation-Wide Impacts of Military Training on Hawaiian Geese (Branta sandvicensis) at Pohakuloa Training Area, Hawaii* (2012-F-0241). As currently required by this Biological Opinion with the United States Fish and Wildlife Service (Service), the Army is required to fund construction, operation, and maintenance of two 20-acre fences for 20 years at Hakalau Forest National Wildlife Refuge (Hakalau) to offset impacts to Hawaiian geese at Pohakuloa Training Area (PTA). The requirement is to produce an average of 21 adult Hawaiian geese (the equivalent of 26 fledglings) per year over the 20-year term of the Biological Opinion.

Starting in September 2012 and culminating in April 2013, the site selection process for these two fences involved input from subject matter experts of the Nene Recovery Action Group, Hawaii Volcanoes National Park (HAVO), PTA, Hakalau, and the Service. The type of predator-proof fence and habitat requirements for Hawaiian geese, including specific plant species to out-plant for food and cover (nesting and foraging), are described in a Technical Note by the Natural Resources Conservation Service (NRCS 2007). These specifications are currently being used successfully at HAVO for their Hawaiian goose fence with cats, rats, and mongooses successfully excluded. Both Hakalau fences will be built by the Army consistent with recommendations provided by HAVO biologists and the NRCS (2007) Technical Note.

Specifically, this Amendment request is to change the requirement of two 20-acre predator-proof fences to an 18-acre predator-proof fence at Pua Akala and a 13-acre predator-proof fence at Honohina. These acreages are the largest possible at each preferred site without clearing native forest at Hakalau. In addition, these two fences for Hawaiian goose conservation at Hakalau will

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still be completed by the Army before the 2013 Hawaiian goose breeding season beginning in October.

The objectives of the off-site Hawaiian goose conservation program funded by the Army at Hakalau remain unchanged from the Biological Opinion. As stated there and repeated verbatim here for clarity, the Service anticipates that this conservation program will take several years to refine. As a result, we do not anticipate achieving the goal of 26 fledglings in a single year until the 5th breeding season after the fences are constructed (i.e., the 2017-2018 breeding season). Additionally, the Service does not expect the *average* production for all years to reach 26 fledglings until the 10th breeding season after the fences are constructed (i.e., the 2022-2023 breeding season). However, if either of these goals is not achieved, the Army will work with the Service to identify additional conservation measures that the Army will implement to benefit Hawaiian geese and offset the Army's annual incidental take.

The Service approves this request and has determined that this change does not significantly modify our analysis nor constitute a reinitiation of the 2013 Biological Opinion. This amendment should be appended to the original 2013 Biological Opinion. If you have any questions regarding this letter, please contact Fish and Wildlife Biologist Dr. Tim Langer (808-792-9462).

Sincerely,

FOR Loyal Mehrhoff
Field Supervisor

cc: Dr. Peter Peshut, Program Manager, Pohakuloa Training Area Natural Resources Office
Jim Kraus, Refuge Manager, Hakalau Forest National Wildlife Refuge
Steve Evans, Refuge Biologist, Hakalau Forest National Wildlife Refuge

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