

**PROCEEDINGS FROM THE
U.S. DEPARTMENT OF DEFENSE'S
PACIFIC ISLANDS REGION THREATENED, ENDANGERED, AND
AT-RISK SPECIES WORKSHOP-II**



**FEBRUARY 2-4, 2010
HONOLULU, HAWAII**



These proceedings encompass outcomes from the *DoD Pacific Islands Region Threatened, Endangered, and At-Risk Species Workshop-II*, and reflect the opinions and views of workshop participants, and not necessarily those of the Department of Defense. This document is available in PDF format at <http://dodworkshops.org/PAC-TERS.html>.

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EXECUTIVE SUMMARY

The U.S. Department of Defense (DoD) manages nearly 29 million acres of land, and thousands of square miles of air and sea space to conduct missions vital to United States national security. These same lands, air, and sea space provide habitat for a great diversity of plants and animals, more than 40 of which are found only under DoD stewardship. Nowhere else do DoD lands harbor greater biological diversity than in the Pacific Region. Yet, this vibrant and diverse ecology is under immediate and significant threat, especially from development and urban expansion, non-native invasive species (NIS), global climate change, and expanding military mission needs. NIS are of particular concern in the Pacific, with one new species established in Hawaii every 18 days.¹ Approximately 10 percent of these non-native species become invasive, posing a significant threat to the native flora and fauna at both a species and ecosystem level.

DoD has a vested interest in maintaining training and testing capabilities throughout the Pacific Region. DoD presence is greatest on the island of Guam and among the Hawaiian Islands, where there are 15 military installations and ranges encompassing more than 200,000 acres. These lands harbor more than 100 federally-listed species.

With funding from the Legacy Resource Management Program (Legacy), the DoD Natural Resources Conservation Program sponsored the *Pacific Islands Region Threatened, Endangered, and At-Risk Species Workshop-II* held February 2-4, 2010, in Honolulu, Hawaii. This workshop was the second Pacific Region threatened, endangered, and at-risk species (TER-S) workshop, and resulted from a national symposium addressing TER-S on DoD and adjacent lands held in June 2005 (see www.serdp.org/tesworkshop or <http://dodworkshops.org/PAC-TERS.html>). The first Pacific Islands Region TER-S Workshop was held in June 2006.

The specific objectives for the *Pacific Islands Region TER-S Workshop-II* were to:

1. Revisit the adaptive management priorities identified at the 2006 workshop, and assess to what extent those needs have been met.
2. Identify and prioritize opportunities for future investments to benefit TER-S and their habitats on DoD lands in the region, especially considering potential climate change impacts.
3. Bolster partnerships established at the 2006 workshop and establish new connections.

To achieve these objectives, the workshop brought together approximately 30 subject matter experts across the endangered species discipline spectrum, including representatives from federal and state agencies, academia, and non-governmental organizations.

The workshop began with presentations from Hawaii's State Department of Land and Natural Resources and The Nature Conservancy, followed by overviews on the state of aquatic and terrestrial ecosystems in Hawaii. Scientists then gave presentations on a sample of the research, demonstrations, and surveys resulting from the 2006 workshop. The day concluded with presentations on Hawaii's Army Natural Resources Program (host for the workshop field tour), the U.S. Fish and Wildlife Service's partnerships and conservation programs in the Pacific Region, and NOAA Fisheries' priorities for TER-S in the Pacific Region.

¹ Zimmerman, E.C. 1970. Adaptive Radiation in Hawaii with Special Reference to Insects. In *A Natural History of the Hawaiian Islands*. University Press of Hawaii, Honolulu.

The second day consisted of breakout group discussions on the following topics: *Terrestrial: Invasive Species*; *Terrestrial: Species and Systems*; and *Aquatic (Coastal, Wetland, Riparian, etc.)*. Workshop discussions elucidated a number of information gaps that could be addressed by DoD’s funding mechanisms: assessment of particular management approaches applicable to multiple DoD installations (Legacy), research (Strategic Environmental Research and Development Program [SERDP]), and technology or method demonstration (Environmental Security Technology Certification Program [ESTCP]). In addition, participants also identified a need for better communication and data sharing among regional stakeholders.

On the final day of the workshop, participants toured U.S. Army Garrison, Schofield Barracks to learn how DoD natural resources management personnel deal with the challenge of effectively using lands, air, and sea space for national security missions, while simultaneously conserving species protected by the Endangered Species Act and those at risk of needing such protection.

This proceedings document summarizes workshop discussions and identifies priority information gaps. The table below provides a synthesis of the top aquatic and terrestrial recommendations.

TABLE 1: DOD TERRESTRIAL AND AQUATIC PRIORITIES

Terrestrial	Aquatic
DoD Biosanitation Strategy for Pacific Region	Evaluate the Effectiveness of Supersucker® for Invasive Algae Control
Biocontrol for a Priority Invasive Plant	Endangered Waterbird Recovery: Life History, Mapping, and Distribution
Rat Control: Monitor Effectiveness of Aerial Bait Application	Evaluate Interactions Between Native and Non-Native Species
Slug/Mollusk/Snail Detection and Control	Aquatic Habitat Restoration: Improve Management of Barriers and Diversions
Predator Control Fences for Hawaiian Landscape	Evaluate Relationships Between Water Quality and Invasives
Invertebrate Inventory and Database	
Species Level Considerations for Restoration	
Bird Habitat Restoration in Vicinity of Airfields	
Ex Situ Strategies and Capacity for Restoration	

In examining these priorities, it is clear that invasive species control is a key management concern for both aquatic and terrestrial systems, whether the NIS are grasses, mammals, slugs, or algae. Habitat restoration efforts rely on NIS control and on the availability of sufficient numbers of ex situ resources to support restoration projects. At the basic science level, life history information is still lacking for some classes of species (such as invertebrates and waterbirds) and for many of the naturally rare species in the region. A general consensus emerged that improving existing partnerships and forming new alliances can provide synergistic benefits.

By considering the recommendations resulting from this workshop, DoD and its stakeholders can help address ecological threats in the region by targeting program resources towards conservation-related efforts that support training and testing flexibility, while maximizing species and habitat protection goals. By working in partnership, projects can achieve mutually beneficial goals.

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LIST OF ACRONYMS

BMP	Best Management Practice
BRAC	Base Realignment and Closure
CESU	Cooperative Ecosystem Studies Unit
CGAPS	Coordinating Group on Alien Pest Species
COE	Corps of Engineers
DoD	Department of Defense
DDNR	Deputy Director, Natural Resources (DoD)
DLNR	Department of Land and Natural Resources (Hawaii)
ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
ESTCP	Environmental Security Technology Certification Program (DoD)
GIS	Geographic Information System
HCA	Hawaii Conservation Alliance
INRMP	Integrated Natural Resources Management Plan
ISC	Invasive Species Council (each Hawaiian Island has one... e.g., Maui ISC)
Legacy	Legacy Resource Management Program (DoD)
NBII	National Biological Information Infrastructure
NGO	Non-Governmental Organization
NIS	Non-Native Invasive Species
NOAA	National Oceanic and Atmospheric Administration
NRM	Natural Resource Management
R&D	Research and Development
SAR	Species At-Risk
SERDP	Strategic Environmental Research and Development Program (DoD)
TES	Threatened and Endangered Species
TER-S	Threatened, Endangered, and At-Risk Species
TNC	The Nature Conservancy
TNR	Trap, Neuter, Release
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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The *Pacific Islands Region TER-S Workshop-II* sponsor wishes to thank all of the event's participants (see Appendix A) whose considered and knowledgeable input has informed this document and will likely influence TER-S conservation efforts in the region.

The sponsor also thanks the steering committee, plenary speakers, breakout session chairpersons, and rapporteurs for helping make this event a worthwhile and productive endeavor (see Appendix B), and extends a special thanks to Michelle Mansker, Natural Resource Manager, for coordinating and leading a field tour of U.S. Army Garrison, Schofield Barracks and Makua Reservation.

Finally, the sponsors also acknowledge the dedicated efforts of Alison Dalsimer and Derrick Golla from Booz Allen Hamilton, and Alicia Shepard from HydroGeoLogic, Inc.

For more information on the TER-S Symposium and subsequent regional workshops, please visit <http://dodworkshops.org/Workshops.html> or www.serdp.org/tesworkshop.

1.0 INTRODUCTION AND BACKGROUND

This document presents a summary of results from the *DoD Pacific Islands Region Threatened, Endangered, and At-Risk Species Workshop-II* sponsored by the DoD Natural Resources (NR) Conservation Program through its funding arm, the Legacy Resource Management Program (Legacy). The workshop took place February 2-4, 2010, in Honolulu, Hawaii.

The U.S. Department of Defense (DoD) manages nearly 29 million acres of land and hundreds of square miles of air and sea space to conduct missions vital to national security. The same land, air, and sea space provides habitat for a great diversity of plants and animals, more than 40 of which are found only on DoD lands. In fact, with approximately 420 threatened and endangered species (TES) and 523 species at-risk (SAR), DoD harbors more sensitive species per acre than any other federal land managing agency. Although its mission is to train Military Service personnel and test weaponry, DoD is committed to protecting its lands, oceans, and airspace, as well as the species that inhabit them. Through improved understanding of these species, their habitats, and relationships to military training and testing activities, DoD can work with stakeholders to enhance species conservation in ways that sustain mission requirements.

1.1 WORKSHOP SPONSOR

Legacy is a DoD NR Conservation Program that provides funding to projects that conserve and protect our nation's natural and cultural heritage. Legacy helps DoD protect and enhance natural and cultural resources while supporting military readiness. Three principles guide DoD's Conservation and Legacy programs: *stewardship*, *leadership*, and *partnership*. Stewardship initiatives help safeguard our nation's irreplaceable resources for future generations. By embracing a leadership role, DoD serves as a model for respectful use of natural and cultural resources. Through partnerships, DoD strives to access the knowledge and talents of many individuals. The DoD NR Conservation Program achieves these goals by funding management-oriented projects through its Legacy Program.

DoD's three primary natural resources funding programs are Legacy, the Strategic Environmental Research and Development Program (SERDP), and the Environmental Security Technology Certification Program (ESTCP). Together, these programs help DoD maintain its dual missions of readiness and environmental stewardship. Research and development initiatives begun in SERDP may need to be validated through ESTCP and later implemented via Legacy. Likewise, on-the-ground management funded by Legacy may uncover basic research and development (R&D) needs for future investment through SERDP and ESTCP. Ultimately, the three programs offer an integrated and adaptive approach to managing DoD's natural resources.

Information about the DoD NR Conservation Program, including links to fact sheets and other materials, can be found at www.dodnaturalresources.net. Details about Legacy proposal requirements and Areas of Emphasis can be found online at www.dodlegacy.org.

1.2 JUNE 2005 SYMPOSIUM AND WORKSHOP ON TER-S ON DoD AND ADJACENT LANDS

In June 2005, the U.S. Army Corps of Engineers Engineer Research and Development Center, Legacy, SERDP, and other federal and non-federal partners sponsored a national symposium to examine issues related to Threatened, Endangered, and At-Risk Species (TER-S) on DoD and adjacent lands. The objectives were to:

- Present the most up-to-date information on government and academic TER-S research relevant to DoD.
- Stimulate collaboration and foster partnerships among participants.
- Identify additional areas of research needed to address TER-S and associated habitat issues facing DoD and other federal land-managing agencies.

Participants included nearly 200 researchers and managers from DoD, all the Military Services, the U.S. Fish & Wildlife Service (USFWS), National Park Service (NPS), U.S. Geological Survey (USGS), U.S. Department of Agriculture (USDA), and various non-governmental organizations (NGOs), state agencies, universities, and private consulting firms. Findings from this event are described in a proceedings document, available at www.serdp.org/tesworkshop.

Participants identified the following needs as high priority:

- **Research basic species life history and improve biological information.** There is a serious lack of basic biological information for many listed and at-risk plant and animal species. Only through a clear understanding of the species and the stressors that directly impact population health and viability can suitable management protocols be developed.
- **Increase proactive conservation efforts for species at-risk.** When considering the threats to already listed and at-risk species, it is evident that additional resources must be focused on proactive conservation measures to prevent additional species listings. Research is needed to properly and fully evaluate the cost-benefits associated with proactive (versus reactive) conservation efforts, especially with respect to the impacts of non-native invasive species (NIS). Knowledge gained could then be used to implement appropriate policies and funding initiatives that would conserve resources in the long-term.
- **Develop more consistent peer-reviewed data standards and monitoring protocols.** Monitoring protocols, guidelines, and indicators are not fully developed for many TER-S. Additionally, in cases where protocols exist, they do not necessarily provide meaningful data for decision makers. Therefore, research is needed to develop protocols. This must be done using a rigorous scientific approach and peer review process that incorporates how data are to be collected, managed, analyzed, and reported to ensure efficient collection of data elements directly relevant to key management decisions.
- **Improve predictive models to support management decisions.** To manage and conserve TER-S habitat at a regional scale, land managers must apply a complex suite of management measures across a wide landscape in coordination with other regional landowners to achieve ecosystem goals. While several pilot projects have been completed, additional research is needed to refine, validate, and expand these predictive modeling efforts.

- **Improve information-sharing among stakeholders.** Funds available for monitoring and conserving listed species are limited, with no single organization having the ability to collect all of the necessary data or to fully implement regional conservation restoration measures. It is important to be able to leverage conservation-related information and actions across agencies and in partnership with private initiatives. Through the development and application of new technologies based on significant collaboration, it may be possible for TER-S conservation organizations and partners to yield significantly enhanced results.
- **Focus on protection of endangered ecosystems rather than individual species.** There is a need to focus TER-S conservation efforts on the protection of “endangered ecosystems” at a regional scale, rather than managing the biological needs of single species. Research is needed to develop more sophisticated regional management tools and approaches.

Symposium participants agreed that TER-S issues are fundamentally regional in nature, and should therefore be addressed at that level. Therefore, to refine and implement the 2005 Symposium results, Legacy, SERDP, and ESTCP developed a plan to host a series of regional TER-S workshops.

Symposium participants specifically identified the need for workshops in the following four regions: Pacific Islands, Southeast, Southwest, and Northwest.² Boundaries for the four identified regions were to be determined by location of military installations and key ecological features, rather than by existing, but artificial, agency boundaries.

Participants overwhelmingly identified the Pacific Islands Region as the region most at-risk of having additional species listed or, for those already listed, go extinct in the relatively near future.

1.3 PACIFIC ISLANDS REGION

The Hawaiian Islands boast more than 15 military installations and ranges encompassing more than 200,000 acres of land and supporting more than 100 federally-listed species – one-third of all listed species in Hawaii. Significantly, many of these populations exist nowhere else in the world and have less than 50 individuals. Current threats to TER-S in Hawaii and elsewhere in the Pacific Islands Region (e.g., Guam and other areas in the Marianas) include the prolific spread of NIS, encroachment, global climate change, and expanding military training requirements.

DoD has a vested interest in maintaining training capabilities throughout this region. With the implementation of the 2005 Base Realignment and Closure (BRAC) action plan,³ the military footprint in the Pacific Islands Region will increase significantly. This will be especially true on Guam, but also in Hawaii (Oahu and the Big Island). Because the region has the highest number of TER-S in the United States, the challenge for DoD is to determine how to effectively use the available land and water resources for national security missions, while simultaneously conserving species protected by the ESA and those at risk of needing such protection.

² DoD did not hold a Northeast workshop because the military does not have significant TER-S issues in that region.

³ See www.dod.mil/brac/ for more information on BRAC 2005.

Legacy, SERDP, and ESTCP work to address this challenge by targeting their program dollars towards conservation efforts that achieve species and habitat protection goals, while maximizing training and testing flexibility. Working together, these three programs strive to tackle conservation challenges holistically and proactively. By removing the threats that impair at-risk species, recovering listed species, and using an adaptive, ecosystem-based approach that considers ecological processes as well as multiple spatial and temporal scales, DoD's conservation programs strive to keep common species common and prevent additional species listings.

1.4 JUNE 2006 PACIFIC ISLANDS REGION TER-S WORKSHOP I

Through a collaborative effort, SERDP, ESTCP, and Legacy sponsored the *Pacific Islands Region Threatened, Endangered, and At-Risk Species Workshop* held June 6-8, 2006, in Honolulu, Hawaii. This workshop was the first in a series of regional TER-S workshops recommended at the 2005 Symposium.

The specific objectives for the *Pacific Islands Region TER-S Workshop* were to: 1) identify and prioritize TER-S management needs among the Pacific Region Islands; 2) examine the current state of practice within DoD for TER-S management; 3) identify the gaps in knowledge, technology, and management; and 4) prioritize investment opportunities to address these gaps. To achieve these objectives, workshop sponsors and organizers brought together a broad spectrum of discipline experts from the research and management communities, including federal and state agencies, academia, and the NGO conservation community.

The workshop's plenary session consisted of presentations from Hawaii's Department of Land and Natural Resources (DLNR), the Bishop Museum, and the Hawaii Army National Guard. The workshop also provided overviews on the state of aquatic and terrestrial ecosystems. Participants toured Marine Corps Base Hawaii to learn how DoD natural resources management personnel deal with the challenge of effectively using lands, air, and sea space for national security missions, while simultaneously conserving species protected by the Endangered Species Act (ESA) and those at risk of needing such protection.

The next two days consisted of breakout group discussions on the following topics:

- *Individual Species Approaches: Remaining Critical Questions*
- *Ecosystem Management*
- *Impacts of Non-native Invasive Species on TER-S*
- *Synthesis and Prioritization of Aquatic and Terrestrial Issues*
- *Technology Transfer*

Except for the synthesis session, each session comprised three concurrent breakout groups focused on specific aspects of a topic. Workshop discussions elucidated a number of information gaps that could be addressed by research (SERDP), technology or method demonstration (ESTCP), or assessment of particular management approaches applicable to multiple DoD

installations (Legacy). In addition, participants also identified a need for better communication and data sharing among regional stakeholders.

The following projects were funded as a direct result of the 2006 workshop. These projects supported both TER-S conservation and mission readiness.

Legacy Resource Management Program - www.dodlegacy.org

Through Legacy, the DoD Natural Resources Conservation Program funds projects that support military readiness by protecting and enhancing our nation's natural and cultural heritage.

- **07-362** *Removal of Invasive Fire-Prone Grass to Increase Training Lands in the Pacific (Marine Corps Base Hawaii, Bellows Training Area, HI)*
- **07-374** *Range Ignition Probability (RIP) Analysis Tool (Schofield Barracks and Pohakuloa Training Area, HI)*
- **07-339** *Predator-Proof Fencing for Invasive Species Control in Hawaii: A Comprehensive Prioritization and Implementation Plan to Protect Native Species (HI)*
- **07-364** *Intensive Plant Conservation Training (Pacific Region)*
- **07-383** *Hawaii Cooperative Conservation Project (HI)*
- **08-362** *Invasive Fire Prone Grasses Removal to Increase Training Lands in the Pacific, continued (Marine Corps Base Hawaii, Bellows Training Area, HI)*
- **09-374** *Full-Scale Range Ignition Probability Tool, continued (Schofield Barracks and Pohakuloa Training Area, HI)*

Legacy Funding: \$559,324

Strategic Environmental Research and Development Program - www.serdp.org

SERDP funds basic and applied R&D projects focused on DoD's ongoing environmental challenges.

- **SI-1644** *Understanding the Role of Typhoons, Fire, and Climate on the Vegetation Dynamics of Tropical Dry Forests (Pacific Region)*
- **SI-1645** *The Potential for Restoration to Break the Grass/Fire Cycle in Dryland Ecosystems in Hawaii (HI)*
- **SI-1646** *Development and Use of Genetic Methods for Assessing Aquatic Environmental Condition and Recruitment Dynamics of Native Stream Fishes on Pacific Islands (Pacific Region)*
- **SI-1731** *Purifying and Testing Gecko Skin Compounds, a Promising Attractant for Small Brown Tree Snakes (Guam)*
- **SI-1732** *Development of Non-Prey Baits for Delivery of Acetaminophen to Brown Tree Snakes (*Boiga irregularis*) on Guam (Guam)*
- **SI-1733** *A Phylogenetic Strategy for Identifying a Biological Control Agent for Non-Native Populations of the Brown Tree Snake (*Boiga irregularis*) (Guam)*

SERDP Funding: \$4,600,000

Environmental Security Technology Certification Program – www.estcp.org

ESTCP identifies, demonstrates, and transfers technologies and methodologies that address DoD's highest priority environmental requirements.

- **SI-0925** *Aerial Application of Acetaminophen-Treated Baits for Control of Brown Tree Snakes (Guam)*

ESTCP Funding: \$1,600,000

DoD funding directly resulting from the first *Pacific Islands Region TER-S Workshop* totaled **\$6,759,324**. This amount does not include partner contributions or projects funded by other stakeholders.

2.0 APPROACH

The stated objectives for the *Pacific Islands Region TER-S Workshop-II* were to:

- Revisit the adaptive management priorities identified at the 2006 workshop, and assess to what extent those needs have been met.
- Identify and prioritize opportunities for future investments to benefit TER-S and their habitats on DoD lands in the region, especially considering potential climate change impacts.
- Bolster regional partnerships that were established at the 2006 workshop and establish new connections.

2.1 STEERING COMMITTEE

Formal invitations were extended to representatives from various sectors of the region's endangered species community, including to federal, state, academic, and NGO representatives. The committee's purpose was to act as an information source and guiding force for agenda development. Members were asked to provide input to a draft agenda, and help identify speakers, participants, and chairpersons.

2.2 READ AHEAD MATERIALS

Priorities and needs identified from this workshop will influence future TER-S related funding for Legacy, SERDP, and ESTCP, as well as for other interested parties. To prepare participants for the workshop, organizers provided various read-ahead materials as "thought stimulators." These included documents summarizing the results of the 2006 workshop, fact sheets on SERDP, ESTCP, and Legacy-funded projects in the Pacific Region, a white paper on the potential impacts of climate change on DoD's resources, and a link to a participants-only website hosting a variety of online resources.

Additionally, prior to the workshop, organizers provided instructions to breakout session chairpersons to help them guide their respective sessions (Appendix C). Their charge was to ensure that each group identify needs/gaps, priorities, and project ideas that would be articulated in this proceedings document.

2.3 PARTICIPANTS

Because this workshop was intended as a follow-on to the 2006 workshop, organizers first looked to the participant list from the previous workshop to identify a potential pool of participants. To accomplish this, Booz Allen developed and sent a scoping survey to the 2006 workshop participants requesting input regarding potential invitees for the 2010 workshop (Appendix D). Organizers analyzed the survey results and chose two representatives from each relevant federal agency and each of the Military Services. State agencies and NGOs representatives who work with TER-S issues in the region also were considered. By cross-referencing organizational representation with subject matter expertise, the sponsor was able to invite a limited number of participants across agencies, and still ensure sufficient breadth of expertise.

2.4 AGENDA ELEMENTS

The structure for DoD's regional TER-S workshops includes a day of plenary and overview presentations, a day of working group discussions, a field tour, and a half-day wrap up session for chairs, steering committee members, and organizers (Appendix E). For this event, organizers wanted input from principal relevant stakeholders (including the state, NGO, and military communities), an update on 2006 workshop outcomes, and a field tour of an award-winning DoD Natural Resources program.⁴ With these considerations in mind, organizers structured the workshop as follows:

- Day 1: State and NGO speakers provided an introduction and overview of the current situation facing TER-S in the Pacific Islands Region; Principal Investigators provided results from projects funded as a result of the 2006 workshop; federal agencies concluded the day by speaking about their work in the region.
- Day 2: Participants divided into three breakout groups – *Terrestrial: Invasive Species*, *Terrestrial: Species and Systems*, and *Aquatic*. The goal was to develop a list of priorities, brainstorm projects to address those needs, and prioritize identified projects.
- Day 3: Workshop attendees traveled to U.S. Army Garrison, Schofield Barracks and the Kahanahaiki Management Unit for a field tour. After the field tour smaller, a smaller invitation-only working group returned to further refine and expand the highest priority needs/project ideas generated during the breakout session discussions. For each project, the group listed potential partners, the type of project, and the timeframe for each project.

2.5 FORMATION OF BREAKOUT GROUPS

Organizers assigned participants to a breakout group based on their subject matter expertise. During breakout group discussions, attendees were instructed to identify key needs and gaps for their respective ecological system. Next, participants developed specific project ideas to address each need/gap. Using a five-star system, the group then ranked each project according to priority. At the end of the day, each breakout group presented its top priorities, as well as the key issues and challenges facing each ecological system, to all workshop participants.

⁴ www.army.mil/-news/2009/03/20/18533-us-army-garrison-hawaiiis-natural-resource-program-takes-home-award/

3.0 PLENARY SESSION

The workshop opened with presentations from NGO representatives who detailed high-priority TER-S issues in the Pacific Islands region. The NGOs also provided background information about sensitive ecosystems and stressors. Next came presentations about some of the projects funded as a result of the 2006 Pacific Islands Region TER-S Workshop. Those individuals gave status updates and overviews of their projects to offer the workshop attendees a better understanding of different ways to tackle issues in the region. The session concluded with presentations from federal agency representatives who offered insight into their work in the region and presented goals for moving forward. Each presentation in the plenary session helped set the stage, provide charges, and establish goals for the rest of the workshop. The presentations also provided background information on the current situation in the Pacific Islands region.

Each presentation is available in PDF format on the workshop website.

3.1 PARTNERING TO MEET KEY CHALLENGES – MS. LAURA THIELEN, HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES

Current policies, operational structures and laws are not set up for landscape level, ahupua‘a species management. Particularly in light of climate change, government agencies will be challenged, in the current framework, to work across partnerships and jurisdictional boundaries to improve TER-S management. Ms. Laura Thielen identified some of the key institutional challenges and concrete actions for their resolution.

Hawaii DLNR encompasses 11 divisions with multiple mandates, and manages all state lands and the oceans up to 300 miles offshore. Representatives of the state’s Aquatic Resources Division, Division of Forestry and Wildlife, and Natural Area Reserves attended the workshop.

3.2 THE NATURE CONSERVANCY’S WORK WITH THREATENED, ENDANGERED, AND AT-RISK HAWAIIAN SPECIES – DR. SAM ‘OHU GON III, THE NATURE CONSERVANCY

The Natural Conservancy’s (TNC) mission of biodiversity protection extends to TER-S species, but is not restricted to them. Endangered forest birds were the impetus behind TNC’s initial work in Hawaii, but since the 1980s, TNC in Hawaii has shifted its primary action areas to large viable landscapes of native-dominated ecosystems. These areas provide an umbrella of protected habitat for the majority of TER-S species, but the landscapes exclude those species restricted to more damaged habitats. Because partnerships with all private and public entities that share TNC’s conservation mandates is one of their key strategies, they continue to work with policy-makers and land managers to build capacity for managing native species and ecosystems, including with DoD. DoD supports significant management efforts at its installations in Hawaii—TNC has partnered with DoD to benefit biological resources, to help plan for endangered species stabilization and recovery, and to forge and strengthen partnerships that build conservation capacity. Dr. Sam ‘Oahu Gon III, Senior Scientist and Cultural Advisor, stressed that landscape scale management partnerships are key to TNC’s success. In this vein, Dr. Gon urged greater DoD presence in the Hawaiian Conservation Alliance.

3.3 DOD'S REGIONAL TER-S WORKSHOPS, PAST AND PRESENT – MS. ALISON DALSIMER, BOOZ ALLEN HAMILTON

This 2010 Pacific Islands Region TER-S Workshop is a follow-on effort to a similar workshop held in 2006, which resulted from recommendations developed at a 2005 National Symposium on TER-S. Ms. Alison Dalsimer, Booz Allen Hamilton consultant to DoD's Deputy Director for Natural Resources, discussed the broader context of a series of DoD regional TER-S workshops hosted in the Pacific, Southeast, and Southwest regions, summarizing outcomes from the 2006 Pacific Islands Region TER-S Workshop, and helping set the stage for the 2010 workshop by outlining basic goals and objectives.

3.4 THE POTENTIAL FOR RESTORATION TO BREAK THE GRASS/FIRE CYCLE IN DRYLAND ECOSYSTEMS IN HAWAII (SERDP SI-1645) – DR. SUSAN CORDELL, U.S. FOREST SERVICE AND DR. JIM KELLNER, CARNEGIE INSTITUTION

Tropical dry forests in Hawaii and the Pacific are declining at alarming rates. This loss of habitat for TES is largely a result of fire, forcing land managers such as DoD to develop strategies to protect and restore these areas. Studies show that native forest restoration may be the most cost-effective management tool to reduce fuel loads, fire danger, and fire impacts, while also controlling invasive species establishment and spread. Dr. Susan Cordell, U.S. Forest Service Research Ecologist, and Dr. Jim Kellner, Carnegie Institution Postdoctoral Associate, discussed their ongoing SERDP-funded research to integrate remote sensing technologies with field approaches in providing concrete, practical information needed for restoration planning and for monitoring threats to the restoration process. This research provides basic scientific information and practical tools for managing and restoring tropical dry forest landscapes on military lands in the Pacific.

3.5 REMOVAL OF INVASIVE FIRE-PRONE GRASS TO INCREASE TRAINING LANDS IN THE PACIFIC (LEGACY 07/08-362) – DR. SHAHIN ANSARI, SWCA ENVIRONMENTAL CONSULTANTS

In 2003, a wildland fire swept across the northern part of Marine Corps Training Area Bellow (MCTAB) and came very close to a neighboring residential community. This incident highlighted the danger and liability associated with wildfires caused by the widespread, invasive and fire-prone guinea grass (*Urochloa maxima*), and identified the grass as a major threat to the training areas. The objective of this Legacy-funded project was to quantify the surface fuel loads on MCTAB and compare the effectiveness of three fuel treatment methods in removing guinea grass fuel loads: mechanical cutting, herbicide application, and cattle grazing. Dr. Shahin Ansari, SWCA Environmental Consultants Botanist/Invasive Species Ecologist, discussed the potential application for grazing on intensively used lands (lacking TER-S) that need to reduce fuel loads or as an initial step to prepare lands for restoration efforts. Grazing is one of the only options for large-scale grass management.

3.6 DEVELOPMENT AND USE OF GENETIC METHODS FOR ASSESSING AQUATIC ENVIRONMENTAL CONDITIONS AND RECRUITMENT DYNAMICS OF NATIVE STREAM FISHES ON PACIFIC ISLANDS (SERDP SI-1646) – DR. MICHAEL BLUM, TULANE UNIVERSITY

Dr. Michael Blum, Assistant Professor, discussed the initial findings of ongoing SERDP-funded studies focused on native amphidromous fish in Hawaii that are intended to enable use of genetic protocols for environmental assessment and monitoring. Preliminary study results illustrate how patterns of genetic variation reflect in-stream and watershed conditions, as well as connectivity between streams and adjoining near-shore habitats. By encompassing broader comparisons, ongoing studies will further enhance a basic understanding of oceanic island stream ecosystems and help deliver powerful new tools for watershed management and conservation of at-risk species native to Pacific Island streams.

3.7 TEN-YEAR RESURVEY OF BIODIVERSITY OF MARINE COMMUNITIES AND INTRODUCED SPECIES IN PEARL HARBOR, OAHU, HI (LEGACY 07-343) – DR. STEVE COLES, BISHOP MUSEUM/PEARL HARBOR NAVAL BASE

In the past three decades, introduced marine species have become recognized as one of the major environmental and economic problems potentially affecting marine communities worldwide. Hawaii, due to its strategic location as the “Crossroads of the Pacific,” has been a major recipient of introduced species. The designation, detection, and distribution of these introduced species in Hawaiian waters has been a major focus of research for marine biologists in the Bishop Museum Department of Natural Sciences. In 1996, in Pearl Harbor, Bishop Museum staff completed the first of many comprehensive surveys for introduced marine species throughout the Hawaiian Islands. The Museum conducted a Legacy-funded follow-up survey in 2007-2008 to determine changes that occurred in the harbor for introduced/invasive marine species, as well as for reef corals that were first discovered in Pearl Harbor in 1996. Dr. Steve Coles, Marine Invertebrate Biologist, described study findings that coral colonization continued and spread in the harbor into areas where corals were formerly not reported, but the invasive, introduced algae *Gracilaria salicornia* had widely proliferated, and high densities of this alga dominate the nearshore benthos throughout the harbor at shallow depths. Continued growth and monopolization of habitat by *G. salicornia* is likely to prevent further successful settlement and survival of reef corals.

3.8 HAWAII’S ARMY NATURAL RESOURCES PROGRAM, WORKING TODAY FOR A BETTER TOMORROW – MS. MICHELLE MANSKER, U.S. ARMY GARRISON, HAWAII

This presentation provided an overview of the Oahu Army Natural Resources Program, which is responsible for managing more endangered species than any other Department of Defense installation in the U.S. Ms. Michelle Mansker, Natural Resources Manager, discussed the program’s unique planning efforts and its internal best management practices that reduce the military’s impact to endangered species. In addition to wildfire, she discussed natural threats including small mammal pests, invertebrate pests, and ungulates. Ms. Mansker stressed the need to identify thresholds for management actions. For example, how much weeding is enough to benefit native species? The program has extensive monitoring, outreach, and partnership efforts. She concluded by providing an overview of the plethora of partnerships the Army has established to achieve successful natural resources management in Hawaii. For these successes,

the U.S. Fish and Wildlife Service recognized the U.S. Army Garrison-Hawaii with the 2008 Military Conservation Partner Award.

Ms. Mansker led the field tour to U.S. Army Garrison, Schofield Barracks (refer to Section 5.0).

3.9 U.S. FISH AND WILDLIFE SERVICE PARTNERSHIPS AND CONSERVATION IN THE PACIFIC ISLANDS REGION – DR. LOYAL MEHRHOFF, U.S. FISH & WILDLIFE SERVICE

Dr. Loyal Mehrhoff, Field Supervisor of the Pacific Islands Fish and Wildlife Office, provided an overview of the Fish and Wildlife Service’s partnership and conservation actions, challenges, priorities, and plans in the Hawaiian Islands and Pacific Region. He discussed watershed partnerships and invasive species partnerships in which DoD is currently involved, and encouraged greater DoD participation in the Hawaii Conservation Alliance (HCA). Dr. Mehrhoff then discussed the ongoing effort to establish the Pacific Islands Climate Change Cooperative, which is hosted by the HCA, and its anticipated products, including vulnerability assessments, monitoring and research needs, decision support tools, and adaptation strategies. Armed with these resources, agencies will evaluate specific needs and applications as they relate to missions and management responsibilities. He also discussed the Hawaii Restoration & Conservation Initiative, which blends natural and cultural environments in tackling landscape-level restoration, and opportunities for DoD involvement in this initiative.

Dr. Mehrhoff stressed that partnerships are critical to addressing the most important resource management challenges in the region—biosecurity, ungulates, mosquitoes, fire-prone grasses, and climate change. For partnerships to succeed, there is a need to identify opportunities and eliminate obstacles such as funding, collocating/imbedding, and stationing across the landscape.

3.10 NOAA FISHERIES PRIORITIES FOR THREATENED AND ENDANGERED SPECIES IN THE PACIFIC ISLANDS REGION – DR. LANCE SMITH, NOAA PROTECTED RESOURCES DIVISION

Dr. Lance Smith, Regulatory Branch Chief in the Protected Resources Division of NOAA Fisheries Pacific Islands Regional Office, provided an overview of NOAA Fisheries (formerly the National Marine Fisheries Service) efforts in the region to conserve threatened and endangered marine species, including statutory responsibilities, restoration initiatives, and other strategies. He highlighted recent petitions to list 75 Pacific coral species and propose new critical habitat for monk seals in the Hawaiian Islands. In addition to endangered species, NOAA Fisheries is responsible for fisheries management, marine mammals, coral reefs, and international fisheries.

4.0 BREAKOUT SESSIONS

The second day of the workshop, attendees participated in one of three breakout groups. Their charge was to clarify the state of the science for TER-S management as a basis for determining gaps in current scientific knowledge, identify and roughly prioritize needs, and develop specific research and management project ideas for Pacific Island TER-S. Breakout groups covered the following three topics:

- Terrestrial: Invasive Species
- Terrestrial: Species and Systems
- Aquatic (Coastal, Wetland, Riparian, and Off-shore)

4.1 TERRESTRIAL: INVASIVE SPECIES

Invasive species present a particular threat to the tourist industry, the military training mission, and other economically important land uses throughout the Pacific Region. They also are the primary cause of species decline in the Pacific Islands Region. As such, invasive species were a primary point of discussion throughout the workshop.

4.1.1 Biosecurity Workshop

Although outside the scope of this event, participants felt strongly that a workshop to tackle biosecurity issues take place. The group took time to recommend how DoD might structure the event.

- Clearly define meeting scope
- Consider organizing by sample units (island, state, nursery, harbors, international) or by vector and target (vectors of introduction, species, mammals, plants, insects)
- Initial focus should be on identifying species that haven't yet arrived and keeping them out, as opposed to tackling what has already arrived and/or become established
- Include the Department of Transportation and Department of Agriculture in planning and implementing the workshop

4.1.2 Biosanitation

Particular biosanitation-related issues of concern in the region were the transfer of cocqui frogs and snails via vehicles, roads, and nursery plantings.

- Develop a biosanitation methods handbook
- Field-test the handbook (and its described methods) to further demonstrate its utility—for example, what is the efficacy of suggested groundwork? Are vehicle cleaning racks efficient at removing seeds?

4.1.3 Public Outreach

Participants felt it was important to inform the public about invasive species issues. The public can help reduce the threat of invasives by making smarter decisions during everyday activities.

- Engage the public in tackling invasive species issues, particularly for monitoring efforts
 - Evaluate management plans
 - Participate in field trials for plants
 - Conduct radiotelemetry for rats
 - Target housing communities for education and monitoring efforts
- Educate the commercial sector about the hazards of selling invasive species
- Establish methods for the public to notify the authorities about invasive species they encounter

4.1.4 Vendor/Sales Outreach

Executive Order 13112 provides a legal driver for using regionally beneficial plants.

- Target the Landscape Industry Council of Hawaii as a management and monitoring source
- Create an economic model for native plant nurseries and how they will be sustained by native plant projects, and the financial profits associated with supporting demand
- Retrofit planting guides and plans to include native plants in restoration projects when a sufficient supply of appropriate native plants is lacking
 - Screen non-natives if they have to be used to ensure they are not invasive
 - Ensure guides and mandates are consistent with supply and region
- Use weed risk assessments to guide plantings on DoD lands
 - Create a threshold scoring system
 - Conduct weed risk assessments for non-native species plants that are already present in the Islands
 - Target biosecurity assessments on species that have not yet arrived
- Raise public awareness about the aesthetic value of plants that make Hawaii unique. Educate vendors and the public to work toward creating and establishing more native systems
- Establish demonstration plots on DoD lands to counteract the perception that natives are high maintenance. Make sure to match plants to specific areas on the landscape
- Consider adapting the Chesapeake Bay region's "BayScape" model to the Pacific region
 - Use a holistic approach to landscaping through principles inspired by relationships in the natural environment
 - Promote environmentally sound landscapes that benefit people, wildlife, and the region

4.1.5 Biocontrol

Biocontrol can be a highly effective approach for managing NIS populations, particularly ones that are not amenable to control by physical or chemical approaches. Yet, many agencies and

installations lack the capacity to implement a biocontrol program. Agencies that do have available programs and resources include the U.S. Forest Service, which is a major player and leader in biocontrol (e.g., strawberry guava [*Psidium cattleianum*] biocontrol with scale insect *Tectococcus ovatus*), and the National Park Service, which has facilities for insect control at Hawaii Volcanoes National Park Quarantine Facility. DoD and others can partner with others to develop biocontrol agents. Another issue is that the public has concerns regarding the release of biocontrol agents and their potential for harm to other species or humans. Outreach is needed to educate the public on the potential benefits of biocontrol, especially for the control of invasive grasses in Hawaii.

- Conduct research and follow-up studies of experimental control projects
- Develop fungal pathogens for invasive species control
- Conduct public outreach about biocontrol successes, highlighting the steps taken to ensure host specificity
- Identify specific species to target for biocontrol, and fund the entire process
 - Fountain grass and red mangrove are potential targets
- Establish a Biocontrol Working Group to disseminate information about control options and providers
- Advance biocontrol efforts for invasive mammals
 - For menopause accelerators, the biggest issue is repeated delivery of toxins; the goal is to create a single dosage compound that doesn't result in non-target take

4.1.6 Rat Management

Rats cause damage and disturb the balance of ecosystems in areas where they are not native.

- Demonstrate rat exclusion in more areas
- Evaluate habitat response from exclusion efforts
 - Improve understanding of the effect removal on ecosystem dynamics and food web systems
 - Quantify and track ecosystem change after control/eradication

4.1.7 Monitoring Control Effectiveness

Efforts to control ecosystems vary widely. It is important to be aware of each action's consequences before implementing a control plan.

- Collect baseline data before eradication/control efforts
- Develop a systematic approach for monitoring control effectiveness
 - Before and after monitoring
 - Changes to ecosystem monitoring
 - Changes to ecosystem services
- Identify response variables and methods to capture those responses
- Utilize new technologies through easily repeatable monitoring (e.g., GIS)
- Establish discipline-wide monitoring plans with focus on plants, invertebrates, birds, etc.
 - Some will be short-term and need certain techniques

- Others can be long-term and landscape wide
- Assess unintended consequences of control efforts, will other exotics flourish?
- Target monitoring efforts along human corridors where invasion is likely to occur

4.1.8 Cats

Cats are a complex social issue in Hawaii with two perspectives on their control: trap, neuter, release (TNR) versus euthanasia. There is little data to suggest TNR is effective; however, there is a strong constituency of advocates for this approach.

- Conduct research on the Toxic Plasma viral infection to determine if transmittal vectors exist for TER-S such as monk seals, passerines, turtles, etc.
- Conduct outreach/education/policy about handling and keeping cats
- Monitor adherence to DoD requirement to neuter cats on installations
 - Develop mailer to send to military families before they arrive at post

4.1.9 Pigs

Pig populations are expanding beyond control. Some Native Hawaiians have cultural beliefs that oppose reducing pig populations, and they view pigs as a permanent fixture of society that should be preserved.

- Establish additional fences for large pig populations, and ensure adequate maintenance of existing fences
- Conduct outreach to Native Hawaiians to help them better understand the issues and damages related to invasive pig populations
- Help Native Hawaiians reestablish native species after pig populations are managed, and provide training so they can monitor the benefits of pig reductions/eliminations

4.1.10 Slugs

Though the University of Hawaii is conducting research on slugs, the U.S. Army is the only organization implementing active slug control.

- Provide additional support to control this introduced species

4.1.11 Ants

Fire ants are expanding beyond their historical range. This concerns DoD because of health and safety issues, and the potential for missions to be affected due to soldier injury or incapacitation. Case studies have shown that TER-S also are affected by introductions of various ant species. Yellow crazy ants on Johnston Atoll are eliminating nesting habitat for red-tailed tropicbirds, and have caused chick mortality. On Christmas Island, yellow crazy ants have decimated land crab populations.

- Conduct a DoD-wide presence-absence survey for ants of concern
- Begin biosanitation for areas where pest ants exist to reduce further spread

- Monitor the effectiveness of biosanitation methods
- Research new biosecurity methods to prevent further encroachment

4.1.12 Invasive Species Management Plan

Each island maintains lists of invasive species and develops invasive species management plans for priority species. Good species examples are plans for *Miconia calvescens* and coqui.

- Include management plans for invasive species in Integrated Natural Resources Management Plans (INRMPs)
- Ensure plans have a spatial perspective
- Establish a monitoring team to evaluate trends over time

4.2 TERRESTRIAL: SPECIES AND SYSTEMS

4.2.1 Invasive Species

Invasive species pose a significant challenge in the Pacific Islands region. Non-native invasive grasses (e.g., fountain, cogon, guinea) are particularly problematic throughout Hawaii because they increase the risk of fire. Chemical and manual approaches to control these grasses have proven largely ineffective at landscape scales. Tools to suppress these grasses are needed as are landscape-scale fencing, herbicide, and rodenticide to control other invasive species. Biocontrol presents a significant new opportunity to control these grasses. Additionally, although effective predator control fences exist, they need to be adapted for the Hawaiian landscape, which can include remote mountainous terrain and hard surfaces.

- Use Moderate Resolution Imaging Spectroradiometer (MODIS) data to develop statewide fire forecasting tools
- Develop biocontrols for fountain grass and other fire-prone grasses (e.g., Guinea grass)
- Explore concept of “designer grazers”
 - Develop ungulate preferences for certain grasses
 - Educate herdsman to move grazers around landscape
 - i.e., overgrazing can be a transition to remediation
- Develop capabilities for landscape herbicide use
- Develop suppression, removal, and eradication methodology for red mangroves in coastal waters
 - Focus on TES, security, and flooding issues
 - Develop master contracts or joint permits across Military Services
 - Develop a mangrove removal education campaign to inform the public about why mangroves are bad in Hawaii, but highly desirable elsewhere
- Assess how to control erigeron species in restoration projects
- Develop an evaluation process to assess when invasives become problematic
- Conduct public outreach campaign about the benefits of biological control
- Demonstrate the ecological impacts of complete removal of invasives/pests
- Adapt current predator fencing to fit Hawaiian landscapes
- Explore fencing to keep invasives/pests in, rather than out

- Explore options for programmatic rodenticide application

4.2.2 Global Climate Change

Uncertain future conditions due to our changing climate present challenges for managing TER-S. Efforts are underway to improve the understanding of climate change impacts at a regional level through the interagency Pacific Islands Climate Change Cooperative (PICCC). The PICCC will provide a range of scientific and technical tools to help land managers make informed decisions for landscape-scale conservation. Functions include: 1) developing predictive models; 2) assessing management options using models and historical data; 3) validating ecological models and management actions; and 4) providing a forum for information exchange. The U.S. Army Garrison Hawaii Natural Resources Program is currently a member of PICCC.

- Assess natural resources impacts on DoD lands
- Conduct vulnerability analyses for TER-S
- Develop adaptation plans (potentially leveraging INRMPs to do so)
- Develop a DoD vision for future land use benefiting mission and stewardship
- Integrate this vision and any plans with the PICCC and other landowners to develop a landscape perspective
- Link climate networks with biological data
- Assess biodiversity impacts from the return of agriculture to support biofuels

4.2.3 Restoration Planning and Success

To restore degraded systems effectively, managers need new technologies and approaches, as well as a better understanding of species-specific needs to target efforts, develop goals, execute projects, and monitor progress. Within the Pacific Region, there are numerous examples of successful, as well as ineffective restoration projects. Workshop participants recommended that these examples be consolidated into a lessons learned manual that would cover different ecosystem types and restoration goals. This manual would then serve as an invaluable resource for future restoration projects. Convening a workshop focused on this topic was one method suggested to collect examples. The State of California undertook a similar effort, which should be reviewed when planning this effort.

- Conduct basic research on species for which greater information is needed
- Develop technologies for more broadly disseminating native seeds
- Explore application of landscape techniques to restoration efforts
 - i.e., hydromulching with native seeds (DOT research)
- Identify native plants for erosion control purposes
- Evaluate removal of all vegetation from a swath to preserve vegetation at higher elevations to enhance firebreaks
- Use terrain modeling to target restoration of TES (i.e., ability to predict where occurrences are likely and where restoration is more likely to be successful)
- Develop manual on restoration lessons learned across ecosystems, and consider sponsoring a workshop to kick-off effort—issues to consider include:
 - Some species are easy, others are more difficult

- A ghost writer could be hired to interview and pull information together
- Information on scenario modeling would be critical to overcome varying restoration goals (e.g., TER-S habitat, erosion prevention, fire prevention)
- Could include site-specific case studies by ecotype and/or overarching goal
- Dan Sailor developed a restoration manual that could be referenced
- Explore use of non-invasive, non-native species to promote restoration (e.g., silk oak, kiavi)
- Investigate relationship between restoration and coral reef recovery
- Evaluate impacts of TES bird habitat restoration in the vicinity of airfields to minimize BASH potential
- Develop an integrated strategy across agencies
- Identify acceptable levels for non-native species using a trait-based approach
- Develop clear restoration targets based on historical range, current realities, and global climate change considerations
- Evaluate reserve design approach—potential questions may include:
 - How does one make a good natural resource management (NRM) area?
 - What are related issues that can be tackled concurrently with conserving biodiversity? For example, fencing designs, fire mitigation, etc.
 - What new tools and models can assist efforts to manage conservation units?
- At the species level, actions could include selecting some genera to do Population Viability Analyses and niche modeling (e.g., ongoing at Makua for some species)—potential questions may include:
 - How big does a TES plant population need to be to sustain itself?
 - How should populations be spaced across a landscape to ensure survival?
 - How big does a management unit need to be to support a viable population?
 - How close do management units need to be to facilitate bridges between them?
 - What is the best way to protect species from catastrophic events?

4.2.4 Ex Situ Strategies and Capacity

Adequate numbers and access to native seeds and pollen for both common and rare species is a challenge throughout the region. The capacity of current ex-situ resources is insufficient to support restoration projects. Compounding this issue is the lack of industry certification standards. Adequate seed banks and accounts are needed. In addition, propagation techniques still need to be developed for some species, and approaches to handle pollen are yet to be determined. These ex-situ strategies and capacities are needed not only for TER-S, but also for common, matrix, and transition species. Ex-situ efforts could be undertaken in one ecosystem at a time, or one species at a time with multiple phases per ecosystem.

- Develop an overall ex-situ strategy for biodiversity in the Pacific with clear restoration goals
- Establish seed banks with sufficient capacity for TES, common, matrix, and transition species
- Provide for both immediate and long-term needs—for immediate needs (post-fire or conversion restoration), ensure area-specific seed banks and accounts
- Develop broadcast seed approaches

- Identify commercial partners to grow native seed banks
- Determine how to store pollen for rare ‘special needs’ plants that don’t produce seeds

4.2.5 Basic Biology

Basic biological information (e.g., life history, community size, distribution) is generally lacking, which complicates natural resources management. This is especially true for invertebrates and Hawaiian seabirds. This lack of information makes species management particularly challenging. For example, participants questioned the validity of managing a native forest without understanding invertebrate community size and distribution.

- Conduct inventories, especially for invertebrates and rare species
- Identify key biodiversity assets to protect (based on existing inventory data)
- Investigate impacts of military activities on key biodiversity assets
- Develop and implement plans to manage key biodiversity assets
- Conduct population viability analyses and niche models for some TES
- Assess TES dependence on non-native habitat, when is non-native and sometimes non-native invasive habitat acceptable under certain management conditions?
 - Examples – elepaio/guava, blackbird/sphinx, hoary bat/tree plantations
 - Assisted migration/transition plan considerations
- Identify transition/matrix species that can stabilize an area (ground cover species)
 - Propagation of plants like kohe or uluhe as erosion stabilization tools
- Expand remote sensing capabilities for monitoring invasive species (plants, ungulates, nest predation) and ecosystem health across agencies/landowners
- Increase number of user-friendly outputs/products from remote sensing

4.2.6 Information Management

Land management agencies monitor biodiversity throughout the Pacific Region; however, the frequency and intensity of monitoring events varies considerably, and monitoring efforts on some lands may be relatively non-existent. Additionally, inventory data is not always current (e.g., Natural Heritage), and tools to share biodiversity data across agencies are generally lacking. Workshop participants stressed the need for a statewide biodiversity monitoring network. To manage monitoring data currently being collected by land management agencies, as well as monitoring data that might be captured through a statewide biodiversity monitoring network, workshop participants also recommended that a systematic approach for data management be implemented statewide (i.e., an integrated biodiversity database). Such a database should include common and rare species as well as invasives. The National Biological Information Infrastructure’s (NBII) Pacific Basin Information Node (P-BIN) and the National Park Service are potential partners to establish and maintain this database.

- Implement a biodiversity monitoring network across the State
- Develop a systematic multi-agency data management system
- Implement a systematic approach for data management statewide (integrated biodiversity database), potential for P-BIN or NPS to fill this role
 - Especially useful for Guam/Marianas build-up

- Include common and rare species, as well as invasives
- Specifically for DoD, utilize this approach to data management to inform planning for the build-up under way in Guam and the Marianas

4.2.7 Partnerships and Outreach

Extensive natural resource management (NRM) partnerships exist throughout the Pacific region. Land management agencies monitor natural resources to understand status and trends independent of or in direct relation to management actions. At the watershed scale, which is so meaningful in the Pacific Region, there is a need to integrate resource-monitoring efforts. The group identified several opportunities to build on existing interagency collaboration, stressing the need to continue pursuing innovative solutions to NRM challenges. Integration of knowledge and resources will benefit management actions throughout the watershed.

- Conduct NRM outreach to communicate good stewardship at regional level
 - Have HCA disseminate pamphlets about each partner’s activities
 - Target both the conservation community and the general public
- Provide tools to partners within each watershed to facilitate TES restoration
- Expand options for mitigation banking to alleviate pressures resulting from incompatible land use
- Be proactive in educating new command/political appointees
 - Develop tools to educate leadership (e.g., an HCA leadership brief that stakeholders could adapt/tailor for specific organizations)
- Expand DoD buffer program, targeting encroachment, fire, species, etc.
- Explore options to increase capacity of USFWS to conduct consultations
 - Add liaison positions at USFWS to facilitate the consultation process for DoD
 - Have USFWS develop “how to” guidance for preparing a good Biological Assessment
- Explore options to increase capacity of Hawaii DLNR to conduct consultations
- Evaluate tools for sharing costs of infrastructure maintenance across agencies

4.3 AQUATIC (COASTAL, WETLAND, RIPARIAN, AND OFF-SHORE)

The Aquatic breakout group identified desired outcomes for a number of categories related to coastal, wetland, and riparian systems. For each of these categories, participants identified specific projects. Overall, the group stressed the need for the Environmental Protection Agency (EPA), Hawaii Department of Health, Hawaii Department of Aquatic Resources, and U.S. Fish and Wildlife Service (USFWS) to be engaged in these efforts. The group also acknowledged that a ridge-to-reef perspective was essential to realizing significant improvement in aquatic habitat restoration and species recovery. Outreach is an important overarching element to any effort. For aquatic invasives, stakeholders need to educate pet storeowners, employees, and customers about the hazards of releasing these species into the environment.

4.3.1 Aquatic Invasives

Non-native fish are prevalent in aquatic systems (wetlands and high streams) in the Pacific Region. Techniques for removal of these non-native fish are needed to create habitat for native

species. Efforts are needed to demonstrate, validate, and implement alternative approaches such as toxicant control, genetic control, and physical control (i.e., drying streambeds). However, these non-native fish and other species may be filling an important ecological role in the aquatic system. Beyond identifying effective removal techniques, there is a need to evaluate indirect impacts on native species currently co-inhabiting an area after removing non-native fish and other species. All interactions between native and non-native species in aquatic systems should be further studied. Topics should encompass predation, egg predation, and competition.

- Implement demonstration projects
 - Remove non-native fish and relocate natives (tilapia/cichlids/poeciliids)
 - Evaluate removal techniques for non-native fish (e.g., tilapia)
 - Use water as tool (drying streambeds, toxicants, genetic control)
 - Evaluate Supersucker® effectiveness and cost effectiveness of employing technology in field settings
 - Use urchins afterwards to keep biomass down
 - If successful, the effort could be implemented across the region
- Fund Research
 - Evaluate interactions between native and non-native species (i.e., predation, competition, and egg predation)
 - Evaluate relationships between water quality and invasives
 - Evaluate indirect threats of aquatic invasive species removal
- Conduct a Pacific-wide risk assessment
 - Prioritize aquatic invasive species development
 - Coordinate Micronesian Biosecurity Plan implementation

4.3.2 Aquatic Habitat Restoration

Stream barriers and water diversion systems have been constructed throughout Hawaii to support agriculture and development. These barriers and diversions can negatively affect the ability of native species to migrate through aquatic systems. Efforts are needed to assess potential ecological improvements that can be made through direct removal of barriers and diversions. In cases where barriers and diversions will remain, studies should be undertaken to improve their design for TER-S. For example, some barriers allow native fish to go upstream but prevent invasives from doing so.

- Improve management of barriers and diversions
 - Assess potential impacts from barrier removal
 - Conduct barrier design studies for at-risk species
 - Determine minimum daily flow requirements for maintaining native species
 - Assess end-stream channelization impact on sediment introductions
- Restore wetland habitats
 - Determine proper outplanting techniques for native species
- Improve best management practices for coral reefs
 - Evaluate relationship between upland habitat and coral health (e.g., reforestation and coral recovery)
 - Evaluate relationship between freshwater flows and coral health

- Develop standardized protocols for coral reef mitigation efforts (coral species/community structure)
- Adaptively manage for climate change impacts
 - Conduct modeling to show anticipated changes for military installations
 - Predict distributional shifts of TER-S
 - Identify hot spots for restoration (e.g., coral)

4.3.3 Monitoring Larval and Post-Larval Migrations (Fish)

Native fish life histories involve migrations between fresh and saltwater. To improve the understanding of threats to these species, efforts should be undertaken to trace larvae from headwaters to the ocean, aiming to assess the points at which they disappear and identify barriers that may be preventing larval and post-larval migrations. Such knowledge can inform subsequent management actions to facilitate migrations for native fish.

- Evaluate taro/role in native species ecology
- Evaluate estuarine habitat as a filter for emigration and post-larval immigration
- Assess restoration potential (e.g., evaluate point and nonpoint sources of contamination using nitrogen isotope assay)
- Monitor changes in water phosphorous levels to indicate species shifts in an ecosystem

4.3.4 Endangered Waterbird Recovery

To improve the understanding of waterbird life history and distribution in the Pacific region, efforts are needed to band birds and conduct satellite tracking of their activities. Such efforts will help fill key knowledge gaps regarding waterbird diet and use of habitat for foraging and nesting.

- Map Statewide distributions
 - Band birds
 - Track birds via satellite
 - Target birds that travel from island to island, wetland to wetland
- Target life history studies
 - Dietary studies
 - Habitat use requirements (foraging, feeding, nesting)
 - Use aquatic invertebrate surveys to track endangered waterbird species
- Conduct predator control
 - Remove introduced mammalian predators
 - Determine most effective removal techniques
 - Install predator proof fencing
 - Implement population viability models
- Reduce light pollution so birds will not be as attracted to installations

5.0 FIELD TOUR: U.S. ARMY GARRISON, SCHOFIELD BARRACKS

Led by Ms. Michelle Mansker and her team, workshop participants toured U.S. Army Garrison, Schofield Barracks and the Kahanahaiki Management Unit. During the scenic hike to the rim of Makua Valley, participants learned about the following natural resources management efforts:

- **Rare Plants Population Management**

Management efforts for rare plant populations encompass monitoring, growing, and outplanting, as well as threat control for rats, pigs, and weeds. Along the hike, participants visited monitoring stations and ongoing outplanting efforts. Plants and water are transported to remote locations via airlifts. Participants visited several of these rare plant populations along the hike, as well as the Army's mid-elevation greenhouse. In terms of threat control, rat traps are proving effective, and key areas are ungulate free as a result of fencing efforts.

- **Rare Snails (*Achatinella mustelina*) Management**

Management efforts for rare snails include monitoring and using enclosures. Enclosures protect native snails from cannibal snails and rats. U.S. Army Garrison has two snail enclosures, and researchers are currently studying the optimal enclosure design. Participants were able to see several native snails within the enclosure.



Pahole Kahuli

- **Research Support**

U.S. Army Garrison Hawaii conducts and supports extensive research on rat control, slug control, black-twigg borers, natural pollinators, and rare plant hybridization.

- **Volunteer Service Projects**

U.S. Army Garrison Hawaii has an extensive outreach program, providing service opportunities for Hula halau, the general public, school groups, eagle scouts, and military families.

6.0 SUMMARY OF PRIORITY PROJECT NEEDS

On the final day of the workshop, a subset of attendees – including steering committee members, breakout group chairpersons, Military Service representatives, and organizers – met to review, refine, and define the top priorities identified during the breakout group discussions. This group articulated DoD’s highest priority needs and identified stakeholder priorities for each defined project idea or need (research, demonstration, and management). They then identified potential partners, provided a rough timeframe for beginning and completing each project, and estimated the level of effort needed. Prioritization results are detailed in the matrix created onsite (see Table 2). The top priority DoD project needs included:

6.1 DoD PRIORITIES: TERRESTRIAL

- Hold a Biosecurity Workshop, inviting all relevant stakeholders.
- Develop a comprehensive Biosanitation Strategy for the Pacific Region.
- Evaluate the effectiveness of current biosanitation practices, and develop new approaches where needed. Promulgate outcomes as a guide for military personnel (similar to the current INRMP guide/handbook).
- Develop a biocontrol agent for one grass species, supporting its development from start to finish. This would be a long-term effort involving numerous partners.
- Monitor and evaluate the effectiveness of aerial bait application for rat control at Schofield Barracks.
- Develop methods to detect and control slugs and other alien mollusks and snails.
- Collect native seed and pollen to bank for future restoration needs. Build storage facilities, if needed.
- Conduct research to acquire basic life history information and data for invertebrate species.
- Research and execute projects to develop new technologies and approaches to species-level restoration efforts. Ensure projects are monitored to improve understanding of species specific needs.
- Partner with commercial firm(s) to conduct a demonstration project to evaluate the effectiveness of predator control fencing tailored to Hawaiian landscape(s).
- Develop interagency working groups to develop airfield restoration methodologies to benefit bird species.
- Develop methods and opportunities for red mangrove control and eradication in coastal waters that are applicable across the Military Services. Implement an outreach plan to inform the public of mangroves’ negative consequences to native systems and species.
- Develop a welcome packet for incoming installation personnel that contains information about the benefits of native species and the threats of invasives, and what steps to take to avoid harmful species introductions.
- Assess climate change impacts to natural resources, conduct vulnerability analyses for TER-S, develop adaptation plans and incorporate appropriate strategies into INRMPs.⁵

⁵ Installation personnel attending the workshop did not identify climate change as a top priority; however, organizers added it because understanding and adapting to climate change is a top priority for the Office of the Secretary of Defense (see Dr. Robyn's testimony to the House Armed Services Committee, 3/18/2010, Section III, Page 11).

6.2 DOD PRIORITIES: AQUATIC

- Conduct a demonstration/validation effort to evaluate the effectiveness and costs of employing Supersucker® technology in field settings to control invasive algae.
- Map bird distribution and life history information using satellite tracking and expanding banding efforts. Use information to conduct population viability analyses.
- Evaluate the effect of interactions between native and invasive species (e.g., predation, competition)*
- Remove barriers and diversions to improve capacity and capability to restore aquatic habitats. Tracing larvae from headwaters to ocean will help identify which barriers to remove.*
- Evaluate the relationships between stream water quality and invasives in terms of structure and function.*

* These priorities were medium for DoD, but high for other stakeholders.

TABLE 2: PROJECT PRIORITIES MATRIX

Group	DoD Priority	Other Priority	Projects	Partners	Time Frame	Level
Aquatic	High	TBD	Evaluation of Supersucker® effectiveness and cost effectiveness (targeting invasive algae)	DLNR, TNC, USFS, NOAA, USGS, UH-Hawaii Institute of Marine Biology (HIMB), USFWS	Immediate need, ongoing monitoring	Demonstration
Aquatic	High	TBD	Waterbird life history, mapping & distribution: band birds and conduct satellite tracking; assess diet and habitat use for foraging, nesting; and conduct population viability analyses	USFWS-Refuge System, DLNR, UH, USGS, Audubon, ABC, schools, NPS	Immediate need, 1-3 year time frame	Mgmt
Terrestrial -Invasives (T-I)	High	TBD	Develop comprehensive biosanitation strategy for DoD (Pacific) that includes evaluation of current practices (something along the lines of INRMP handbook)	ISCs, HCA, COE, HI Landscape Council, DLNR, UH, Waianae Arboretum, TNC, DOA, NOAA, NPS	TBD	Mgmt
T-I	High	TBD	Implement complete biocontrol effort for a priority plant species, target a grass (e.g., fountain, cogon, guinea)	USDA-APHIS, USFS, DOA, UH, NPS, DLNR, USFWS	Immediate need but long-term process (~5 years, dependent on whether insect or pathogen focus)	Applied R&D leading to a full solution
T-I	High	TBD	Monitoring efficacies of the aerial bait application at Schofield (rat control)	USFWS, EPA, USDA, USGS, DLNR, CESU, TNC, New Zealand Department of Conservation	Post-fence installation and ungulate removal (start in 3-5 years), once begun a 2+ year effort	Mgmt
T-I	High	TBD	Detection and control of slugs and other alien mollusks/snails	Researchers (UH), USFS, USGS, DLNR, DOA, CESU, Bishop Museum	Immediate need, long-term effort	R&D
Terrestrial -Species and Systems (T-SS)	High	TBD	Ex situ strategies and capacity (seed banks/accounts, propagation techniques, pollen storage); relevant for TES, common, matrix, and transition species	DLNR Division of Forestry and Wildlife (DOFAW), USFWS, UH Center for Conservation Research and Training, CESU, USDA, Center for Plant Conservation-National Tropical Botanical Garden, USFS	Immediate need, multiple components, able to be accomplished over numerous years in increments, ecosystem component	R&D, Mgmt, Demonstration

T-SS	High	TBD	Invertebrate inventory and database	DLNR-DOFAW, DOA, USFWS, USGS, CESU, UH, EPA, Bishop Museum, TNC	Immediate need, multiple components, could be tackled in short-term for a species but long-term need	R&D, Mgmt
T-SS	High	TBD	Species Level: how big does a TES plant population need to be to sustain itself? select some genera to do PVA; niche modeling; how big does a management unit need to be to support a viable population? how close do management units need to be to facilitate bridges between them? protect species from catastrophic events?	USFWS, DLNR-DOFAW, Washington University at St. Louis, UH, and other researchers	Immediate need, multiple components, could be tackled in short-term for a species but long-term need	Mgmt, Demonstration
T-SS	High	TBD	Build predator fences to fit Hawaiian landscapes; start with a forest demonstration	Commercial firms, USFWS, DLNR, TNC	Immediate need, complete w/in 2 years	Demonstration
T-SS	High	TBD	Develop interagency working group to discuss restoration projects for bird habitat in vicinity of airfields; mangrove removal element, conversion to native habitat	DLNR, USFWS, USGS, DOT, FAA USDA-APHIS Wildlife Services	Immediate and ongoing	Coordination, Mediation
T-I	High	TBD	Welcome package on native (benefits) and non-native species (threats), especially relevant for Guam	TBD	TBD	TBD
Aquatic	Med	High	Evaluate effect of interactions of native and non native species; ex: predation, egg predation, competition	DLNR-DAR, USFS, USFWS, NOAA, TNC, UH	Immediate potential, 2 years to complete	R&D
Aquatic	Med	High	Tracing larvae from headwaters to ocean; at what points do they disappear? evaluating barriers to larval and post-larval migrations	USFWS, Taro Growers Assn; COE, EPA, UH, USFS, Department of Health, DLNR-DAR, USGS, TNC, Researchers	Immediate potential, 2-5 years to complete	Applied R&D
Aquatic	Med	TBD	Evaluate relationship between stream water quality and aquatic or terrestrial invasives (structure/function)	COE, EPA, UH, USFS, DOH, DLNR-DAR, USGS, TNC, Researchers	Immediate potential, 2+ years to complete	R&D

Aquatic	Med	High	Removal of non-native fish and other species and relocation of natives to create habitat for other species (relevant to both wetland and high stream context); evaluate relationship of indirect threats of removal of aquatic invasive species	DLNR Division of Aquatic Resources (DAR), USFS, USFWS, NOAA, TNC	Immediate potential, 1-2 years to get going, 2-3 years to complete at one site	Mgmt
Aquatic	Med	High	Evaluate additional techniques for removal of non native fish-toxicant control, drying stream bends, genetic control	DLNR-DAR, USFS, USFWS, NOAA, TNC, UH	Immediate potential, 2 years to complete	Applied R&D, Demonstration
T-SS	Med	High	Conduct biocontrol outreach campaign	HCA, USFS	Immediate, within 1 year	Outreach
T-I	Med	TBD	Develop comprehensive (terrestrial, riparian, aquatic, marine) weed management plan for DoD installations in collaboration with other partners: watershed vs. island level, dependent on species	ISCs, HCA, HI Landscape Council, DLNR, UH, TNC, DOA, NPS, USFS, NOAA, COE	Immediate need, 3-5 years to complete	Mgmt, Coordination
T-SS	Med	TBD	Implement and expand remote sensing capabilities; share imagery, develop user-friendly applications/products	UH, NPS, Carnegie Institution, USFS, USGS, Other Researchers	Immediate potential, ongoing expansion opportunities	Mgmt, Demonstration
T-SS	Med	TBD	Develop methods and opportunities for red mangrove control and eradication in coastal waters	DLNR, USFWS, USGS, USDA-APHIS Wildlife Services	Immediate and ongoing	Coordination, Mediation
T-SS	Low	High	Develop manual on restoration lessons learned across ecosystems in consideration of restoration goals (i.e., outcome driven); convene workshop with ghost writer to develop web site/book (California model)	HCA, Hawaii Coral Reef Initiative	Immediate need, convene workshop, 2 years for manual development	Coordination
T-SS	Low	High	Global Climate Change: assess NR impacts on DoD lands; conduct vulnerability analyses for TES; develop adaptation plans, incorporate into INRMPs	PICCC	Immediate and long-term components	Coordination, R&D, Mgmt
Aquatic	Low	High	Barriers/diversions: assess potential improvements of barrier removal, pro/con; conduct studies of design of barriers for at-risk species; evaluate minimum daily flow	DLNR-DAR, private landowners	TBD	Policy/Mgmt, R&D, Demonstration

T-I	Low	High	Enhance and develop comprehensive multi partner resource monitoring on watershed partnership scale (Ko'olau Mountains Watershed Partnership)	TBD	TBD	TBD
T-SS	Low	High	Biodiversity monitoring network across state	TBD	TBD	TBD
T-SS	Low	High	Systematic data management across agencies	TBD	TBD	TBD
T-I	Low	TBD	Native plant landscaping demonstration (Fort DeRussey)	TBD	TBD	TBD
T-I	Low	TBD	Menopause accelerator for rats	TBD	TBD	TBD
T-I	Low	TBD	Native and acceptable non-native species for landscaping (guide) and weed risk assessment	TBD	TBD	TBD
T-SS	Low	TBD	Expand options for mitigation banking in the Pacific	TBD	TBD	TBD
T-SS	Low	TBD	Increase USFWS capacity to help consultations	TBD	TBD	TBD
T-SS	Low	TBD	Develop capabilities for landscape herbicide use	TBD	TBD	TBD
T-SS	Low	TBD	How should populations be spaced across landscape to ensure survival? use of terrain modeling to target restoration of TES	TBD	TBD	TBD
T-SS	Low	TBD	Explore options for large-scale multiagency fencing	TBD	TBD	TBD

7.0 CONCLUSIONS AND RECOMMENDATIONS

Building on the results of the 2006 Workshop, the *2010 Pacific Islands Region TER-S Workshop-II* sought to identify and prioritize opportunities for future investments to benefit TER-S and their habitats on DoD lands in the region. Select managers and scientists from various sectors helped establish a common platform among federal, state, and non-governmental organizations for future research, demonstration, and management actions that benefit TER-S, their associated ecosystems, and the sustainment of training and testing operations.

Workshop participants identified several important topics for TER-S management in the Pacific Region, including how fire, invasive species, habitat fragmentation, and other factors exacerbate habitat and species management challenges. Invasive species, in particular, dominated discussions for both aquatic and terrestrial systems. Further, participants suggested that tackling significant restoration challenges, such as ex situ resources and capacity, is paramount to future natural resources management success in the region. At the basic science level, there continues to be a lack of life history information for invertebrates and waterbirds, as well as numerous naturally rare species. Participants agreed that improving existing partnerships and forming new alliances can provide synergistic benefits to all stakeholders, especially with regard to monitoring, information management, and understanding how global climate change may impact the region's unique natural resources.

By implementing the workshop outcomes outlined in the Executive Summary and Section 6.0, and detailed in Sections 4.0 and Table 2, DoD and its many stakeholders can address TER-S management challenges throughout the region. By targeting its program dollars towards conservation efforts that achieve species and habitat protection goals, DoD can maximize training and testing flexibility while minimizing mission impacts and bolstering regional partnerships.

By removing the threats that impair at-risk species, recovering listed species, and using an ecosystem-based adaptive management approach, DoD's conservation programs strive to keep common species common while preventing the need for additional species listings. Advancing research priorities and using the resulting information to better manage listed and at-risk species offers a significant opportunity to benefit TER-S populations. Although no single group or agency can undertake all the actions enumerated in this document, recommendations captured are relevant to, and may prove valuable for, many interested stakeholders throughout the Pacific Region for the next several years. Therefore, these proceedings should be viewed as a source document when prioritizing annual planning and resource allocation activities.⁶

⁶ In July 2010, Legacy received over 15 pre-proposals for FY2011 funding as a result the *Pacific Islands Region TER-S Workshop-II*.

Appendix A: Workshop Attendee List

Last Name	First Name	Organization	E-Mail Address
Ansari	Shahin	SWCA Environmental Consultants	sansari@swca.com
Blum	Michael	Tulane University	mjblum@tulane.edu
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Char	Alvin	U.S. Army Garrison-Hawaii	alvin.char@us.army.mil
Cobb	Coralie	Naval Facilities Engineering Command	coralie.cobb@navy.mil
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Golla	Derrick	Booz Allen Hamilton (Support Staff)	golla_derrick@bah.com
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Helm	Joel	Booz Allen Hamilton (Support Staff)	helm_joel@bah.com
Ingoglia	Mark	Headquarters Pacific Air Forces	mark.ingoglia@hickam.af.mil
Jacobi	Jim	U.S. Geological Survey, Pacific Island Ecosystems Research Center	jim_jacobi@usgs.gov
Kellner	Jim	Department of Global Ecology, Carnegie Institution, Stanford University	jkellner@stanford.edu

Kennedy	Randall	Hawaii Department of Land and Natural Resources, Forestry & Wildlife	randall.w.kennedy@hawaii.gov
King	Cynthia	Department of Land and Natural Resources	cynthia.b.king@hawaii.gov
Koob	Greg	USDA, Natural Resource Conservation Service	gregory.koob@hi.usda.gov
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Shepard	Alicia	HydroGeoLogic, Inc. (Support Staff)	ashepard@hgl.com
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Spooner	Deanna	Hawaii Conservation Alliance	spooner@hawaii.edu
Thielen	Laura	Hawaii Department of Land and Natural Resources	laura.thielen@hawaii.gov

Appendix B: Steering Committee Members, Plenary Speakers, Breakout Session Chairpersons, and Rapporteurs

Steering Committee Members

Last Name	First Name	Organization	E-Mail Address
Cordell	Susan	USDA Forest Service	scordell01@fs.fed.us
Duffy	Dave	University of Hawaii	dduffy@hawaii.edu
Giambelluca	Tom	University of Hawaii at Manoa	thomas@hawaii.edu
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Miller	Steve	U.S. Fish & Wildlife Service	stephen_e_miller@fws.gov
Pepi	Vanessa	Naval Facilities Engineering Command	vanessa.pepi@navy.mil

Plenary Speakers

Last Name	First Name	Organization	E-Mail Address
Ansari	Shahin	SWCA Environmental Consultants	sansari@swca.com
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Cordell	Susan	USDA Forest Service	scordell01@fs.fed.us
Dalsimer	Alison	Booz Allen Hamilton	dalsimer_alison@bah.com
Gon	Sam	The Nature Conservancy	sgon@tnc.org
Kellner	Jim	Department of Global Ecology, Carnegie Institution, Stanford University	jkellner@stanford.edu
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Breakout Session Chairpersons

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Boice	Peter	DoD Deputy Director, Natural Resources	peter.boice@osd.mil
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Rapporteurs

Last Name	First Name	Organization	E-Mail Address
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Helm	Joel	Booz Allen Hamilton	helm_joel@bah.com
Shepard	Alicia	HydroGeoLogic, Inc.	ashepard@hgl.com

Appendix C: Chairperson Guidance

Onsite Resources

- A rapporteur knowledgeable of TER-S issues will be assigned to help you. The rapporteur's primary responsibilities are to capture key discussion points and recommendations, and to help develop the report-back PowerPoint presentation.
- The larger meeting room will have an LCD projector and screen. Each rapporteur will have a laptop.
- Individual breakout rooms will feature a conference room setup, with flip charts, and markers.
- An onsite coordinator (Alison Dalsimer) will be available to help with any situation that may arise.

Roles and Responsibilities

▪ **Lead the Breakout Group**

As a breakout group chair, your main responsibility is to ensure that participants remain focused on an outcomes-driven discussion. The outcomes we seek are key needs/gaps, short and long-term priorities, and specific project ideas. You should lead but not dominate discussions, seeking instead to facilitate productive participant input.

▪ **Discussion Topics and Strategies**

As breakout group chair, it is important that you manage the group's time to ensure you cover all important discussion areas relevant to your breakout topic. Please ensure your group identifies needs/gaps, priorities, and project ideas for the following areas:

- Individual species
- Ecosystem management
- Impacts from invasive species
- Impacts from climate change
- Other (additional topics of interest/concern)

The goal is to ensure that all groups touch on the four core areas, and to encourage each group to explore and identify priorities for other topic areas, as appropriate (these will likely differ across breakout groups).

You will want to develop a strategy for covering all topics and goals, either ahead of time or as the first group task. For example, you may choose to identify and prioritize needs and gaps in the morning, then spend the afternoon identifying and prioritizing goals, objectives, and project ideas.

Please work with your rapporteur to ensure that all priorities identified during group discussions are clearly identified and listed in descending order of importance (most important first). This output will help you to develop your report back to all workshop participants, and will be published in its entirety in the proceedings document.

▪ **Report Back**

At the end of the breakout session, a rapporteur will help you create a brief PowerPoint presentation using a provided template. The PowerPoint should summarize the top 3-5 priorities and project ideas resulting from your group's discussion. You will have 5-10 minutes to present results to the larger group. Presentation goals are to:

1. inform other workshop participants of your group's priorities,

2. highlight key discussion points and/or controversies that arose; and
3. identify important needs, priorities, and/or project ideas for consideration as potential action items for the Thursday afternoon session.

- **Thursday Afternoon Synthesis Session**

As a breakout group chair, we ask that you attend the final, invitation only working group from 1:00-5:00 pm on Thursday. *Lunch will be provided.* The objective of this session is to more fully describe and prioritize workshop outcomes and action items, and to better define project ideas (including timelines, scope, objectives, and potential partners). The results of this session will form the heart of the workshop recommendations.

- **Contribute to the Proceedings**

After the workshop, we will ask that you review and, as appropriate, edit those sections of the workshop's proceedings that are relevant to your breakout group discussions. We anticipate the document to be ready for review in two to three months.

Appendix D: Pre-Workshop Questionnaire

You have been identified as a participant in the 2006 DoD Pacific Islands Region Threatened, Endangered, and At-Risk Species (TER-S) Workshop held in Honolulu, HI. As promised in 2006, the DoD Legacy Resource Management Program will be hosting a follow up workshop in 2-4 February 2010 at the Hilton Hawaiian Village (Honolulu, HI). We are writing today to request your assistance in identifying 1-2 people within your organization who are experts in or responsible for managing TER-S and/or have responsibility for adaptive management strategies in light of anticipated climate change impacts.

The goals/objectives of this workshop will be to:

- Revisit the research, technology, and adaptive management priorities identified at the 2006 workshop, and assess to what extent those needs have been met.
- Identify and prioritize opportunities for future investments to benefit TER-S and their habitats on DoD lands in the region, especially in light of potential climate change impacts.
- Bolster regional partnerships that were established at the 2006 workshop and establish new connections.

(Please see the attached factsheet for a summary of the 2006 PAC TER-S Workshop. Full workshop proceedings are available at www.serdp.org/tesworkshop).

Please forward all recommendations for participation in this important workshop no later than **16 July 2009**. This will be an invitation-only workshop, so we will contact accepted invitees directly.

Please feel free to contact me with any questions.⁷

⁷ NOTE: Sent by A. Dalsimer, Workshop Coordinator.

Appendix E: Workshop Agenda

DAY 1 - Tuesday, February 2: Setting the Stage

Time	Presentation Title	Presenter
0830-0900	<i>Continental Breakfast (provided)</i>	-----
0900-0915	Welcome/Introductions	Peter Boice, <i>Deputy Director DoD NR Program</i>
0915-0945	Partnering to Meet Key Challenges	Laura Thielen, <i>Hawaii Department of Land and Natural Resources</i>
0945-1015	An Overview of The Nature Conservancy's Work with Threatened, Endangered, and At-Risk Hawaiian Species	Sam 'Ohu Gon III, <i>The Nature Conservancy</i>
1015-1030	<i>Break</i>	-----
1030-1100	DoD Regional TER-S Workshops - Past and Present <i>(www.dodnaturalresources.net)</i>	Alison Dalsimer, <i>Booz Allen Hamilton</i>
1100-1130	The Potential for Restoration to Break the Grass/Fire Cycle in Dryland Ecosystems in Hawaii <i>(SERDP Project #SI-1645, www.serdp.org/Research/upload/SI-1645.pdf)</i>	Susan Cordell, <i>U.S. Forest Service, and</i> Jim Kellner, <i>Carnegie Institution</i>
1130-1200	Removal of Invasive Fire-prone Grass to Increase Training Lands in the Pacific <i>(DoD Legacy Project #07/08-362)</i>	Shahin Ansari, <i>SWCA Environmental Consultants</i>
1200-1300	<i>Lunch (provided)</i>	-----
1300-1330	Development and Use of Genetic Methods for Assessing Aquatic Environmental Conditions and Recruitment Dynamics of Native Stream Fishes on Pacific Islands <i>(SERDP Project #SI-1646, www.serdp.org/Research/upload/SI-1646%20(2).pdf)</i>	Michael Blum, <i>Tulane University</i>
1330-1400	Ten Year Resurvey of Biodiversity of Marine Communities and Introduced Species in Pearl Harbor, Oahu, HI <i>(DoD Legacy Project #07-343)</i>	Steve Coles, <i>Bishop Museum/Pearl Harbor Naval Base</i>
1400-1430	Hawaii's Army Natural Resource Program <i>(http://aec.army.mil/usaec/newsroom/update/spr09/spr0918.html)</i>	Michelle Mansker, <i>U.S. Army Garrison, Hawaii</i>
1430-1445	<i>Break</i>	-----
1445-1515	U.S. Fish and Wildlife Service Partnerships and Conservation in the Pacific Islands Region	Loyal Mehrhoff, <i>U.S. Fish & Wildlife Service</i>
1515-1545	NOAA Fisheries Priorities for Threatened and Endangered Species in the Pacific Islands Region	Lance Smith, <i>NOAA, Protected Resources Division</i>
1545-1615	<i>Discussion and Questions/Wrap Up</i>	-----

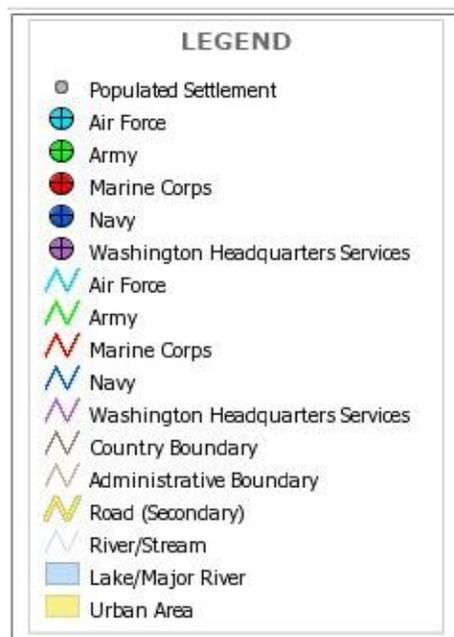
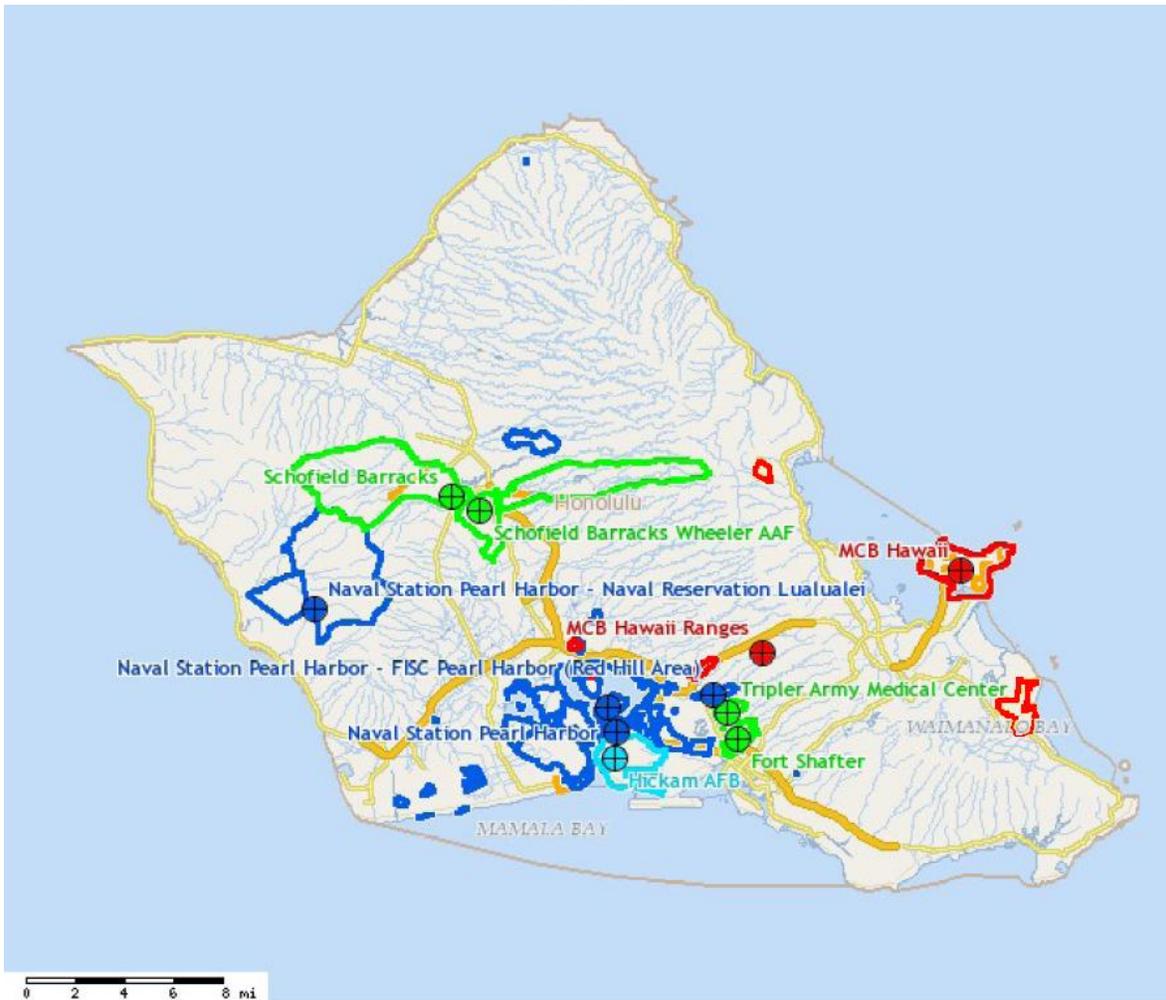
DAY 2 – Wednesday, February 3: Defining the Situation, and Identifying Priorities

Time	Presentation Title	Presenter
0830-0900	<i>Continental Breakfast (provided)</i>	-----
0900-0915	Welcome & Review of Day 1	Peter Boice, <i>Deputy Director DoD NR Program</i>
0915-0930	Breakout Group Assignments and Instructions	Alison Dalsimer, <i>Booz Allen Hamilton</i>
0930-1030	Breakout Groups - <i>Terrestrial: Invasive Species</i> - <i>Terrestrial: Species and Systems</i> - <i>Aquatic (Coastal, Wetland, Riparian, and Off-Shore)</i>	Chairpersons: Peter Boice: Invasives Susan Cordell: Spp/Systems Jim Gilliam: Aquatic
1030-1045	<i>Break</i>	-----
1045-1230	Breakout Groups - <i>Terrestrial: Invasive Species</i> - <i>Terrestrial: Species and Systems</i> - <i>Aquatic (Coastal, Wetland, Riparian, and Off-Shore)</i>	Chairpersons: Peter Boice: Invasives Susan Cordell: Spp/Systems Jim Gilliam: Aquatic
1230-1315	<i>Lunch (provided)</i>	-----
1315-1445	Breakout Groups continued	Chairpersons: Peter Boice: Invasives Susan Cordell: Spp/Systems Jim Gilliam: Aquatic
1445-1500	<i>Break</i>	-----
1500-1630	Breakout Groups continued: <i>Prioritization of ideas/projects/needs for each group - Brainstorming/Identifying specific projects for Legacy funding</i>	Chairpersons: Peter Boice: Invasives Susan Cordell: Spp/Systems Jim Gilliam: Aquatic
1630-1650	<i>Break/Chair-Rapporteur PPT creation</i>	-----
1650-1730	Breakout Group Report Outs (Top 5)	Chairs

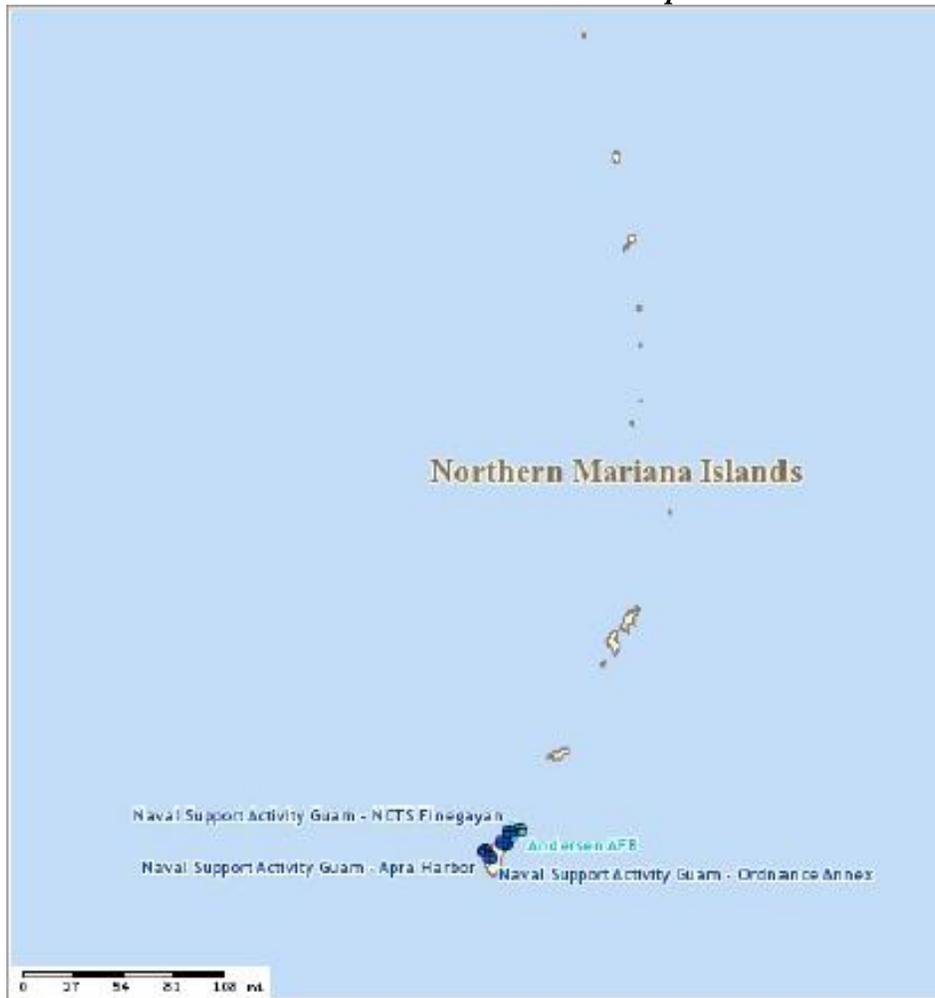
DAY 3 – Thursday, February 4: Field Trip

Time	Presentation Title	Presenter
0700	<i>Meet at Hotel to Board Buses</i>	-----
0715-1300	Tour of U.S. Army Garrison, Schofield Barracks (Includes drive time)	Michelle Mansker, <i>U.S. Army Garrison, Hawaii</i>
	<i>Formal Workshop Ends</i>	-----
1300-1630	Invitation Only Working Group (Lunch Provided)	Steering Committee/Chairs

Oahu



Northern Mariana Islands Map



Guam Map

