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Conserving Biodiversity on Military Lands – A Guide for Natural Resources Managers, 3rd Edition

Compiled Case Studies

(Revised to address Legacy Program Technical Review comments)

NATURESERVE

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Conserving Biodiversity on Military Lands: A Guide for Natural Resource Managers

Case Studies

(Photo: Doug Ripley)

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Case Studies

1. Case Study: Balancing Mission and Biodiversity at Fort Bragg

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This is embedded in Chapter 1 of the main Handbook.

2. Case Study: Wildlife Management and Climate Change– Marine Corps Base Hawaii

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Introduction

On the Island of O'ahu, Marine Corps Base Hawaii (MCBH) has miles of beach used for amphibious and shoreline training and recreation by the military and its civilian community. However, in 2020 a new visitor decided to take advantage of the beaches at MCBH Kaneohe Bay and Marine Corps Training Area Bellows (MCTAB) – the federally threatened Hawaiian green turtle, locally known as the "honu". Normally, 96% of green turtles nest over 600 miles away in the French Frigate Shoals, the largest atoll in the Northwestern Hawaiian Islands. In 2015, the first green turtle nest was discovered on a beach in MCBH's Fort Hase area within the Nu'upia Ponds Wildlife Management Area. Seven nests were documented along this same shoreline in 2019. Then, in 2020, green turtles nested on the beaches at Kaneohe Bay and MCTAB several miles to the south in unprecedented numbers. It is believed that climate change and foraging habitat (marine) degradation are driving the green turtle to find alternative nesting sites. It is possible that beach closures due to COVID-19 restrictions during the spring nesting season made MCBH shorelines and other beaches around O'ahu more inviting as well.

Challenges and Management Concerns

These nesting events pose some challenges to the military and natural resources managers on MCBH. Nesting activity may restrict areas of the beaches used by the military for training events that include visits by Marine Expeditionary Units transiting the Pacific, the biannual Rim of the Pacific or RIMPAC international maritime warfare exercise, and training activities of Hawaii-based Marine Corps, Navy, and Army units. Green turtle nesting occurs between April and September and can occur anywhere along MCBH's beaches. Furthermore, although not all discovered nest sites contain eggs, all presumed nesting sites need to be protected. MCBH Natural Resources Section relies heavily on volunteers on foot to help monitor the vast shorelines both day and night during the six-month nesting season. Another challenge is that unless a green turtle is observed in the act of laying eggs, it is difficult to pinpoint the exact location of the egg chamber. To complicate matters, severe shoreline erosion is eating away at shorelines around O'ahu, including MCBH's shorelines. Erosion of MCBH shorelines will reduce the width of beaches and start to constrain where training can be conducted. This may result in conflicts with green turtles vying for the same space. Additionally, artificial lighting from sources such as streetlights and housing near the beaches can disorient the hatchlings.

Approach

MCBH natural resources staff are building alliances with local non-profit organizations that support efforts to protect Hawaii's honu, mainly through help with the volunteer monitoring efforts. The Base also works with the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (FWS) to develop turtle nest monitoring protocols and conduct nest chamber excavations after the nesting season to collect biological data. As nests are discovered on MCBH beaches, the natural resources staff set up rope and post barriers with commercially fabricated warning signs. The nest sites are then regularly monitored to ensure the nests are not disturbed and to look for signs of hatchling emergence. Military training units are educated on how to protect the nests and the natural resources staff works with them to ensure the nests pose as few constraints as possible to training by identifying safe routes through and around the nesting sites.

National Environmental Policy Act analysis was completed to consider environmental impacts from nest excavation work. This included a Section 106 consultation because potential Hawaiian burials may also exist along these shorelines and could be at risk of being unearthed during nest excavation.

MCBH conservation law enforcement officers played an essential two-part role as both educators and enforcers. Often working 10 hour shifts over the weekends during May through September, they worked day and night interfacing with the community to ensure nest avoidance and compliance.

MCBH natural resources staff also conducted extensive outreach to inform the public of the presence of the nests and appropriate mitigation measures. Outreach included numerous local news articles and interviews, and messaging through MCBH social media outlets. Potential harm from residential light sources will be addressed through conversations with the military housing office to reduce residential light adjacent to beaches, coordination with the Base Facilities Department to install International Dark Sky compliant lighting, and installation of screening around nests as the time of emergence draws near.

Successes and Outcomes

- The 2020 nesting event did not hamper any military training due to close coordination between the natural resources staff and military units.
- The local community praised our volunteer efforts and the pro-active measures we took to protect the green turtle nesting sites from military training activities and to enable continued recreational use of the beaches.
- MCBH had at least 17 volunteers from the base and local communities as well as support from FWS, NOAA, and the Hawai'i Marine Animal Response (HMAR) organization. Working with oversight from NOAA and FWS, volunteers excavated the 11 presumed nests at MCTAB and another 6 on Kaneohe Bay shorelines and regularly walked the MCBH shorelines numerous times a week to monitor for signs of turtle activity and ensure found nests were protected and undisturbed. Volunteers also responded to two

emergences from undocumented nests, and relocated a number of hatchlings that had been disoriented by street and housing lights. While all the potential nests did not contain eggs, the ones that did had over 90% hatching success with an average of 70 eggs per nest.

In preparation for future nesting seasons, MCBH plans to:

- Refine its turtle nest protocol using lessons learned from the 2020 nesting season.
- Investigate various ways to distinguish nests with eggs from those considered “false crawls” that appear to be a nest but in fact don’t contain eggs.
- Apply for research permits to hopefully be able to excavate future nests ourselves.
- Purchase more barrier materials and posts for warning signs.
- Solidify a cadre of volunteers to support the turtle monitoring effort.

Figure 2-1. Hawaiian green turtle laying eggs (Photo by MCBH).

2020 Honu Season @ MCTAB TA1

Nest	Date Found	Est. Date of Emerg (+60)	Possible Exc. Date (+70)
1	1-Apr-20	31-May-20	10-Jun-20
2	22-May-20	21-Jul-20	31-Jul-20
3	22-May-20	21-Jul-20	31-Jul-20
4	23-May-20	22-Jul-20	1-Aug-20
5	23-May-20	22-Jul-20	1-Aug-20
6	23-May-20	22-Jul-20	1-Aug-20
7	23-May-20	22-Jul-20	1-Aug-20
8	2-Jun-20	1-Aug-20	11-Aug-20
9	4-Jun-20	3-Aug-20	13-Aug-20
10	4-Jun-20	3-Aug-20	13-Aug-20
11	4-Jun-20	3-Aug-20	13-Aug-20

Figure 2-2. Turtle nesting areas on Marine Corps Base Hawaii with associated nest data (Photo by MCBH).

Figure 2-4. Beach sign to protect turtle nesting areas on Marine Corps Base Hawaii (Photo by MCBH).

Figure 2-3. Turtle nest excavation to support FWS and NOAA data collection, Marine Corps Base Hawaii (Photo by MCBH).

3. Case Study: Camp Ripley Sentinel Landscape

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Introduction

In 2013, The US Departments of Defense, Agriculture and Interior announced an initiative titled “The Sentinel Landscape Partnership”. This created a nationwide federal, local and private collaboration dedicated to promoting natural resource sustainability in areas surrounding military installations. In Minnesota, working lands for agriculture and forestry and other natural lands provide many important public benefits:

- Source and surface water protection
- Recreational opportunities for hunting and fishing
- Habitats for species of greatest conservation need
- Threatened and endangered species and their habitats
- Shoreline protection of the Mississippi River
- Open space
- Commodity production
- Maintaining the rural character of Minnesota

Military installations such as Camp Ripley, located in Minnesota, are proven to be critically important habitat for several threatened, endangered, and species At-Risk. Camp Ripley has demonstrated that military training does not negatively impact the conservation of biodiversity over a large landscape, despite biodiversity loss occurring at an alarming rate within the greater landscape. Creating partnerships with other Federal, State, non-government and local entities working to achieve goals developed through a larger Sentinel Landscape program is necessary to support an increasing number of imperiled species and provide unrestricted and realistic military training at Camp Ripley.

Sentinel Landscapes are working or natural lands important to the Nation's defense mission-places where preserving the rural character of key landscapes strengthens the economies of farms, ranches, and forests; conserves habitat and natural resources; and protects vital testing and training missions conducted on those military installations that anchor such landscapes. The Sentinel Landscape partnership is a nationwide federal, local and private collaboration dedicated to promoting natural resource sustainability and the preservation of agricultural and conservation land uses in areas surrounding military installations. The Sentinel Landscape partnership seeks to recognize and incentivize landowners to continue to maintain these landscapes in ways that contribute to the Nation's defense. Where shared interests can be identified within a landscape, the partnership coordinates mutually beneficial programs and strategies to preserve, enhance or protect habitat and working lands near military installations to reduce, prevent or eliminate restrictions due to incompatible development that inhibits military testing and training.

The Camp Ripley Sentinel Landscape (CRSL) mission is to protect the current and future military training mission of Camp Ripley while protecting and enhancing natural and cultural resources and preserving the rural character and economies of the landscape. The Camp Ripley Sentinel Landscape focuses on the needs of communities and common interests in a defined geographical landscape. Successful landscape stewardship collaboratively builds agency, organizational and community capacity, increases landowner trust through streamlined management and communications by partners, and motivates landowners using messages and activities suited to their needs and, supports the application of science and knowledge through well informed policies and practices.

Purpose

The purpose of the CRSL is to identify and develop programs that provide land protection and restoration strategies that benefit the military mission of Camp Ripley and improve working lands and local communities within the landscape. Improved coordination and collaboration across different resource priorities within a Sentinel Landscape provides an opportunity for participating agencies and organizations to better target their collective resources and possibly develop new technical and financial assistance options that are specifically tailored to local needs.

In 2004, the Minnesota Army National Guard (MNARNG) approved moving forward with the Camp Ripley Army Compatible Use Buffer (ACUB) Program between the Department of Military Affairs) DMA and the Minnesota Department of Natural resources (DNR). In 2006, this interagency partnership included the Minnesota Board of Water and Soil Resources (BWSR), integrating their Reinvest in MN (RIM) easement program to be locally delivered by the Morrison Soil and Water Conservation District. The ACUB initiative is referred to as the "Central Minnesota Prairie to Pines Partnership...preserving our heritage" and is intended to maximize the compatibility of land use adjacent to Camp Ripley and thereby sustain not only the military mission but also the natural environment that Camp Ripley has been nationally recognized for.

One of the largest threats to both the mission of Camp Ripley and the surrounding natural landscape is residential encroachment and significant land conversion from current natural state to other non-habitat compatible state. If significant lands are converted to a non-habitat state, Camp Ripley may become the only refuge for threatened and endangered species or species of special concern, resulting in mission training impacts. Central Minnesota's population has grown by 140,000 residents between 2000 and 2016. The population in Crow Wing County is projected to increase by about 29% to over 80,000 by 2035 (City of Baxter Comprehensive Plan 2015).

The ACUB boundary was narrowed to lands that lie within unacceptable noise contour zones that extend beyond the boundary of Camp Ripley. Noise is a significant encroachment issue, the main sources being blast and airfield noise. The noise contours were developed through a noise model prepared by the U.S. Army Public Health Command as part of Camp Ripley's Environmental Noise Management Plan. The approved ACUB boundary allows for fee and easement acquisitions within a specified buffer area surrounding Camp Ripley. This buffer represents approximately 130,000 acres with an end state goal of protecting 75% of lands within the buffer.

Approach

The partnership wished to expand services to private landowners within the ACUB program and out to a 10-mile radius around Camp Ripley. Working in cooperation with the Minnesota Forest Resources Council staff, the Camp Ripley program applied for a U.S. Forest Service (USFS) grant to develop a Landscape Stewardship Plan (LSP). The plan would guide development of strategies to foster private forest management, working forests and technical support to landowners. Out of that LSP process came a watershed-based map intended to bring forest management goals and objectives into other statewide watershed plans currently underway.

Successes/Outcomes

In May 2015, Camp Ripley, through state law (Minnesota Statue 190.33), was designated as the first state Sentinel Landscape in the Nation. The designation established a state coordinating committee in March 2016. The group is comprised of state commissioners from BWSR, DNR, DMA and Minnesota Department of Agriculture (MDA). This legislation allows the MNARNG to more effectively compete for federal funding from agencies extending beyond the Department of Defense and to better align federal, state and local programs that could support private landowners in a Sentinel Landscape. Federal agencies, such as the Natural Resources Conservation Service (NRCS), USFS, and U.S. Fish and Wildlife Service (USFWS), who envision enhancing their program priorities and interests that are complementary to the CRSL joined at the table. In 2016, Camp Ripley was designated as a federal Sentinel Landscape representing the formal partnership agreement between the U.S. Departments of Defense, Agriculture and Interior.

This government agency and legislative collaboration directly contributes to

protecting the military mission of Camp Ripley by conserving natural resources at a larger landscape scale. The Minnesota biological survey determined the Camp Ripley Sentinel Landscape to contain high biodiversity significance due to the quality occurrences of the rarest species, high quality examples of native plant communities, and important functional landscapes. The Camp Ripley Sentinel landscape contains more than 50,000 acres of protected lands; including 30,000 acres protected through the Camp Ripley Army Compatible Use Buffer Program. These protected lands will provide critical habitat and allow for adaptive management strategies that will hopefully sustain biodiversity at a landscape scale.

Lessons Learned/Applicability to others

The Camp Ripley Sentinel Landscape developed a Strategic Plan in order to communicate the direction and strategies of partner organizations under one philosophy: “Where Missions Meet.” Each organization has their own mission statement and enabling programs. These missions will be accomplished by using a holistic approach toward managing a landscape where all parties have an opportunity to provide input in management decisions. Each agency has the opportunity to target their priorities, programs, and initiatives in one or more of the three strategy areas: education outreach, improve/manage, or acquire. Within the three broad categories in the toolbox measure acres protected or enrolled, best management practices (BMPs), restoration acres and nutrient reduction tracked at the minor watershed level to achieve either a goal of 75% protected or 20% reduction in nitrogen and phosphorus.

The CRSL hosts a protection working group and a restoration and practices working group consisting of Federal, State, Local and non-government partners. These working groups meet quarterly to collaborate and communicate on opportunities to pursue objectives within the Strategic Plan.

References/Literature Cited

Camp Ripley Sentinel Landscape Strategic Plan:
https://sentinellandscapes.org/landscapes/camp-ripley/

Figure 3-1. Aerial View of Mississippi River valley adjacent to Camp Ripley: Courtesy of Minnesota Army National Guard Public Affairs Office.

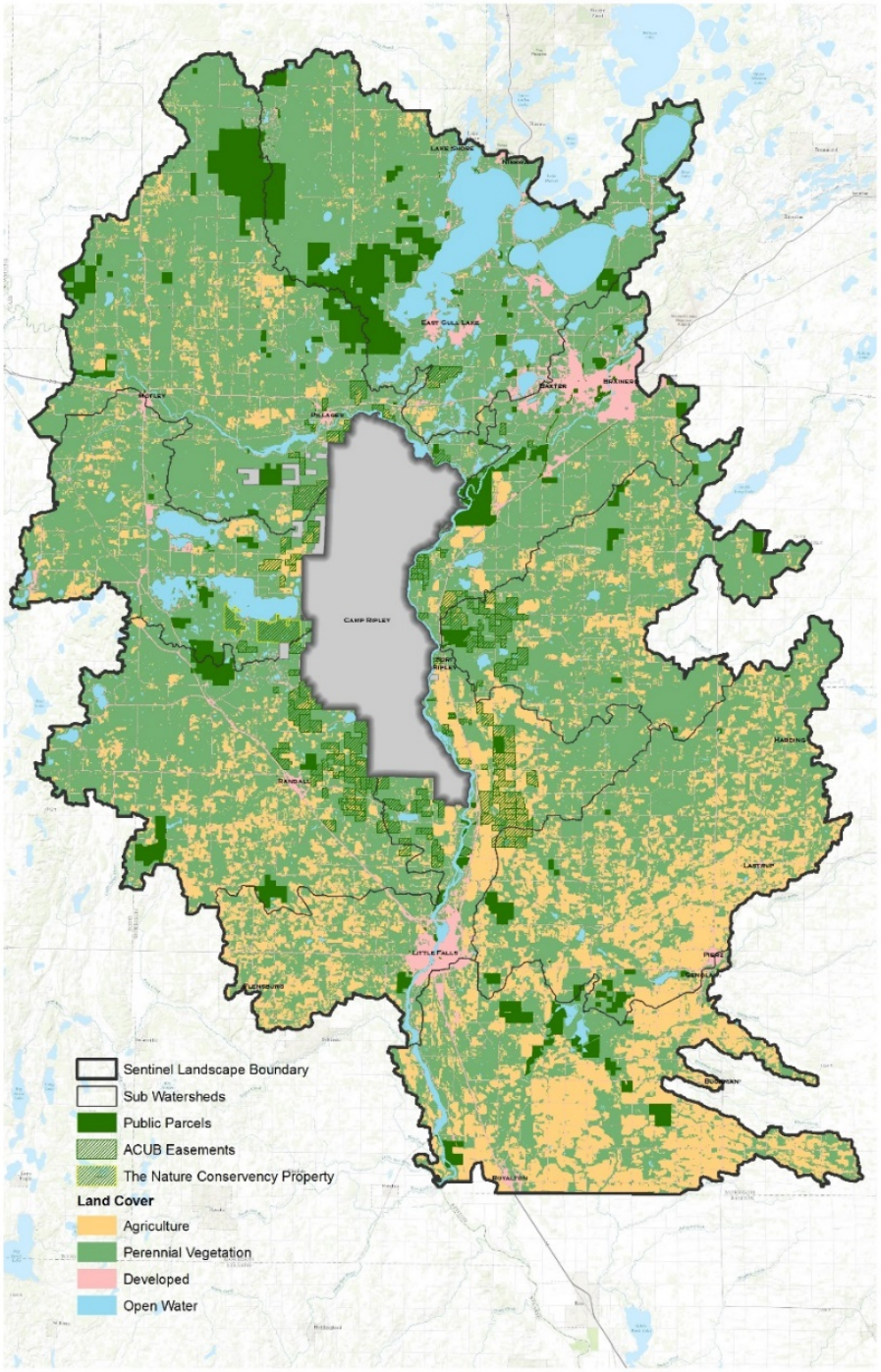

Photo 3-2. Camp Ripley Sentinel Landscape Boundary: Camp Ripley Sentinel Landscape Strategic Plan.

4. Case Study: Establishing Biosecurity for the Military Transportation Network within Joint Region Marianas Area of Responsibility

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Introduction

Island ecosystems are especially vulnerable to introduced invasive species. Plants and animals native to islands are often endemic (not found elsewhere), may have few defenses to novel predators or diseases, and may be ill-adapted to compete with novel species.

The Mariana Islands provide a strategic location for military readiness training. In 2010, the Navy established the Mariana Islands Range Complex (MIRC), a half-billion-square nautical mile live-fire training range that surrounds Guam and the Commonwealth of the Northern Mariana Islands (CNMI). In its 2015 Record of Decision for the Final Mariana Islands Training and Testing Environmental Impact Statement, the Navy amended the MIRC program to further increase the range of activities to be conducted, their frequency, and geographic extent. This increased area is collectively referred to as Joint Region Marianas (JRM) Area of Responsibility (AOR). In response to these proposed activities the U.S. Fish and Wildlife Service issued its 2015 Biological Opinion for the Navy's Mariana Islands Training and Testing Program, which directed the Navy to take specific measures to avoid and minimize invasive species transport and introduction, and specific

measures to provide for a rapid response to such introductions. The biosecurity program, funded and directed by the Navy and implemented by Colorado State University's Center for Environmental Management of Military Lands (CEMML), is designed to provide these measures.

Challenges

The major challenges for this program are: 1) the scope and frequency of training activities in the region are substantial—Guam is the hub for an increasing number of large inter-island military training activities (e.g., Cope North and Valiant Shield) involving U.S. foreign partners and U.S. units from outside the JRM AOR, all of which have their own invasive species or native species potentially capable of accidental transport on military equipment; 2) having evolved in relative isolation, the plant and animal species of the islands are particularly vulnerable to the adverse effects of invasive species; 3) the region is home to a number of federally-listed plant and animal species (threatened and/or endangered) found nowhere else; and 4) Guam and some of the other islands (but not all) already harbor certain invasive plant and animal species considered to be some of the worst in the world. Potential for inter-island "cross contamination" is inherent.

Perhaps the most well-known example, the brown treesnake, was accidentally introduced to Guam in the 1940s and has caused the extirpation of nine bird species from the island, population declines of lizard, bat, and other bird species, and frequent power outages. Coconut rhinoceros beetle (CRB), discovered on Guam in 2007 and on Rota in 2017, are decimating native palm trees throughout Guam. The little fire ant (LFA), first detected on Guam in 2011, considered one of the 100 worst invasive species worldwide (GISD 2013), preys on invertebrates and small vertebrates, displaces native ants, and delivers a painful sting to animals and people. Further movement of these and other invasive species have the potential to impact the military mission, hinder the recovery of native species on Guam, and adversely affect other islands in the Pacific region.

Approach

As part of its overall biosecurity program, CEMML cooperators provide JRM with a broad set of products and services that together form an integrated pest management strategy. These include a regularly updated programmatic risk assessment based on existing information and enhanced by more granular data collected by staff at sensitive sites within the transportation network as well as directly from cargo itself during biosecurity inspections. CEMML also provides the Navy with standard operating procedures (SOPs) for controlling high-risk invasives, and are prepared to implement these SOPs and share them with Navy partners in the region. This case study primarily focuses on the main biosecurity requirements of the JRM biosecurity program:

First and foremost, develop and implement a rapid response capability to control and eradicate newly arriving non-native species detected in the vicinity of training and testing areas and the JRM AOR transportation network servicing these areas.

Priority is given to those species posing the greatest ecological and economical threats and greatest risk of transport elsewhere. This capability was met by developing inter-island rapid response and implementation protocols detailing an Initial Investigation Phase, Alert Phase, Rapid Response Phase, Stand-down Phase, and Recovery Phase. Trained rapid-response personnel having all necessary equipment, supplies, and permits are duty stationed on Guam for immediate deployment to CNMI. Species-specific protocols for known high-risk species have been developed and others are in development.

Conduct a baseline survey on all designated sensitive sites within the JRM AOR transportation network, followed by regular early detection surveys. Baseline surveys inventory all non-native species present at a site; early detection surveys are designed to detect any newly arrived invasive species so that control measures can be implemented promptly. These findings provide feedback to inform the risk assessment.

Develop and implement biosanitation and quality assurance/quality control program. This program ensures that all cargo entering the JRM AOR during military training exercises meets cleanliness standards in Armed Forces Pest Management Technical Guide 31. Trained biosecurity inspectors, under the direction of Navy's Regional Biosecurity Program Manager and in cooperation with military exercise personnel, inspect all cargo items arriving into the JRM AOR (Guam and CNMI) prior to interisland movements and at retrograde (redeployment) at the end of an exercise. During biosecurity inspections, intercepted biomaterial is removed and destroyed where present. Data on the type and location of biomaterial are recorded, and findings provide feedback to inform the risk assessment.

As part of the effort to control species that are particularly invasive and are high risk to entering the military transportation network, CEMML staff conduct operational lethal control of the invasive brown treesnake in and around sensitive areas on Naval Base Guam.

Arthropods in the region constitute an extensive and bewilderingly diverse group that is being addressed through development of an invasive arthropod management program. Invasive arthropods pose a particularly difficult problem since the local fauna is poorly understood and the global source pool of new introductions of species make it nearly impossible to identify every newly detected species. Present efforts focus primarily on using traditional taxonomic methods to build an invasive arthropod reference collection in collaboration with regional and international taxonomic specialists. An ancillary project to begin in 2021 will use next-generation DNA sequencing technologies and new sources of environmental DNA, coupled with advances in data science, to develop a DNA-based approach that will greatly accelerate the process of monitoring and identification of invasive arthropod species.

Arthropod management primarily focuses on preventing the coconut rhinoceros beetle and little fire ant from entering the transportation network on Guam by reducing the number of beetles in the vicinities of sensitive sites using an extensive outlay of pheromone-baited traps, and eradicating fire ant colonies wherever they

are detected using established methods of chemical control. Extensive surveys for other invasive ants, including the red imported fire ant have been ongoing across JRM installations on Guam and will expand to Tinian and Rota (CNMI) in 2021.

Successes/Outcomes

Standard operating procedures for implementing baseline and follow-on early detection surveys have been implemented that are effectively cataloging invasive species of plants and animals on sensitive sites within the military transportation network on Guam and training locations on the island of Tinian in the CNMI. An extensive herbarium and collections of invasive vertebrates and invertebrates have been built and these collections grow weekly. To date, there have been no newly arriving novel invasive plant or vertebrate species that have warranted control actions; procedures to identify invasive arthropods are having success although the relatively poor taxonomic understanding of this group in the region hinders easy identifications.

The biosanitation and quality assurance/quality control program is effectively implementing a nearly 100% inspection rate of military cargo entering/departing the JRM AOR and as well as inter-island cargo. This results in the interception and mitigation of large amounts of biomaterial including non-native seeds and live animals from off island locales that would otherwise be inadvertently transported or undetected without a biosecurity program. Biosecurity inspections ensuring washdown standards are being adhered to for inter-island cargo movements and during redeployment out of the JRM AOR are preventing the spread of invasive species within the Mariana Islands as well as to locations outside of the JRM AOR. The implementation of the program is fostering increased awareness and acceptance of these measures among military personnel working within the transportation network.

Methodologies for operational control of the invasive brown treesnake are well-established and CEMML is successfully implementing these methodologies in sensitive areas. The efficacy of these methodologies will continue to benefit from further improvements.

Methodologies for surveying and controlling coconut rhinoceros beetles on military lands on Guam have not been in place long and the efficacy of pheromone traps for reducing beetle ingress to sensitive sites is under evaluation. Analyses of catch rates across the landscape, however, is providing valuable information on beetle hotspots which will enable the strategic placement of additional safeguards.

Methodologies proven elsewhere for surveying and controlling the little fire ant have proven to be equally effective on Guam. An extensive infestation of little fire ants were recently eradicated from an area within Haputo Ecological Reserve Area, an area established by the Navy in 1985 to protect a remnant native limestone forest that provides habitat for native forest species. While there is good confidence that detected infestations on DoD lands can be successfully eradicated, it is too soon to know if this newly-emerging pest species spreading across Guam can be contained

over the long term.

Useful Resources

U.S. Fish and Wildlife Service. 2015. Biological Opinion for the Mariana Islands Training and Testing Program (Consultation #01EPIF00-2014-F-0262). Honolulu, Hawaii. https://mitt-eis.com/Documents/2015-Mariana-Islands-Training-and-Testing-EIS-OEIS-Documents/Endangered-Species-Act-Biological-Opinion (Assessed February 28, 2021).

Armed Forces Pest Management Board Technical Guide No. 31. https://www.acq.osd.mil/eie/afpmb/docs/techguides/tg31.pdf (accessed 9 Nov 2020).

Global Invasive Species Database. 2013. 100 of the World's Worst Invasive Alien Species. Available at http://www.iucngisd.org/gisd/100_worst.php (accessed 9 Nov 2020).

Figure 4-1. Vertebrate trap cluster for surveying small rodents (live trap and snap trap) and invasive lizards (glue board) that is one part of a larger array of trap types (including various arthropod traps) that are typically placed at each trap station when conducting baseline and early detection surveys at sensitive sites within the military transport network. (Photo by CEMML staff)

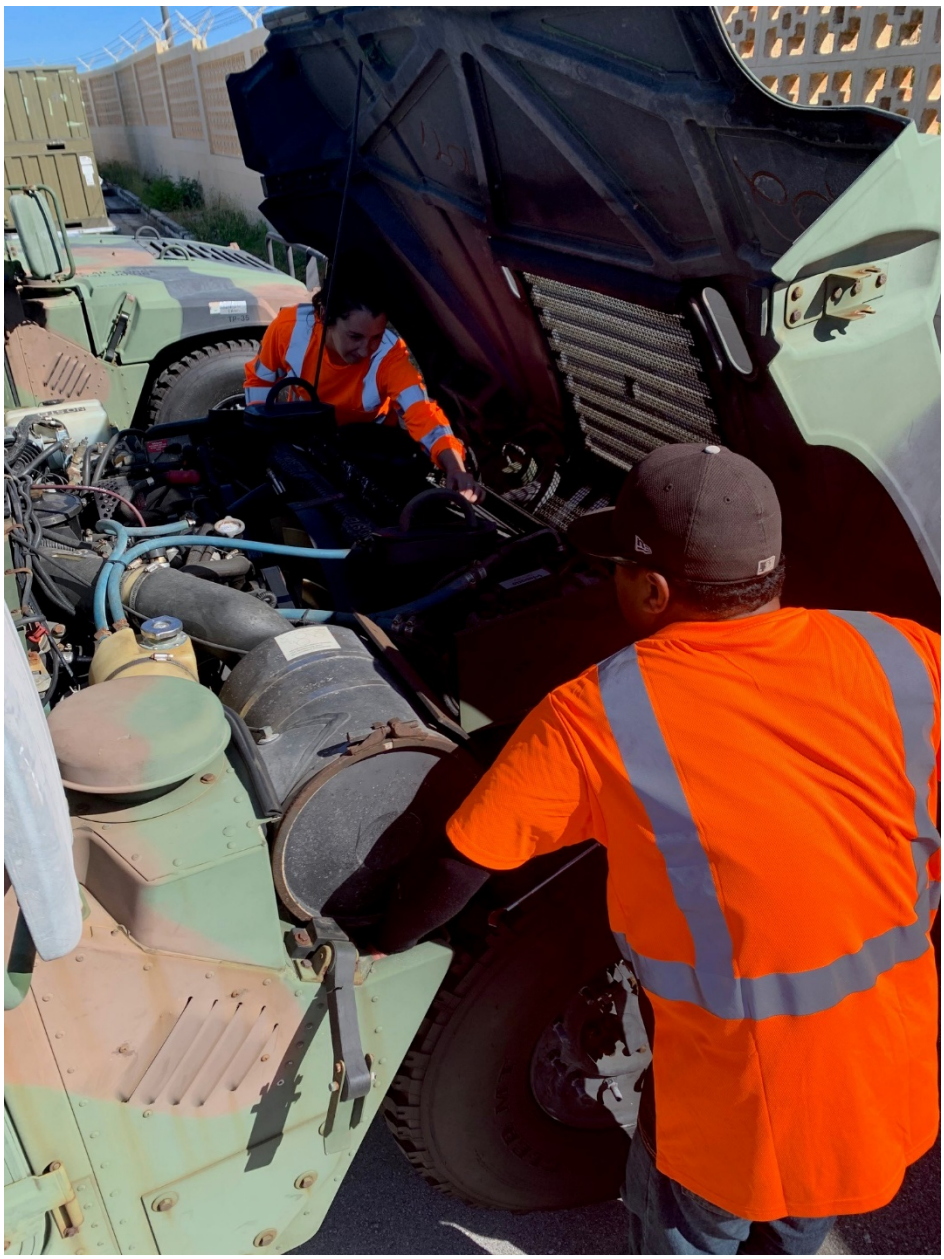

Figure 4-2. Biosecurity inspection of motor compartment of a military vehicle during a military training event to prevent the movement of invasive species within the transportation network. (Photo by CEMML staff)

Photo 4-3. Colony of invasive ant species detected in military cargo on Guam. (Photo by CEMML staff)

Figure 4-4. Locations of brown treesnake toxicant bait tubes (green dots) protecting transportation sites within the military transportation network on Naval Base Guam. (Photo by CEMML staff)

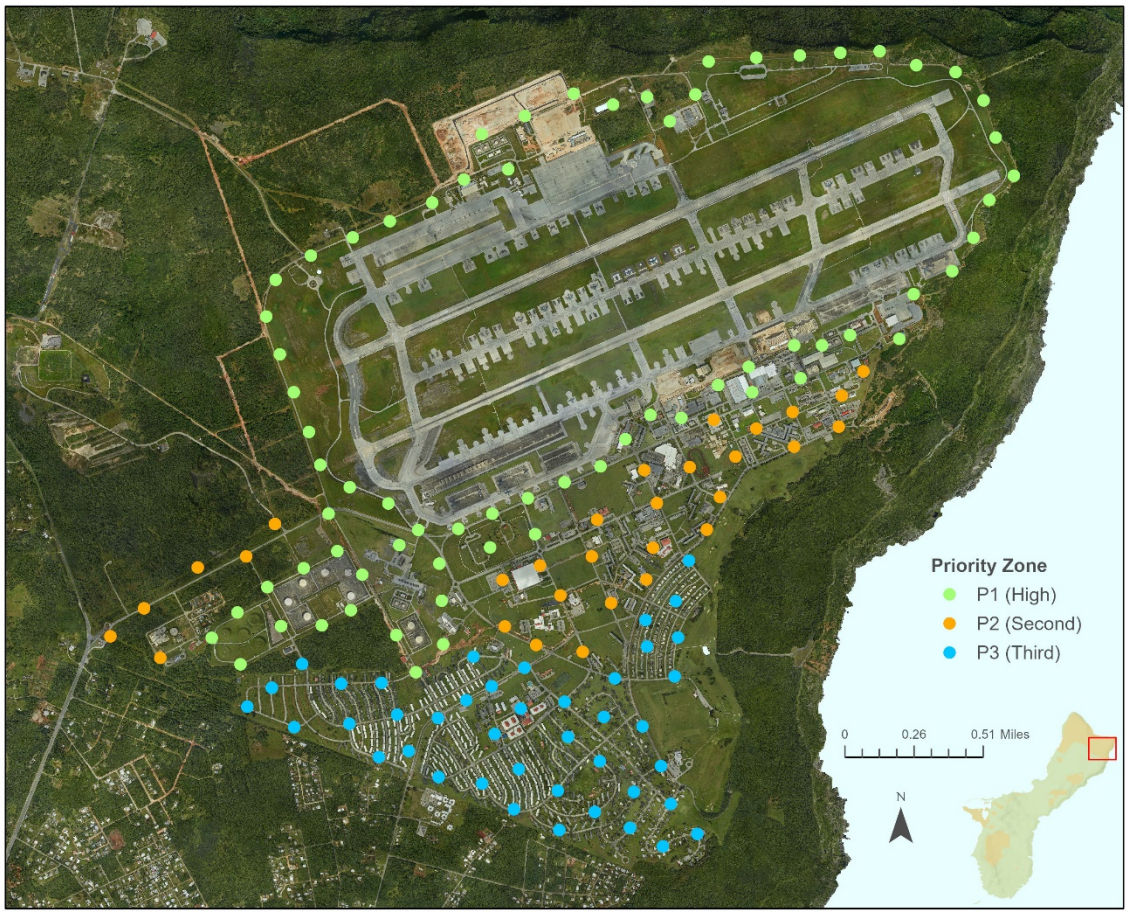

Figure 4-5. Locations of pheromone traps by priority zone for coconut rhinoceros beetles on Andersen Air Force Base, Guam. (Photo by CEMML staff)

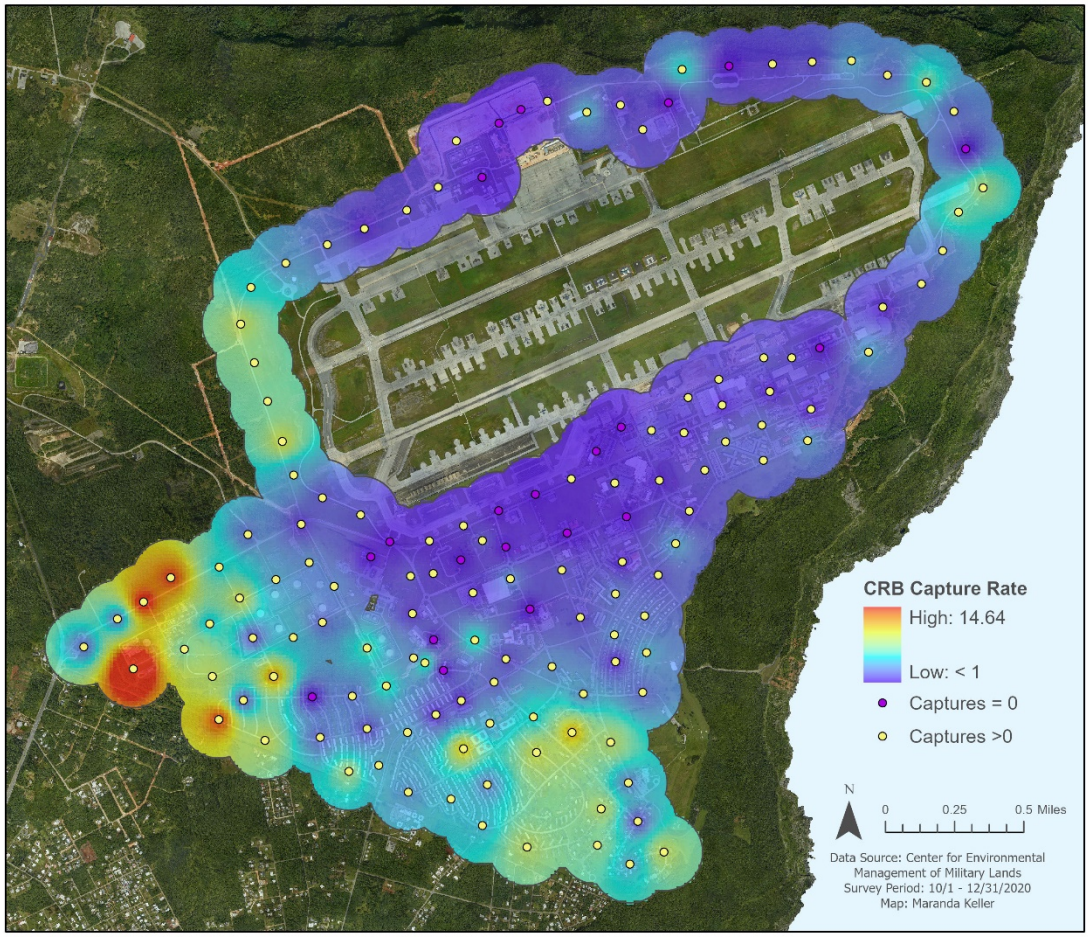

Figure 4-6. Capture rates of coconut rhinoceros beetle in pheromone traps on Andersen Air Force Base, Guam. Each color-filled circle represents a pheromone beetle trap. (Photo by CEMML staff)

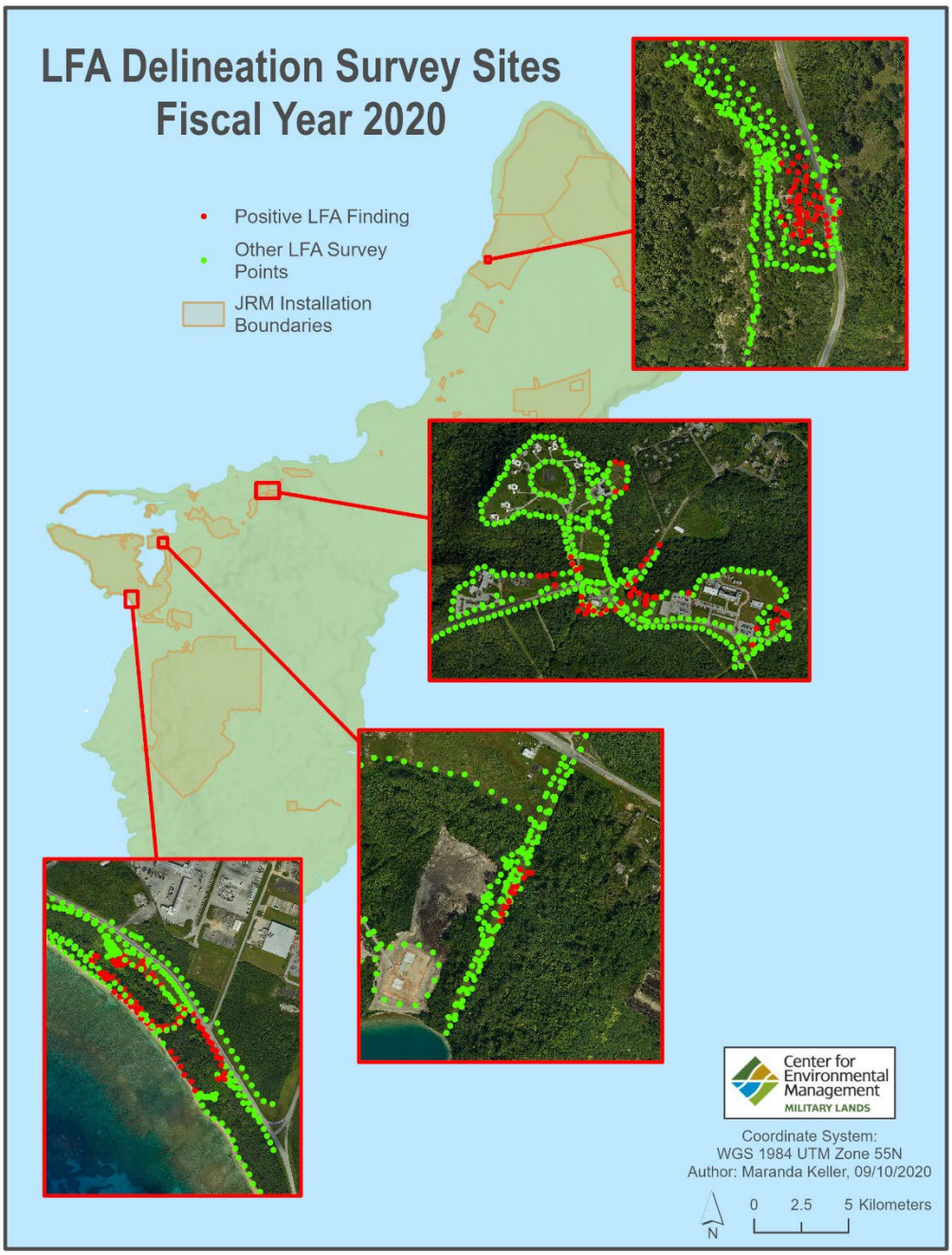

Figure 4-7. Subset of known infestations of the little fire ant (LFA) in the Haputo Ecological Reserve Area on Navy lands on Guam that were successfully eradicated. Treatment is in progress at all other locations. Each color-filled circle represents placement of a bait stick used to assess ant presence. (Figure by CEMML staff)

5. Case Study: A Landscape Approach to Manage Stressors for Multiple Federally Listed Species, Pohakuloa Training Area, Hawai'i

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Introduction

The U.S. Army Garrison Hawai'i—Pohakuloa Training Area (PTA) is located on the island of Hawai'i in the high central plateau between three major volcanic peaks. PTA supports a joint/combined arms live-fire facility and is the primary training area and largest maneuver area in the Pacific for joint, interagency, and multinational forces. No military units are permanently based at PTA; all units deploy from their home station to the training area for the duration of their training mission. At over 133,000 acres, PTA, has a 50,000-acre central impact area where all munitions are directed. Range assets support static, maneuver and aerial live-fire, typically at the battalion level but can accommodate brigade-level training.

The climate at PTA is cool and dry at upper elevations (9,000 ft) and is warm and dry at low elevations (2,000 ft). PTA lies in the rain shadow of tall, steep volcanoes that surround it; average annual rainfall is about 14 inches on cantonment (6,000 ft). Temperature and moisture gradients on PTA vary with elevation to create a heterogeneous environment with high spatial and temporal variability. Various-aged lava flows snake across the landscape effectively forming a mosaic of different vegetation communities of varying seral stages. Subalpine shrublands, Hawaiian montane forests and woodlands and tall shrublands dominate at higher, cooler elevations; perennial grasslands, comprised of introduced grasses and native shrubs, dominate at lower, warmer elevations. Thirteen vegetation alliances have been mapped at PTA, consisting of communities described in the U.S. National Vegetation Classification (USNVC) and other communities present at PTA that are not represented in the USNVC (Figure 5.1). The majority of the installation is broadly characterized as dry tropical forest. Many communities at PTA are still dominated by native Hawaiian vegetation, but invasive plants continue to increase in cover and distribution (Block and Cook 2017). Twenty plant taxa are federally listed under the Endangered Species Act (ESA) and an additional 27 plant species meet the Department of Defense definition of a Species at Risk. Collectively, these listed plants and species at risk will be termed "rare plants" in this case study. The number

of rare plants on PTA represents one of the highest densities of rare plants within DoD.

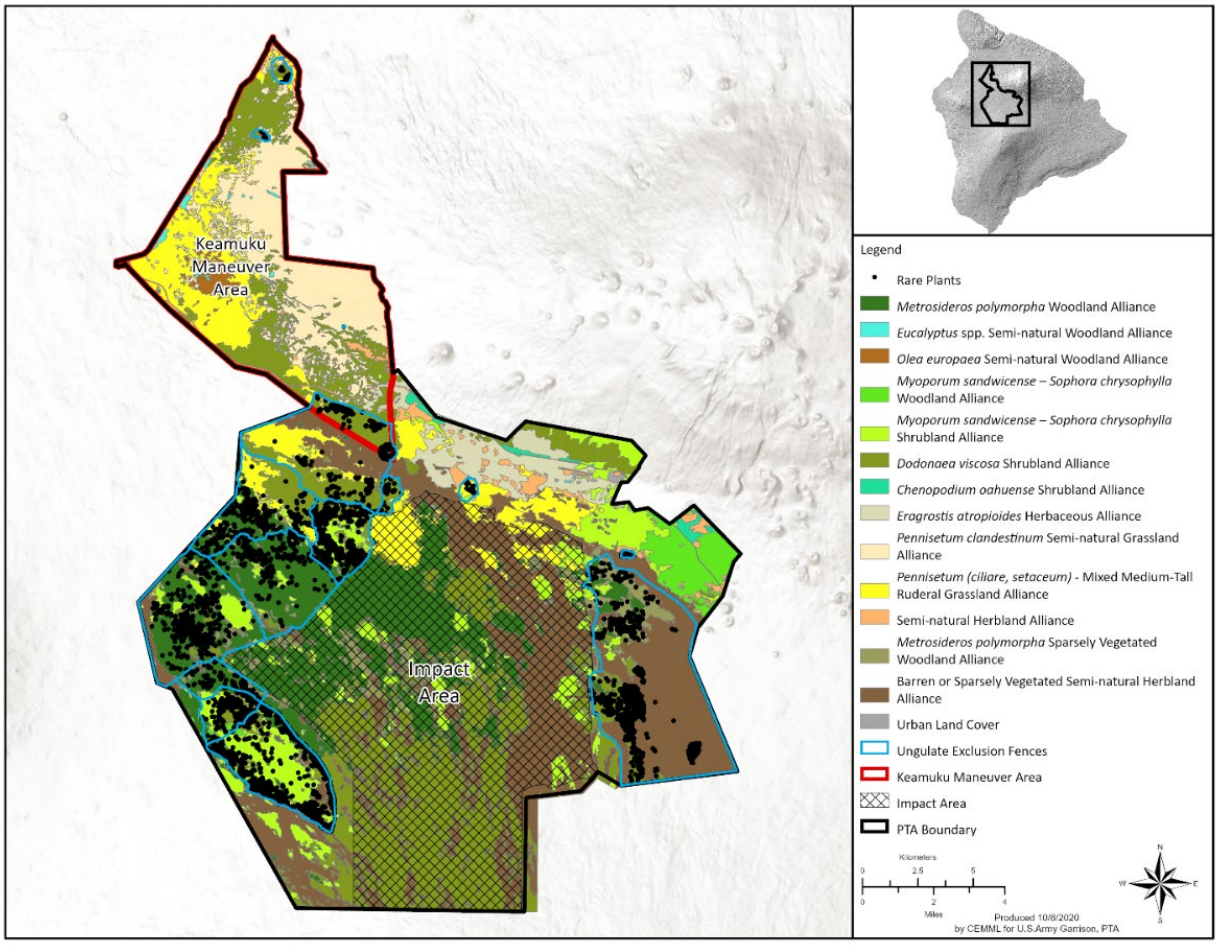

Figure 5-1. Landscape-level ungulate exclusion fences for management of native Hawaiian plant communities and rare plants on PTA.

Multiple Ecosystem and Species Stressors in a Hotspot of Diversity

Effectively managing multiple stressors for multiple rare species on an active live-fire training facility is challenging. Natural Resources Program staff at PTA (hereafter "we") strive to minimize regulatory burdens resulting from ESA consultations by managing multiple stressors to support stable baseline populations of rare plants. By maintaining stable populations of rare plants, we maximize flexibility, minimize constraints on military training and operations, and help to ensure no net loss of training lands or capacity.

Hawaiian ecosystems evolved in the absence of terrestrial grazing mammals and the ecological processes associated with them (Leopold and Hess 2017). Direct and indirect negative effects of introduced ungulates —primarily pigs, goats, sheep, and cattle—are well documented in Hawai'i (Leopold and Hess 2017). At PTA, feral goats and sheep have been on the landscape for about 150 years and cattle were

extensively ranched in the Keamuku Maneuver Area (KMA) in northwest PTA for over 100 years (Figure 1). Although the State of Hawai‘i administered recreational hunting at PTA beginning in the 1960s, reductions in sheep and goat populations were insufficient to prevent damage to the rare plants. Severe browsing killed individuals and significantly impacted population sizes and extents of these rare plants (Shaw and Castillo 1997). Fencing coupled with ungulate removal is the only long-term, permanent solution currently available to land managers in Hawai‘i to manage ungulate-related stressors.

Over 90% of the Hawaiian flora is endemic, existing nowhere else in the world (Sakai et al. 2006). Hawaiian insular ecosystems are highly vulnerable to invasion by introduced species, especially grasses, and these successful invaders continue to alter native plant community dynamics and structure (Vitousek 1986; D’Antonio and Vitousek 1992). Removing invasive grasses reduces competition for space and soil resources and can stimulate and improve native Hawaiian dry forest plant establishment (Cabin et al. 2002; Thaxton et al. 2012).

Wildland fire is another major threat to Hawaiian ecosystems, especially those invaded by non-native, invasive grasses (D’Antonio and Vitousek 1992; Smith and Tunison 1992; LaRosa et al. 2008; Cordell and Asner 2016). These fire-adapted grasses invade the forest and woodland understory, forming contiguous fuels that support high-severity fires that open the forest to further grass invasion. As fire removes woody vegetation and grass cover increases, a shift occurs toward microclimates that are warmer, drier, and windier, which favor future fires (Freifelder et al. 1998). In addition, these grasses recover quickly following fires and slow the recovery of native woody vegetation (Hughes and Vitousek 1993). The resultant novel grasslands support more frequent fire-return intervals compared to native-dominated plant communities (Trauernicht 2019). At PTA, invasive grasses continue to increase in native habitats, especially at lower, warmer elevations (Block and Cook 2017). Moreover, with the climate becoming hotter and drier, the risk of wildland fire is expected to increase at PTA by mid-century (Trauernicht 2019).

Approach

Landscape-scale Management of Stressors and Threats

Introduced invasive plants, invasive animals, and wildland fire have independent impacts in Hawaiian ecosystems, but these stressors also interact within the ecosystems in complex ways that promulgate future invasions and likely contribute to irreversible ecosystem changes (D’Antonio and Vitousek 1992; Cabin et al. 2002; Weller et al. 2018). In addition, climate change is anticipated to amplify existing stressors, especially via more frequent and more severe fires (Trauernicht 2019).

Despite such daunting challenges, we remain hopeful in our efforts to conserve the native Hawaiian dry forests and the rare plants they support. To slow the conversion of tree-dominated communities to grasslands, we manage multiple stressors across the landscape and attempt to minimize the interactions of these stressors. A landscape-level approach is necessary to protect habitats and promote conditions

for passive recovery of native plant communities and some rare plant species. To this end, we implemented programs to exclude ungulates from the habitat via fencing and removal, reduce the impacts of introduced grasses to rare species, and reduce fine fuels within a system of fuel breaks and proximate to federally listed plants. Our aims are to reduce impacts to native habitats, sustain stable populations of rare plants, and sustain training capacity and flexibility to support the Army's mission.

Fencing and Ungulate Management

As part of a formal ESA consultation with the U.S. Fish and Wildlife Service (FWS) in 2003, the Army committed to a large-scale fencing project at PTA to protect federally listed species and their habitats from the effects of introduced ungulates. The Army partnered with Hawai'i Volcanoes National Park and the Center for Environmental Management of Military Lands at Colorado State University to construct 15 fenced areas between 1998 and 2013. Approximately 86 miles of fencing form the fence units, which encompass roughly 37,300 acres (Figure 5.1).

Removing introduced ungulates from the fences was challenging, and required partnerships, innovation, persistence, and learning. Animal removal began immediately following the completion of the first fence unit in 1998 but progressed slowly project-wide due to social and political factors, as well as logistical challenges working in remote areas and rugged lava substrates. Each time a unit was completed, we implemented public hunts or animal drives to force animals out of the fenced areas into adjacent public hunting areas. However, additional efforts beyond public hunting were needed to eliminate the sheep and goat populations within the units. Therefore, when public hunting interest waned or was ineffective at reducing remaining animals in any unit, we contracted animal control professionals to remove the remaining animals.

Unfortunately, significant public opposition caused additional delays to ungulate removal deadlines associated with the FWS consultation. Additionally, in 2012 U.S. Army Garrison—Pohakuloa Training Area leadership prohibited discharging firearms from helicopters for removal operations following a County of Hawai'i ordinance banning aerial hunting of game animals. Aerial hunting had been an effective tool at PTA due to limited road access and the extremely rugged lava landscape. After missing a second deadline in 2014, FWS staff partnered with PTA to develop new aerial-supported ground-hunting methods. A helicopter was used to spot individuals and small herds within a fence unit. Using the helicopter to transport the removal professionals between herds and across the rugged landscape greatly improved efficiency. With help from FWS staff in 2014, we made significant progress toward reducing animal numbers to near zero. In 2015, animal control professionals removed the final animals, aerial surveys were conducted, and the units were declared ungulate-free in 2017. Between 1998 and 2017, 6,773 animals were removed from the 15 fence units. Maintaining the ungulate-free status of the fence unit is an ongoing project (see Lessons Learned below).

Managing Wildland Fire Risk

In Hawai‘i, managing fire risk to native ecosystems is a critical conservation action (Smith and Tunison 1992). At PTA, risk to rare species and their habitats from wildland fires caused by military training activities is minimized by managing vegetation along a system of fuel breaks and controlling invasive grasses (i.e., fine fuels) in buffers around selected endangered plant populations.

Working closely with Army firefighters, we designed a fuel break system to minimize fire risk to rare plants. The system is comprised of 14 fuel breaks, 11 located in the west portion of the training area and three in the KMA (Figure 5.2).

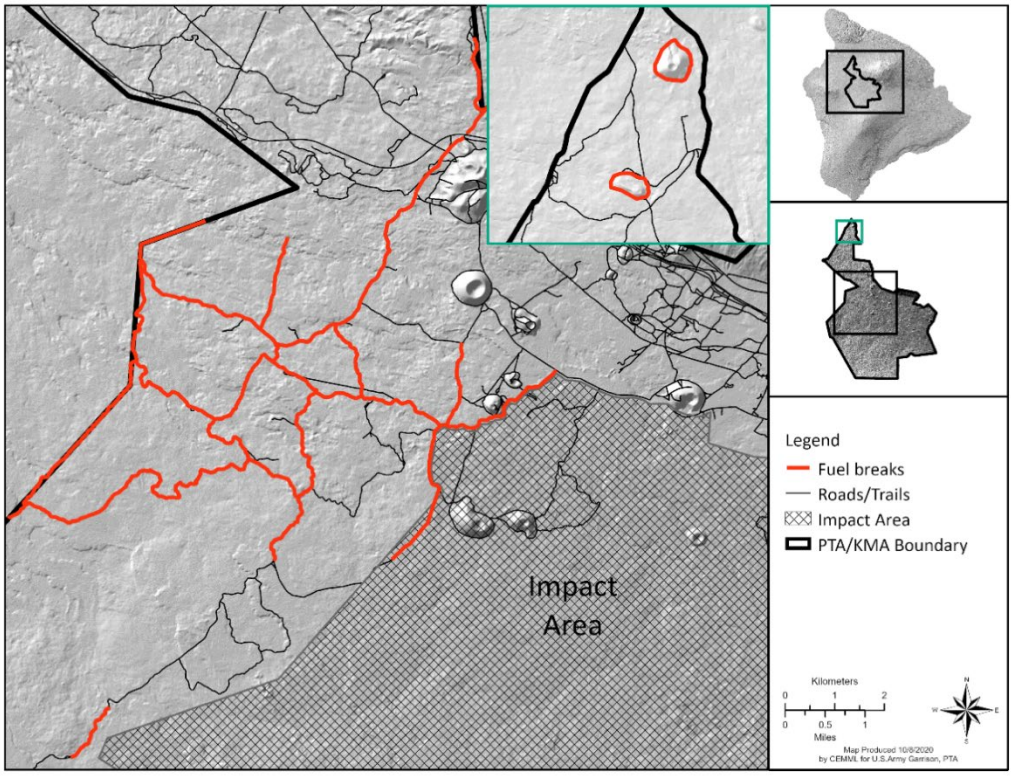

Figure 5-2. Fuel break system to manage fire risk at the landscape scale.

Fuel breaks consist of a 60-foot wide corridor where vegetation is kept at less than 20% cover through mechanical and chemical methods. Most fuel breaks contain a 20-foot wide mineral surface fire break. On the west side of the installation, the fuel break system was designed to compartmentalize the area into discrete cells to protect rare plants from fire escaping the central impact area or from fires moving onto the installation from State of Hawai‘i lands to the west. These breaks are used in conjunction with other firefighting tools and techniques and are not designed to stop a fully developed wildfire on their own. The breaks also provide lines of defense for firefighters, facilitate backburn operations and help ensure that one fire event will not impact the entire distribution of a rare species. The invasive grasses that are the primary fine fuel source at PTA are also aggressive competitors with native plants.

Therefore, we also reduce and maintain fine fuels in buffers around selected rare plant populations.

Successes/Outcomes

Fencing and Ungulate Management Improve Rare Species Outcomes

The fence units at PTA represent one of the largest ungulate-free areas in Hawai‘i the state of Hawai‘i. Between 2014 and 2018, research led by Dr. Creighton Litton of the University of Hawai‘i and funded by the DoD’s Strategic Environmental Research and Development Program (SERDP) examined changes in ecological processes and plant communities following ungulate removal in three habitat types: woodland, shrubland, and grassland. Overall, the study found that rare plants at PTA showed some recovery over time following ungulate removal without significant changes in native and non-native plant cover (Litton et al. 2018). The researchers also found some changes to ecological processes; these changes did not appear to favor the non-native plants following ungulate removal. The team noted the effects of ungulate exclusion on ecological processes were dependent on the condition of the system at the time of ungulate removal and the length of time since removal, and that their results may not apply to other ecosystems.

Wildland Fire Risk Reduction Helps Prevent Species Extinction

Prior to implementation of the fuel breaks and buffers around rare plant populations at PTA, the effectiveness of the dimensions used for the fuel breaks and fine fuel buffers was unknown. However, some encouraging evidence was provided following two major wildfires that burned in the west portion of the base in 2012 and 2018. The fuel breaks and buffers proved to be critical assets in controlling the fires, preventing uncontrolled spread throughout the area and minimizing damage to rare plants within buffers. In fact, the 2018 fire nearly burned the only remaining natural population of the endangered Mauna Kea Pamakani (Tetramolopium arenarium), but a near-extinction event was averted. During the post-fire assessment, we discovered the fire had burned to the edge of the fine-fuel buffer, but no further, thus protecting those plants (Figure 3).

Lessons Learned

Fencing and Ungulate Management

To date, the fencing and ungulate management programs successfully maintain ungulate-free habitats and rare plant populations have increased. However, ongoing fence survey and repair as well as monitoring for animal ingress through gates or breaches are necessary to maintain this ungulate-free status. Since 2017, 16 animals have breached the fences, primarily through poor vehicle gate discipline. To increase the chances of early detection, we educate staff at PTA to report open gates and any sightings of animals inside fences. Also, gates and areas of incidental sightings are monitored using trail cameras. When animals are suspected inside a fence unit, we deploy corral traps, attempt drives, insert radio-collared animals to find and herd with other animals, and/or contract animal control professionals.

Vigilance in monitoring and rapid removal of animals is critical to maintaining PTA's landscape-scale, ungulate-exclusion areas.

Figure 5-3. Localized fuel buffer for federally endangered Tetramolopium arenarium. Top image shows unmanaged invasive grass on the left and native shrubs with fine fuels controlled on the right. Bottom image shows the same location following a large wildland fire that burned in July 2018. The fire burned through the fine fuels in the unmanaged areas and went around the endangered plant population. (Photos by CSU staff)

Wildland Fire Risk Reduction

Wildland fire is an unpredictable force and its behavior varies from fire to fire. So far, the fuel break width and continuous vegetation-cover threshold have proven effective in helping contain and control wildland fires within rare plant habitats. Notably, implementing fuel breaks both at the landscape level and in the immediate areas around rare plant groups helped reduce the overall fire impacts to rare plants. The extensive fuel break system enabled firefighters to backburn and stop fire spread, which helped reduce impacts to the native plant communities and to rare plants without buffers. During some weather conditions, fuel breaks can help slow and prevent fire spread. Overall, the fuel break system has significantly contributed to the successful control of wildfires at PTA and helped to lessen the impacts to rare plants and their habitats.

Conclusions

At PTA, landscape-scale management is a viable approach to address complex interactions of multiple stressors on a plethora of rare species and their habitats. Removing ungulates reduced direct and indirect stressors, and mitigated the compounding impacts of ecological interactions between the animals, invasive plants and fire. Moreover, monitoring of rare plants after animals were removed from the system showed positive recruitment for some species (Litton et al. 2018). Removing animals also can reduce selective feeding on native plants, especially post-fire, and may help slow the alteration of native plant communities (Hughes and Vitousek 1993). Fuels management across the landscape and within localized buffers helped contain fires and reduced the loss of native woody species, rare plants, and habitats. Reducing fire spread, severity, and frequency is critical to conserving Hawai‘ian dry forests and their obligate rare species. Managing for multiple stressors, especially stressors that form complex ecological interactions that promote accelerated changes in Hawai‘ian dry forests, is crucial to slowing the conversion of these forests to grasslands. Because fire, invasive plants, and introduced ungulates can have wide-ranging effects across the landscape, it is imperative to design and implement management on a similar scale to be effective at supporting native ecosystems and the rare species that depend on them. Ultimately, healthy populations of rare species at PTA will help to minimize constraints and maximize flexibility for military training and operations, while conserving the native plant communities ensures a realistic training environment. Accomplishing both endeavors provides maximum opportunity for the Army to achieve their primary mission and sustain readiness.

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6. Case Study: Endangered Species Act Implementation, Dam Removal – Beale Air Force Base, California

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Introduction and Context

Beale Air Force Base (AFB) encompasses approximately 23,000 acres in the northern Sacramento Valley of California. Dry Creek, one of the three watersheds on Beale AFB, flows for a total of 33 miles from its headwaters upstream of the Base, through Beale AFB in Yuba County, and then joins the Bear River downstream of the Base. The Bear River connects to the Feather River just before it joins the Sacramento River, which flows for 70 miles before emptying into the Pacific Ocean through the Delta/San Francisco Bay.

Beale AFB has a long history of managing for species listed under the Endangered Species Act (ESA) with four listed species known to use the Base and 11 additional species that must be managed for because they are either 1) federally listed with potential to use the base at some phase of their life or 2) proposed for federal listing and are known or have potential to exist on the Base (Beale AFB 2019). Most federal land managers' focus with regard to the ESA is due to Section 7(a)(2), which "directs all Federal agencies to ensure that the actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species or destroy or adversely modify critical habitat." However, it is important to highlight another paragraph in the ESA that, even though required, is not discussed or implemented as often. ESA, Section 7(a)(1) states that "All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species." The following case study demonstrates implementation of a project that meets the Air Force's requirements under ESA Section 7(a)(1) and emphasizes the overall benefits to the species, the U.S. Air Force (USAF), and natural resources stakeholders.

Challenge

The U.S. Army installed Beale Lake Dam in Dry Creek in 1943 to provide recreational opportunities to military members. In the 1980s, when it was recognized that the dam was impeding passage to spawning habitat for anadromous fish up Dry Creek, including Chinook salmon (Oncorhynchus tshawytscha) and the federally threatened Central Valley steelhead (Oncorhynchus mykiss), a concrete fish ladder was installed in an attempt to address the issue. Anadromous fish, or fish that

migrate up rivers from the ocean to spawn, utilize Dry Creek as part of their native spawning grounds. In this case, these species migrate from the Pacific Ocean via the Central Valley of California up the Sacramento, Feather, and Bear Rivers.

In 2015, when it was determined that the fish ladder was not fully operational because it was undersized, and the design used was outdated, the Air Force Civil Engineer Center initiated a detailed habitat assessment by U.S. Fish and Wildlife Service fisheries biologists. The study noted that while Dry Creek's water temperatures were still cool enough to support anadromous fish, there were two major barriers that were impeding fish passage on Dry Creek: (1) Beale Lake Dam on Beale AFB and (2) the River Mile (RM) 6.2 Low Flow Crossing roughly 7.35 miles downstream from the Beale AFB boundary on private land. As a result, anadromous fish native to Dry Creek were unable to access their native spawning grounds.

Around the same time, a U.S. Army Corps of Engineers (USACE) study found Beale Lake Dam to have an overall condition of "poor" (USACE 2016). The concrete dam's right abutment was found to be compromised and unstable, and the left abutment was undermined. USACE recommended that Beale AFB implement strategies to improve the safety of the dam structure. The Base does not require a lake or dam to meet its current mission, as it was built only for recreational purposes. Base engineers determined that the long-term maintenance of the dam, and the potential liability for the dam's failure, presented an unacceptable risk.

Approach

Beale AFB's Integrated Natural Resources Management Plan (INRMP) included goals and objectives to improve migration and spawning habitat for these species, but the original focus was on the repair or replacement of an existing inadequate fish ladder. The environmental and engineering teams at the Base and Air Force Civil Engineer Center determined that the cost to repair the dam would be several million dollars more than the environmentally preferred option of removing the dam and restoring the stream and adjacent riparian zone. Removal of the dam was prioritized for environmental funding because of inclusion in the Beale INRMP as a high priority project, due to ESA Section 7(a)(1) requirements for the Air Force to contribute to the conservation of federally listed species.

To address the issue of fish passage through the Base, the USAF partnered with the U.S. Fish and Wildlife Service (USFWS). The USAF and USFWS were joint lead agencies for this project with the USFWS providing engineering, design, and fish passage expertise. The project was planned and implemented using Environmental Quality (EQ) funding programmed by the Air Force Civil Engineer Center, Travis Installation Support Section.

USFWS engineers from Alaska and Massachusetts, who had experience in dam removal in their regions, surveyed an area just upstream of Beale AFB's dam to use as a model for restoring riffles, pools, and the curves of the channel, and ultimately incorporated it into the project design. Another important part of the design was a fish passage over a small natural waterfall upstream of the dam, which served as a

natural barrier to fish except during large rain/runoff events. The design team developed a “rocky ramp” to raise the elevation of the original pool below the waterfall, reducing the vertical distance between the two features, and making the former barrier passable by the fish. The dimensions of the ramp were based on Chinook salmon’s swimming and jumping ability.

On the banks of the new channel, the project planted a variety of native vegetation to prevent erosion, attract birds and insects, and provide shade to help maintain fish-friendly water temperatures.

Figure 6-1. Beale Dam, fish ladder, and pedestrian bridge on Beale AFB, California in December 2017 prior to dam removal. Pictured: Jason Gibbons & Kirsten Christopherson, AFCEC, Travis Installation Support Section. (Figure by Kirsten Christopherson).

Photo 6-2. First day of Beale dam demolition at Beale AFB, California in July 2020. (Photo by Chadwick McCready, Colorado State University, Center for Environmental Management on Military Lands (CEMML).

Figure 6-3. Beale Dam demolition at 95% complete at Beale AFB, California in August 2020. (Figure by Kirsten Christopherson, Air Force Civil Engineer Center, Travis Installation Support Section)

Figure 6-4. Post-construction view looking upstream at the former Beale dam site after removal, but before seasonal rains started at Beale AFB, California in October 2020. The area pictured used to be Beale Lake behind the dam, and is now a rocky, seasonal stream. (Photo by Brandon Honig, U.S. Fish and Wildlife Service, Sacramento, External Affairs Office)

Figure 6-5. Post-construction view from the upstream end of the project area looking downstream, Beale AFB, California in October 2020. The image shows the rocky ramp, which creates a higher elevation jumping pool for salmonids to pass the natural waterfall to upstream spawning grounds. (Figure by Brandon Honig, U.S. Fish and Wildlife Service, Sacramento, External Affairs Office)

Successes/Outcomes

With the successful completion of the Beale AFB dam removal, six miles of historic salmonid spawning habitat are once again available to these rare species upstream of the Base. From a regional perspective, the USFWS is continuing to pursue funding to implement the off-Base work to remove the final fish passage impediment downstream of the Base (RM 6.2 Low Flow Crossing) and to perform gravel injection upstream of the Base to improve the spawning habitat. Once the off-Base portions of the regional project have been completed, a total of over 13 miles of anadromous fish habitat will have been restored.

The importance and impacts of partnerships in this endeavor cannot be overstated. Working with multiple agencies and their varying bureaucracies certainly had its challenges, but the overall benefits were realized through technical expertise, expedited environmental permitting, and confidence in the project by the public. Through the Sikes Act, Beale AFB routinely works with the USFWS and the California Department of Fish and Wildlife. However, this was a larger effort than had ever been undertaken, and each agency played a vital role. It tested and strengthened the partnership. Collaboration with the National Marine Fisheries Service, Central Valley Regional Water Quality Control Board, and U.S. Army Corps of Engineers was critical to the project as well; this was successful because they were invited to be partners on the project at the design kick-off meeting and initial site visit, gaining their support. The team kept open lines of communication

throughout the project. Support was also provided on-site by the Air Force Civil Engineer Center's Wildland Fire Support Module, the USFWS Conservation Law Enforcement Officer, and Colorado State University biologists. Teamwork and consistent communication resulted in successful project completion.

Lessons Learned

DoD Natural Resources Managers would be wise to stay vigilant about opportunities to implement ESA Section 7(a)(1) when developing their INRMP Goals and Objectives. This is a proactive approach that gains trust, participation, and confidence from the natural resources regulatory community, adjacent landowners, base occupants, and the public. It also often results in good media opportunities for the Air Force. In some cases, the Air Force may receive official compensatory mitigation credits for such conservation actions, while in other cases, the benefits may be less tangible, as in Beale AFB's case. Due to these types of proactive conservation efforts and partnerships, Beale AFB has benefitted when other natural resources challenges have arisen. On the whole, federal projects to further the conservation of threatened and endangered species move the species closer to recovery, providing a benefit to all.

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7. Case Study: Habitat Conservation Planning—Beale Air Force Base, California

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Introduction

Beale Air Force Base and its geographically separated unit, the Lincoln Receiver Site, encompass 23,427 acres in the northern Sacramento Valley of California. These properties are home to 36 federal and state threatened, endangered, or other special-status plant, fish and wildlife species and over 3,000 acres of highly sensitive vernal pool wetlands and seasonal streams.

Figure 7-1. Beale AFB seasonal stream with oak woodlands (Photo by Meghan Snow, U.S. Fish & Wildlife Service, Sacramento).

Challenge/Issue

The Beale AFB Installation Development Plan (IDP) (Beale AFB 2015) lists these sensitive natural resources issues as “major constraints” on the Base. Therefore, the Base has had a long history of proactively addressing threatened and endangered species and wetland regulatory requirements using a multi-species ecosystem

management approach, starting as far back as 1998. Complying with the natural resources regulatory requirements can be burdensome and expensive, and it can complicate not only meeting the military mission but can detract from the time and resources needed to implement larger base conservation efforts. Incorporating these challenges into the Base planning and pursuing large-scale permits and consultations has allowed Beale to successfully maintain the delicate balance between mission sustainment and natural resources conservation.

Figure 7-2. Beale AFB Western Pond Turtle, the only native freshwater turtle species in California, is proposed for federal listing under the ESA and uses several wetlands and streams on the Base (Figure by Kirsten Christopherson, AFCEC/CZOW).

Approach

The Beale AFB IDP (2015) describes a goal to “continue to foster community relationships and environmental stewardship,” and an associated objective to “Sustain environmental stewardship programs and practices” based on the importance of maintaining open space and conservation areas to avoid encroachment by regulations. Approximately 80% of Beale AFB properties are categorized as open space, such as undeveloped land in natural conditions, and designated Conservation Areas, Buffer Space, Explosives Safety arcs, and Training Functions (including maneuver areas and firing ranges). Many of these open-space areas contain wetlands and special status species that can be sustained while still carrying out the primary military mission. Also, the open space areas can often be managed to meet conservation goals and also offset natural resources impacts that occur in development areas through mitigation.

An overall goal of ecosystem management is to preserve, improve, and enhance ecosystem integrity and support current and future mission requirements. This goal influences all aspects of the Beale AFB Integrated Natural Resources Management Plan (INRMP) (Beale AFB 2019). Managing ecosystems involves treating the environment as a complex system of interrelated components, rather than a collection of isolated units, and considers other factors such as base development, economics, community values, and adjacent land uses (Beale AFB 2019). The installation's fish, wildlife, and wetland resources have been extensively mapped and fed into the installation development planning process; the IDP and INRMP at Beale AFB are mutually supportive of the same primary mission goals.

Development Areas

The IDP identifies "development areas" that are slated for potential future mission sustainment and expansion. These areas cover about 4,000 acres. From a planning standpoint, future development is mostly focused in areas that are already disturbed and degraded from past use and/or areas directly adjacent to developed areas. DoD- and USAF-prescribed development principles and best management practices for more efficient land use and resource conservation encourage infill development and other more efficient land development and land use techniques to maximize resources before considering development on previously undeveloped land or land acquisition (Beale AFB 2015).

Conservation Areas

In the 1990s, three types of conservation areas were established on Beale AFB totaling over 5,350 acres, which is approximately 23% of the installation. Construction, training, or other incompatible activities were not planned in these areas. However, under the concept of "wise use," outdoor recreation, cattle grazing, education, and research has taken place in these areas. Beale AFB and the U.S. Army Corps of Engineers, Regulatory Program, which administers and enforces the Clean Water Act, Section 404, signed a Memorandum of Agreement (MOA) in 2005 (Beale AFB 2005) designating the following areas for conservation and allowing mitigation for the Base's permitted actions to occur within them.

Vernal Pool Conservation Areas: Three areas covering 1,795 acres provide protection for vernal pools (seasonal wetlands) and their many associated wildlife species. Since 2001 more than 37 acres of wetlands have been created/restored and over 90 acres of wetland and threatened and endangered species habitat have been preserved in these areas as mitigation for Beale's mission impacts.

Riparian Conservation Area: The Dry Creek riparian zone, the most biodiverse area on the Base, encompasses 736 acres. This area supports conservation-compatible outdoor recreation and is also used as a riparian restoration site to offset impacts to other streams on the Base. In 2020 a large restoration project occurred in this area involving a dam removal to support native fish passage to upstream spawning grounds; this gained the Air Force recognition by the regulatory agencies for compliance with ESA Section 7(a)(1), which required federal agencies to contribute

to the conservation of federally listed species.

Vernal Pool Management Areas: Four areas covering 2,825 acres contain high-quality wetlands and threatened and endangered species habitat, but these wetlands are in areas identified for possible (but not likely) development in the future. Any development that would occur in those areas would be done as a last resort, i.e., under the case where there are no other areas that are appropriate for that type of specific activity. Therefore, these areas will be managed in the same way as the conservation areas, unless a special development project is identified for them.

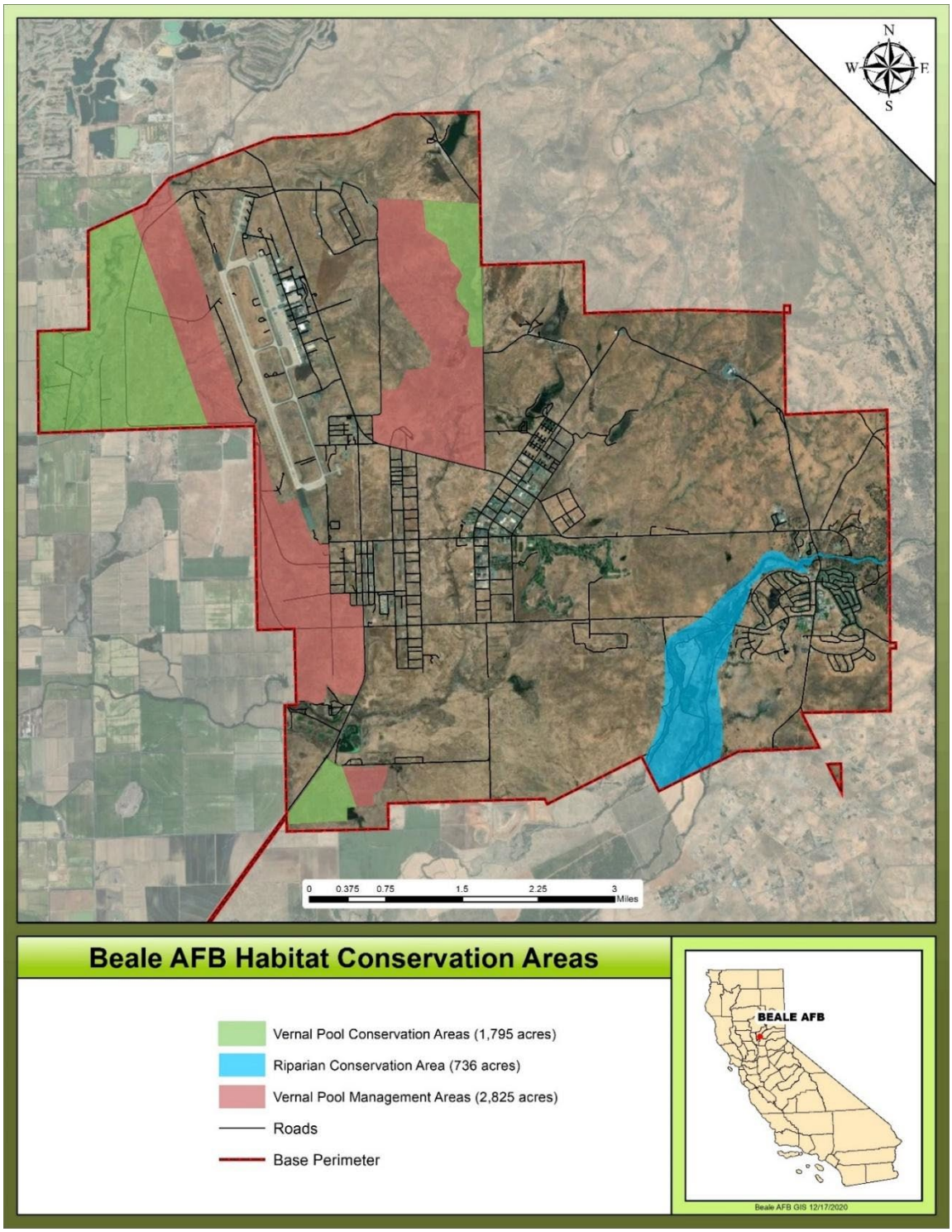

Figure 7.1. Original Habitat Conservation Areas from the MOA between Beale AFB and the U.S. Army Corps of Engineers (2005). This was developed from planning in the late 1990s.

Successes/Outcomes

As the program matured over the years, the original habitat conservation planning

concept at Beale AFB from the late 1990s was updated based on additional data collection on the quality of the natural resources. It was then applied to the most commonly required environmental permitting and consultation processes associated with the sensitive natural resources (Figure 2.1):

Endangered Species Act (ESA), Section 7(a)(2) consultation with the U.S. Fish and Wildlife Service: Beale AFB established a basewide Programmatic Biological Assessment (PBA), which proposes to continue a comprehensive resource planning and implementation program to provide more certainty and predictability for carrying out its mission impacts. The framework for this consultation is based on categorizing areas on the Base into one of three types based on past and future land use and integrity of natural resources: Development Areas, Undeveloped Areas, and High Integrity Areas. An update to the original PBA is underway and has consulted the IDP to include typical activities necessary on Beale AFB properties. Federally threatened and endangered species habitat impacts associated with these activities are consistent with Beale AFB's Programmatic Biological Assessment, which aims to conserve the areas with the most sensitive resources (Beale AFB 2018).

Clean Water Act Section 404 with the U.S. Army Corps of Engineers: Beale AFB and the U.S. Army Corps of Engineers have cooperatively outlined an ecosystem-based approach to addressing wetland and stream permitting requirements for "dredge and fill" on the base. This cooperative effort began in 2005 through basewide mapping and evaluation of the integrity of the wetlands and streams. Although the final step for a basewide Regional General Permit for CWA, Section 404 compliance has not yet occurred, the large-scale planning approach to balance wetland impacts and conservation informs project-specific permitting processes and gains Beale valuable credibility with the regulatory agency. This more comprehensive planning concept has been incorporated into the Beale AFB INRMP, and builds on the 2005 MOA.

Clean Water Act, Section 401 with the Regional Water Quality Control Board (California): The extensive wetland and stream mapping and evaluation feeds into the state water quality certification process as well. The Water Board is able to issue Programmatic General Permits for these types of scenarios to streamline the permitting processes at the Base.

Figure 7-3. Beale AFB Dry Creek Riparian Conservation Area (Figure by Kirsten Christopherson AFCEC/CZOW).

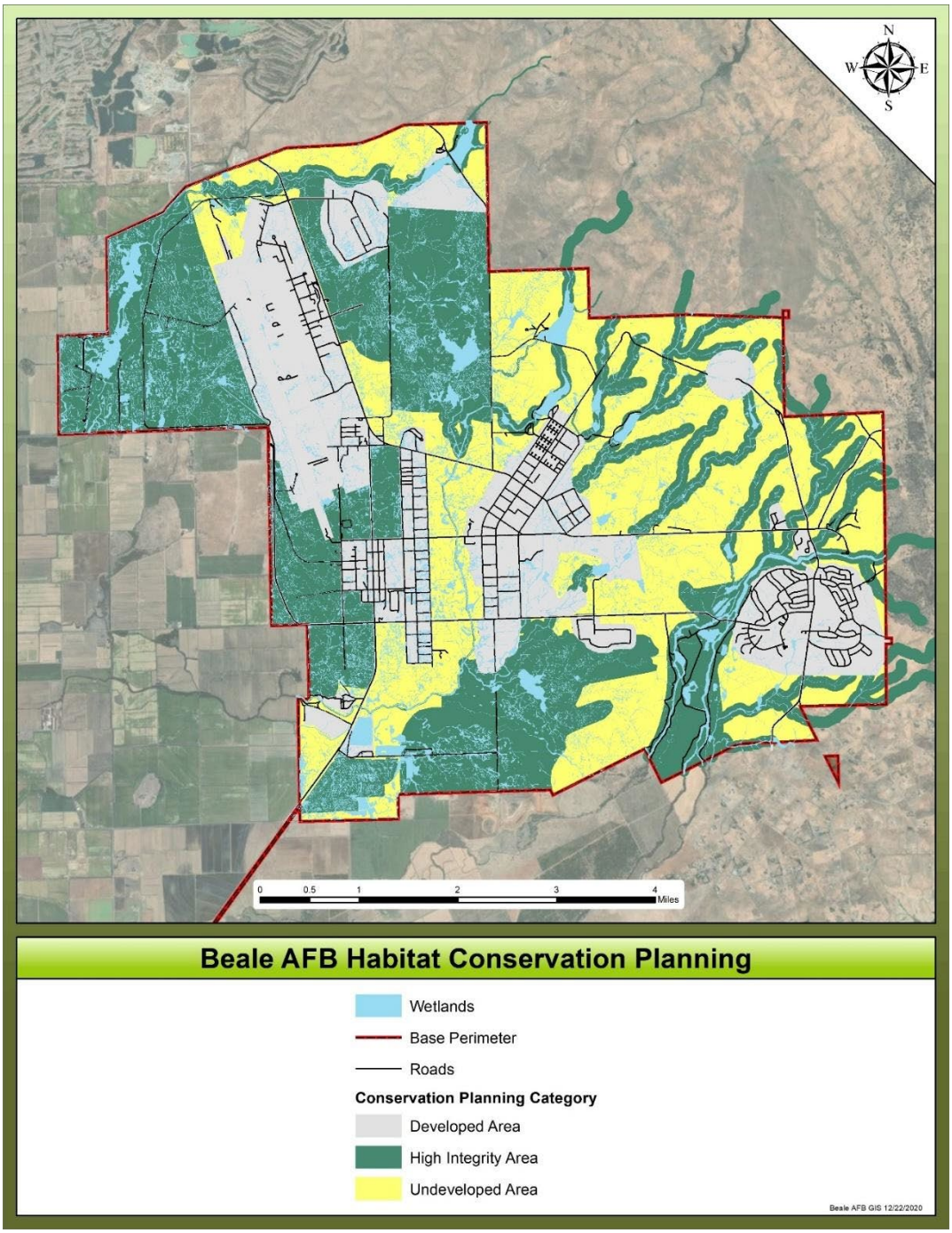

Figure 7.4. Most recent habitat conservation planning map showing the quality of aquatic resources (2009), building on the basic concept from the MOA with the Army Corps (2005).

Lessons Learned

The habitat conservation planning that has occurred over many years builds credibility for Beale AFB and trust with the regulatory agencies and public stakeholders. The extensive initial investment now serves as a basis for obtaining

large-scale permits from the appropriate regulatory agencies. Once these permits are completed, the development process at Beale will continue to be expedited in support of the mission, while still assuring that Beale's precious natural resources are protected.

Through support on strategic planning and budgeting from the Air Force Civil Engineer Center, Beale will continue to focus on proactive surveys, delineations, and habitat assessments for special-status species, especially those that are Proposed or Candidates for federal listing under the ESA. This proactive approach in studying species and their habitat before they are protected by law allows the Base to adjust quickly, and thus, provide better mission support, once a species is listed.

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8. Case Study: Nene Conservation: U.S. Army Garrison-Pōhakuloa Training Area Helps with Endangered Species Success Story for the Hawai‘i State Bird Using Off-Site Management

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Introduction

The Hawai‘i state bird, the Nēnē or Hawaiian Goose (Branta sandvicensis) has a high profile within the conservation community in Hawai‘i. Since it was federally listed in 1967, many conservation efforts have been made by federal, state, private and non-governmental organizations. As a result, in 2019 the U.S. Fish and Wildlife Service (FWS) downlisted the Hawaiian Goose from endangered to threatened under the Endangered Species Act. Between 2017 and 2019, Army efforts at the U.S. Army Garrison, Pōhakuloa Training Area (USAG-P) (Army) contributed to other statewide conservation efforts by protecting 31 Hawaiian Goose nests and confirming 39 successfully fledged goslings in the Hakalau Forest National Wildlife Refuge (HFNWR) on the Island of Hawai‘i.

Since 2004, the Army has monitored the presence, distribution, and habitat use of the Hawaiian Goose at Pōhakuloa Training Area (PTA). In 2013, the FWS issued a Biological Opinion (BO) to the Army that included an Incidental Take Statement for 20 Hawaiian Geese per year at PTA. To offset anticipated take from military training and other activities, the Army committed to implementing conservation actions to reduce threats to breeding Hawaiian Geese with the aim to produce, on average, 26 fledglings per year over the BO’s 20-year period. The island-wide population growth for the Hawaiian Goose is expected to increase the frequency of geese at PTA ranges and maneuver areas. Many of PTA’s live-fire ranges and mounted and dismounted maneuver areas are key military training assets for the U.S. Indo-Pacific Command to achieve military mission-level readiness. The Army strives to ensure the safety of the Hawaiian Geese at PTA, and to resolve natural resource management conflicts to support training. Hawaiian Geese do not typically breed in

the habitats available at PTA.

The overall goal of the Hawaiian Goose Conservation Project is to comply with the 2013 BO by funding and implementing off-site conservation actions to include:

- Construction and maintenance of two 20-acre predator-proof fences at HFNWR
- Provide 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
- Encourage use of the fenced areas by Hawaiian Geese.

Challenges

Following issuance of the BO in 2013, the Army, the FWS, and the Refuge (the partners) disagreed about how to fully implement the project as described. The Army and the Refuge attempted to reach agreement through a draft Memorandum of Agreement (MOA). However, significant concerns remained about project funding, staff dedicated to the project, and the potential for increased management obligations for the Refuge if funding was discontinued. The MOA was never finalized and in the meantime the Army was noncompliant with the terms of the 2013 BO.

In 2016, the partners decided to initiate a pilot project with a 1-year proof-of-concept phase in lieu of initiating a long-term agreement at the outset of the project. During this phase, the partners agreed to construct a single predator-proof fence, and implement and evaluate predator control and habitat management actions for effectiveness and efficiency. The partners agreed to evaluate the project's success at the end of the proof-of-concept phase and to then decide whether to continue the project on a year-to-year basis.

Approach

In early 2017, the partners had still not reached agreement regarding constructing the predator-proof fence and all parties agreed to postpone building the fence and to focus on other important conservation actions to help improve the successful recruitment of geese. By fostering a good working relationship between the partners, Army and Center for Environmental Management of Military Lands (CEMML) staff began implementing conservation activities on a seasonal basis at HFNWR in October 2017. Together, Army and CEMML staff implemented the following management activities within the Army-supported management areas (Map 1) at HFNWR: (1) goose monitoring, (2) nest monitoring, (3) predator control, and (4) habitat management. Implementing these conservation activities and attempting to produce 26 fledging per year supports the Incidental Take Statement in the 2013 BO for the geese on PTA. The Army and HFNWR agreed to incorporate some specific elements into the project:

- Collection of similar field data by all partners related to Hawaiian Goose management and response that can be incorporated into partner databases.
- Creation of shared, online calendars to communicate and document field operations, planning and coordination notes, or alerts/notifications related to field operations.
- Weekly to monthly communication among project leads to coordinate goose observations, nest-related data, and predator removal operations to increase field data collection efficiency between Army and HFNWR staff.
- Annual meetings coordinated with all parties to review breeding season reports and discuss the upcoming season's management plan.
- Predator control and habitat enhancement conducted within the target area at Hakalau. The Army aims to promote high-quality grass areas for Hawaiian Geese in the Army-managed areas within the Refuge.

Successes and Outcomes

Beginning in 2017, the Army initiated and has sustained a Hawaiian Goose Conservation Project in collaboration with FWS and the Refuge to comply with terms in the 2013 BO. The project continues and the results of goose monitoring are encouraging. Construction of a predator-proof fence remains on hold.

A total of 31 nests were found and monitored and 39 goslings fledged from the Army-supported management areas during the 2017-2019 Hawaiian Goose breeding seasons at HFNWR. Seven, twenty and twelve gosling fledged during the 2017-2018, 2018-2019, and 2019-2020 seasons, respectively. In the 2019-2020 season, at least three nests were washed away or abandoned due to severe flooding at the study site. With continued Army-supported conservation management activities, we anticipate that annual fledging numbers will be sustained or increased in the future, notwithstanding periodic events or disturbances to the local population (e.g., severe weather, disease, etc.).

A total of five feral cats, 27 mongooses, and 7 rats were captured and removed from the Army-supported management areas (2017-2019).

Approximately three acres of Hawaiian Goose habitat is managed and enhanced to promote high quality grass for foraging (Photo 1).

An average of 74 individual geese per year were observed in Army-supported management areas (2017-2019) (Photo 2).

Lessons Learned

Annual project meetings promoted discussion and agreement on expectations, roles and responsibilities, and upcoming management action plans; and provided essential feedback that fostered cooperation and trust among partners.

Establishing the same criteria and methods for collecting, storing, and managing data by partners enabled the Army and Refuge to share data efficiently between

compatible Hawaiian Goose databases during each season, including key elements such as goose breeding information (e.g., identifying family groups, nests, and gosling locations); and ensured both partners access to each other's data.

Building and fostering good working relationships is essential for accomplishing partner goals and acknowledging each other's comfort level as the project progresses.

Summary

Establishing a functional partnership between the Army, FWS, and Refuge allowed the Army to implement conservation actions that contributed to increased numbers of Hawaiian Goose fledglings at HFNWR. By fostering a good working relationship between the partners, an agreement was made to postpone building a predator-proof fence and to focus on other important conservation actions to help improve the successful recruitment of geese. Goose and nest monitoring, predator control, and habitat management yielded successful outcomes for the goose at HFNWR. For example, following the implement of habitat enhancement activities in Army-managed areas at HFNWR, geese are regularly attracted to and use these areas. Regular grass maintenance has produced a relatively uniform lawn with periodic grass re-growth that supplements the available forage for geese at the site. With augmented and improved predator removal, geese survivorship and numbers are expected to gradually increase and contribute positively towards the continued success of conservation efforts at the Hakalau Forest Refuge and statewide.

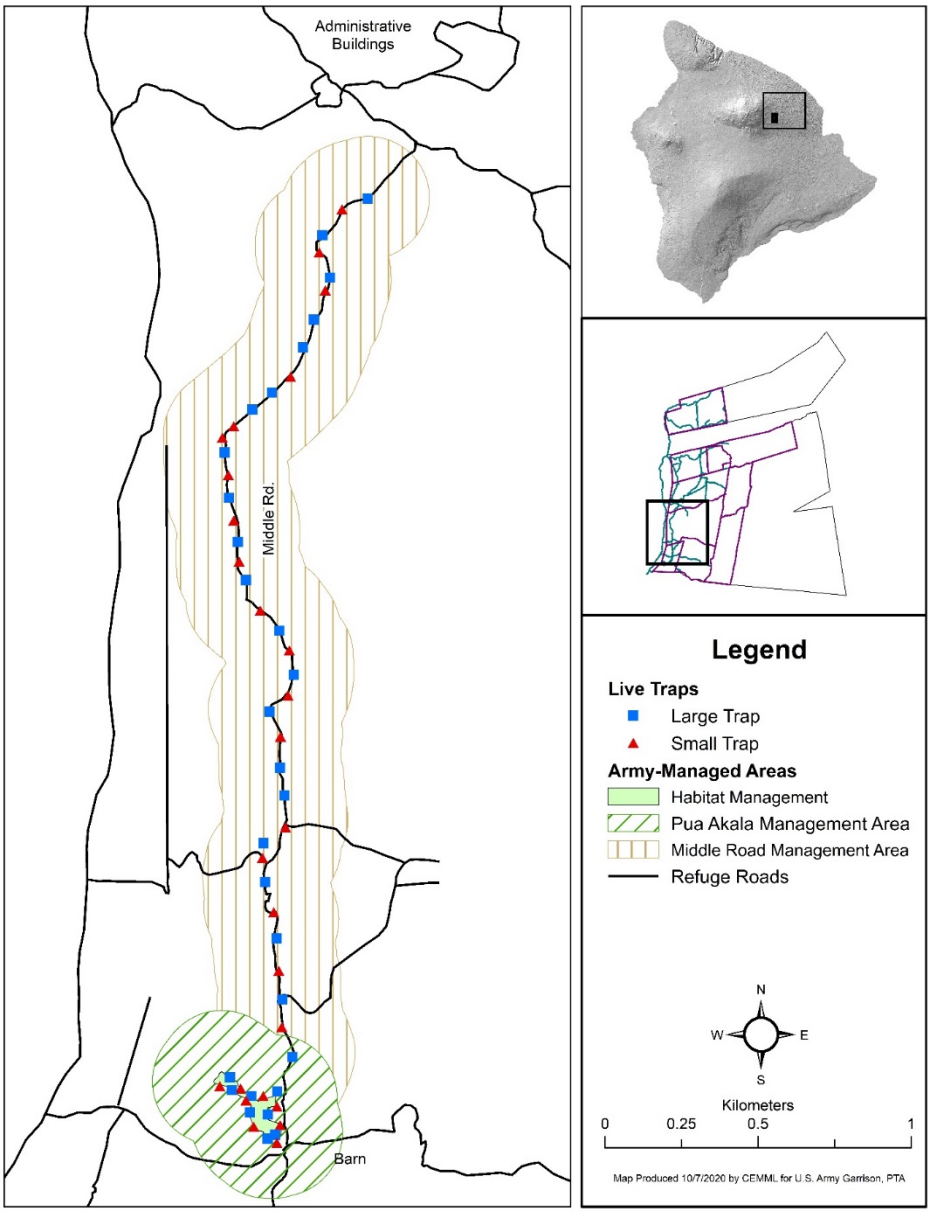

Figure 8-1. Locations of predator control traps and Army-managed areas at Hakalau Forest National Wildlife Refuge.

Figure 8-2. Hawaiian Geese foraging inside the Army-managed area. (Photo by CSU staff)

Figure 8-3. Hawaiian Goose pair inside the Army-managed area. (Figure by CSU staff)

Figure 8-4. Hawaiian Goose nest and gosling inside the Army-managed area. (Figures by CSU staff)

9. Case Study: Threatened and Endangered Species Management for the Palos Verdes Blue Butterfly -- Defense Fuel Support Point, California

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Conservation of the Palos Verdes Blue Butterfly

The Palos Verdes blue butterfly (*Glaucopsyche lygdamus palosverdesensis*) (PVBB) is a postage stamp-sized butterfly that was first described in 1977. It has only been found in a relatively small area on the Palos Verdes peninsula, in southern Los Angeles County, California. Due to its geographic isolation and declining abundance, it was listed as an endangered species in 1980. In spite of this, the City of Rancho Palos Verdes bulldozed the last known site, at that time, for the butterfly in 1983 to establish a baseball field. When the U.S. Fish and Wildlife Service lost its case against the City of Rancho Palos Verdes for knowingly destroying the last known habitat and population, the U.S. Congress amended the Endangered Species Act to allow prosecution of not only individuals, but also Federal and State organizations, subdivisions, municipalities, and other entities. This is the butterfly that rewrote the Endangered Species Act.

In 1994, eleven years after it was thought extinct, a tiny relict population of approximately 65 individuals was discovered on the Defense Fuel Support Point (DFSP), San Pedro: a Defense Logistics Agency (DLA) site which supplied aircraft and marine fuel to dozens of military bases and activities within California, Arizona, and Nevada. The butterfly's coastal scrub habitat on the Palos Verdes peninsula has been shrinking under pressure from urban development; the DLA facility is surrounded by residential neighborhoods, businesses, schools, recreational fields, and industrial producers. Other factors in the decline of the habitat include regional drought, weed control, off-road vehicle use, and non-native plant invasion.

The DLA's Response to the Discovery

The rediscovery of the PVBB triggered one of the most successful recovery efforts for an endangered species in the history of the Department of Defense.

The DLA quickly recognized that the protection of this species was not only a legal

responsibility, but could potentially engender great public support for the DLA mission on the Palos Verdes peninsula and for the Department of Defense in general. Consequently, the DLA, U.S. Navy, and the Department of Defense (DoD) began to work toward the recovery of the species with a team of partners, including the U.S. Fish and Wildlife Service, University of California, Riverside, the Urban Wildlands Group, Palos Verdes Peninsula Land Conservancy, Moorpark College, America's Teaching Zoo, and the Soil Ecology Restoration Group at San Diego State University.

Results

Restoration of habitat was an important first step in recovery, especially the reestablishment of healthy stands of the butterfly's host plants -- locoweed and deerweed. These are cultivated in a special nursery overseen by the Palos Verdes Peninsula Land Conservancy. The Conservancy uses the plants and preserved open space on the Palos Verdes peninsula as a medium for teaching local school children and as a place for volunteers from the local community to aid in botanical propagation and habitat restoration to expand the potential range of PVBB. This symbiotic relationship allows the Defense Fuel Support Point to assist with and support projects in its local community.

Surveys are another instrumental component of the PVBB conservation. Annual surveys for adult butterflies have historically revealed that conservation efforts are effective, as the population had grown and was relatively stable for a brief period. According to recent observation, however, the accelerating decline of the host site following record heat and drought in the region has taken its toll on the reestablished population. The locating and mapping of PVBB host plants has also allowed for identification of potentially suitable habitat and for more informed land management decisions. Captive rearing soon became another important part of the recovery program, as those under human care continue to thrive; offering a stable reserve for potential habitat reintroduction year after year. Through an agreement with UCLA, and in cooperation with the U.S. Fish and Wildlife Service, scientists from the University of California Los Angeles Geography Department began overseeing a captive butterfly rearing program. The primary site is situated at Defense Fuel Support Point San Pedro, and a secondary captive rearing site is with the Butterfly Project at America's Teaching Zoo, overseen by The Urban Wildlands Group. Both sites are funded by grants through the DLA and the U.S. Navy.

A recent shift in the care and handling of the butterflies, involving hand feeding adults by volunteers and interns with specialty lantana blooms and artificial nectar (honey-water), and exclusion of ants and other predators has resulted in an explosion of the captive rearing stock from 2005 to 2007 from 186 to 4,700. This allowed for an unprecedented reintroduction to several areas over its original habitat on the Palos Verdes peninsula in the spring of 2008, and similar large releases to suitable locations in each of the following years continuing to present.

In addition, the restoration efforts have provided many learning and research opportunities for both the general public and university students and faculty. The

DoD and DLA have also received an unprecedented amount of positive publicity for the work they have done to recover the PVBB and the environment in which they were discovered.

Keys to Success

- Early and conscientious attention to the issue once it was recognized
- Cooperative conservation: recruitment of a wide-ranging team of partners to work together for the recovery of the species
- Successful funding to support the recovery programs
- Cost-sharing initiatives, including in-kind services from partners
- Positive and highly effective public affairs support throughout the project

See the following article for additional details:
https://www.fws.gov/endangered/bulletin/2000/11-12/18-19.pdf

Conclusion

The DLA achieved great success in conserving biological diversity in a highly degraded habitat and did so in a way that was completely compatible with its primary military mission of providing supply support, and technical and logistics services to U.S. military organizations and several federal civilian agencies. The DLA has forged a model for government and private efforts to conserve endangered species, and continues to support those efforts through the Palos Verdes Blue.

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https://www.urbanwilDLAnds.org/pvb.html

10. Case Study: Yellow Crazy Ant Monitoring and Control at Marine Corps Base Hawai'i

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Introduction

This case relates to Marine Corps Base Hawai'i (MCB Hawai'i) on the Mokapu Peninsula on the windward (east) coast of the Island of Oahu. The coastal areas at MCB Hawai'i are suitable for landings and amphibious exercises and provide unique, realistic settings for military readiness training.

The coastal beach at MCB Hawai'i is also an important nesting area for birds. The wedge-tailed shearwater (*Ardenna pacifica)* nests in burrows along several acres of shore.

Challenge

Due to its isolation in the Pacific Ocean, Hawai'i has no native ants. People have inadvertently brought various ant species from other parts of the world to Hawai'i, and invasive ant species have become established. Yellow crazy ant (*Anoplolepis gracilipes*) is considered one of the world's worst 100 invasive species (Lowe et al. 2000). Yellow crazy ant is called a "tramp ant", an invasive ant which has spread to islands with the help of people (with nursery stock, on vehicles, equipment, etc.). It is an invader and a threat to island ecosystems, especially in the Pacific and Indian Ocean regions (Wetterer 2005). For example, Christmas Island (National Parks Australia) and Johnston Atoll (US Fish & Wildlife Service) are islands where yellow crazy ant had come to dominate ecosystems, and ant monitoring and control efforts by natural resource management agencies have had success. Yellow crazy ants are considered native to Southeast Asia, but have spread to many Pacific islands, including Okinawa, Johnston Atoll, and the Hawai'i Islands. They infest certain agricultural crops, are spread easily by human activity, and are a severe threat to the distinct biodiversity of islands where they have spread and are invasive. Since the Hawai'i islands have no native ants, they are a threat to the biodiversity of Hawai'i.

Wedge-tailed shearwaters nest along coastal beach at MCB Hawai'i. An invasion of yellow crazy ants into an important wedge-tailed shearwater nesting area at MCB Hawai'i caused dramatic declines in nesting success and low survival of shearwater chicks. Yellow crazy ants spray formic acid, especially around the eyes of the nesting birds. Surviving chicks had deformities of their bills and eyes. To promote nesting success of these special shorebirds, recreational access has been restricted and nest predator control of rats, domestic cats, and dogs has been ongoing (Plentovich et al. 2017). Without control, the yellow crazy ants threatened this extensive and important seabird nesting area.

MCB Hawai'i provides nesting habitat for many shorebirds, in addition to the military training activities which occur at MCB Hawai'i. Declines in the success of nesting shorebirds has an impact on the multiple values at MCB Hawai'i.

Approach

With control efforts, the densities of yellow crazy ants were reduced by 97%, which resulted in substantial increase in seabird nesting success (Plentovich et al. 2017).

In partnership with MCB Hawai'i, the US Fish & Wildlife Service led monitoring and control of the yellow crazy ant in wedge-tailed shearwater nesting areas.

Toxic ant baits with formicide were used to target and reduce yellow crazy ants. Several targeted toxic ant bait formulations were tried, and results were carefully monitored to determine effectiveness of control.

Over the years, MCB Hawai'i has had a variety of community partnerships focused on natural resources, wetlands restoration, and coastal area conservation. MCB Hawai'i has good relations with the community, and there is understanding within the local area of the importance of the military mission, and the commitment of MCB Hawai'i to provide for the military mission, while managing an exemplary coastal area to support wetlands, and wildlife, including shorebirds. A local citizen informed the natural resources staff at MCB Hawai'I that there were a large number of long-legged yellow ants in the coastal area of MCB Hawai'i. Subsequent wedge-tailed shearwater monitoring showed dramatic declines in nesting success in areas which were infested with yellow crazy ants (Plentovich et al. 2017).

Outcomes

Through partnerships, the wedge-tailed shearwater nesting has increased with control of yellow crazy ants.

Lessons Learned

Local people have recognized the many conservation partnership efforts which the MCB Hawai'i staff have led. A member of the community noticed the yellow crazy ants in at MCB Hawai'i and reported it, a great example of early detection of an invasive species, not native to Hawai'i. MCB Hawai'i partnered with US Fish & Wildlife Service, which had experience with yellow crazy ant control at Johnston Atoll. The success of MCB Hawai'i was through partnerships, with the local community who served as eyes and ears for invasive species early detection, and the US Fish & Wildlife Service who had the expertise and natural resource management experience needed for yellow crazy ant monitoring control. Due to these partnerships, wedge-tailed shearwater nesting success has improved at MCB Hawai'i.

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Figure 10-1.Yellow crazy ants (Anoplolepis gracilipes). Copyright John Tann (Creative Commons — Attribution 2.0 Generic — CC BY 2.0) https://eol.org/media/6707305

Figure 10-2. Image of wedge-tailed shearwater from US FWS. (https://www.fws.gov/pacificislands/images/secondary_banner/Shearwater.jpg)