



Legacy Program Update

FY 2010 Project Approvals Delayed: Back-to-back snow storms and an unexpected additional cut to all DoD Installations and Environment programs have caused a delay in getting funds released. We expect to start making announcements as soon as possible.

Legacy Project Highlight of the Month

Legacy Project 03-123 Introduction of Invasive Species from Participation in OCONUS Exercises

Historically, over 50,000 alien invasive species have been found in the United States, many of which are destructive to native ecosystems, agriculture, or infrastructure. Examples include fire ants, Asian gypsy moth, zebra mussels, round goby, knapweed, leafy spurge, various thistles, water hyacinth, purple loosestrife, and soybean fungus. Annual losses of over \$120 billion have been documented from the effects and control of such harmful introductions.

Any organism has the potential to become invasive when moved to a new region with suitable habitats. There are certain criteria that make a species a higher risk over another, such as unrestrained reproductive capability or growth potential. These conditions are not always apparent in an organism's native range and may only be observed in new habitats. For example, Australian pine (*Casuarina equisetifolia*) grows slowly and reaches an average height of 50 ft (15 m) in its native Australia. However, in south Florida, these trees can obtain a height of 100 ft (30 m).

Because of the multitude of factors that may influence potential invasiveness, determining the risk associated with any particular species is exceedingly difficult, since every species can be a potential invader. A more logical approach is to focus on the pathways that allow the movement of organisms from ports of embarkation to ports of debarkation. Some general characteristics need

[See Legacy, page 3](#)



In The News

The Impact of Invasive Species

By Troy Weldy
The Nature Conservancy

Non-native invasive species are a leading threat to our nation's rich biodiversity, as well as to national security, the economy, and human health. Since colonial periods, thousands of non-native species have been introduced to the United States, some by accident and others quite deliberately. Based on the U.S. Department of Agriculture (USDA) Plants Database, currently 13 percent (5,303 of 40,140) of the vascular plant species in the nation are not native to North America. This includes most of Americans' favorite foods and many ornamental plants. The majority of non-native plants and animals existing in the U.S. are not harmful, but some non-native species cause tremendous damage when released outside of their native habitats. As defined by Executive Order 13112, invasive species are those non-native species that "cause economic or environmental harm or harm to human health." The Congressional

[See Impact of Invasive Species, page 5](#)

INSIDE THIS ISSUE

- 1 [Legacy Program Update](#)
- 1 [Legacy Project Highlight of the Month](#)
- 1 [In The News](#)
- 2 [Naturally Speaking](#)
- 13 [Training, Announcements, and Events of Interest](#)
- 16 [Recent Natural Resources Documents on DENIX](#)
- 17 [Photo of the Month](#)
- 18 [Did You Know?](#)
- 19 [Links of interest on the Web](#)



Why Should DoD Care About Invasive Weeds?

Invasive weeds are a key management concern to DoD because they impact both mission readiness and resource stewardship. Whether these impacts are either direct or more subtle, they can rapidly mushroom if not attended to promptly.

Mission effects include...

- Increased fire hazard. Many invasive weeds are more flammable than the natives they outcompete. Like the weeds that feed them, wildfires know no property boundaries. For example, I recently viewed the aftermath of a 2007 guinea grass fire near Schofield Barracks, HI, that burned more than 2000 acres over the course of a week and destroyed 98% of the habitat of Hawaii's state flower, Hibiscus brackenridgei!
- Increased safety hazard. Species such as the yellow starthistle, which infested thousands of acres at Fort Hunter Liggett, CA, can make training lands unsuitable; in the Fort's case, because of millions of inch-long thorns. Other invasive weeds contain toxins that can cause rashes or other allergic reactions among troops in the field.
- Indirect loss of training lands. Once training lands are compromised by the presence of invasive species, they are then more susceptible to wind and water erosion.

Natural resources effects include...

- Habitat loss. Invasive weeds often form dense monocultures, such as the massive cheatgrass infestations prevalent in many parts of the western U.S., and Japanese stilt grass that is the dominant ground cover along many parts of the Appalachian Trail. Not only do these invasive species crowd out native plants, but they also reduce habitat for many animals.
- Altered biogeochemical and hydrological cycles. For example, cheatgrass changes the cycling of water, carbon, and nitrogen. It also changes the reflectivity of the landscape, which affects energy budgets (J.L. Schnase, 2008).
- Impact on fisheries. Salt-tolerant invasive plants can overwhelm brackish water systems and estuaries, important spawning grounds for fish and other species.

These and other impacts demand that DoD focuses significant resources to minimize future problems. Where can we best devote our energies?

- Early detection/rapid response (EDRR). EDRR is the preferred means to minimize future costs, and a very real world example that an ounce of prevention is better than a pound of cure. Invasive weeds can spread rapidly; regular monitoring and prompt control measures are the most effective means of preventing larger and more costly infestations.
- Regional partnerships. Invasive weeds must be controlled across multiple jurisdictions and property lines in coordination with those land owners. It is ineffective, if not cost prohibitive, to manage an invasive weed in one area while neighboring properties sit untreated. Regional invasive species management areas, such as those DoD participates in North Carolina and Florida, are helping to initiate and coordinate many recent control efforts.
- Volunteer efforts. Many invasive weed control efforts require a concentrated labor force, either annually or at recurring intervals. Even in better economic times, volunteers are essential to the success of control projects. Concentrated projects, such as those fostered by National Public Lands Day, will continue to be a mainstay in the fight against invasive species.

Invasive weeds, and the management concerns they present, will always be with us. We must understand that long-term success will likely often be altered landscapes, but ones that preserve as much native biodiversity and flexibility as possible for future generations.



Legacy, continued from page 1

to be considered to mitigate the movement of plants or animals, but detailed analysis of a species probably will provide limited benefit in precluding the movement of species between locations.

Military personnel often have been subjected to extensive time in the field and their personal equipment, as well as unit equipment, may provide easy access for the introduction of exotic organisms. Many exercise participants or warfighters are unaware of the potential troublesome conditions that can arise if organisms are transported to continental United States (CONUS) locations, as well as locations outside CONUS (OCONUS). Often the existing military protocols and instructional videos for the cleaning and transportation of equipment deal with material that is obsolete.

The significant monetary and environmental impact that invasive species are having around the world has focused the responses of many agencies to this problem. Due to these costs, the pathways that allow new invasive species to enter the country are becoming increasingly scrutinized. In addition, the increased terrorist threat levels have also alerted federal and state agencies to be more judicious in introductions of equipment and materials into the United States. Material, equipment, and personnel all pass through ports of embarkation and debarkation. These facilities act as a conduit for the transport of military equipment and personnel. Generally, there are two types of facilities: airports and seaports.

This project documented and reviewed current protocols used by DoD to protect the United States and host nations from the transfer of invasive species associated with the movement of military equipment. The goal of the study was to identify success stories and procedures to improve DoD's efforts to reduce the transport of invasive species associated with military movements.

The field examinations were conducted using the following procedures:

- Conduct discussions with personnel responsible for the movement of soldiers and equipment in the theater in order to examine the procedures and protocols used to facilitate movement.
- Conduct onsite inspections of equipment-cleaning processes at various locations to document the effectiveness of the existing procedures and to determine how to improve these processes.
- Evaluate equipment and personnel being processed for the presence or absence of invasive species or carrier material (soil or vegetation). The analysis looked at equipment placed in the staging areas after cleaning. A number of vehicles in the staging area are inspected for the presence of soil, vegetation, or animals. The percentage of vehicles that are not clean is reported.
- Estimate the time and cost expended by DoD units to prepare vehicles for safe transport with respect to invasive species.

Transportation activities were investigated in two theater commands—the U.S. European Command (EUCOM) and CENTCOM in 2002 and 2004. Following are highlights of the project's findings for each command.

Europe (EUCOM area)

Camp Darby, Italy: A cursory examination of 74 pieces of equipment located in the staging area at the Leghorn, Camp Darby facility revealed the presence of significant snail infestations. While the equipment had been previously cleaned, it was maintained in the area for an extended period allowing the snails time to attach to the equipment. The snail population was so significant that even with superficial examinations, over 50 snails or eggs were observed attached to a vehicle. Apparently, snails were also able to infest equipment that was maintained inside zippered canvas enclosures. Only four vehicles, or 5 percent, were observed having attached clumps of soil or vegetation, further illustrating the potential movement of invasive species even after cleaning.



Vehicles are a common vector for movement and introduction of snail species from one ecosystem to another. European snails have been established near the Military Ocean Terminal at Sunny Point, North Carolina, the seaport of debarkation (SPOD) for equipment from Italy.

Southwest Asia (CENTCOM area)

Camp Doha, Kuwait: At Camp Doha, the study team was briefed by the staff and then allowed to examine the facilities. The team found that there were wash points with and without concrete ramps. Generally, in the operations of this facility no tracked vehicles are cleaned. There also was a recirculation system that processed the expended water. Each wash point is set up with the same type of equipment as found at Camp Arifjan, but the total size of the operation was smaller. This facility did clean aircraft being readied for return.

Military Sealift Command, Kuwait: The team visited the military port facilities in Kuwait to examine the final steps in moving material and equipment out of the country. The operations were quite extensive and well organized. Material and equipment are conveyed to this location prior to the arrival of ships and placed in storage yards after being examined. When the ships arrive, the material and equipment are processed through a final washing facility and then moved onto the ship.



Aircraft prepared at Camp Doha for shipment through the port.



Final washing facility prior to loading for transport.

At this facility, the team also saw equipment that was arriving in Kuwait. This equipment was placed in a different storage area to avoid confusion. A quick examination of this area indicated that the equipment was clean; however, discussions with personnel indicated that arriving equipment is never examined for soil or vegetation. There was no Host Nation representative station at the port to examine the incoming material or equipment. The responsibility of stopping any invasive species from entering the country was assumed to be the U.S. personnel operating the port. However, the operations staff at the port did not concur that stopping incoming invasive species was their responsibility.

Invasive species have gained attention because of the problems they cause, including habitat disruption, impacts on biological diversity, damage to agriculture, and health issues. The best approach to solve these problems is to eliminate the pathway or conduit that allows the invasive species to move freely. By controlling these pathways or conduits, personnel can regulate the movement of invasive species. It has become quite clear that the rule should be that nothing should be shipped when it is dirty. Inspections conducted during this project revealed that, in most situations at seaports of debarkation (SPODs), cargo being loaded onto ships was clean and did not contain invasive species. The main area of concern in this pathway is cleaning equipment and cargo prior to entering into the staging area or sterile lot. Care must be taken to prevent the re-infestation of the material in these areas. This may be a more significant problem depending on the region of the world where the material is being stored.

The DoD Military Customs and Border (Pre-Departure) Clearance/Inspection Program is responsible for implementing guidance and instructions provided by the USDA to ensure that its inspection and cleaning operations will meet the standards for introducing personnel and equipment into the United States.

An important finding from this project is that DoD expends significant resources in preventing the movement of invasive species. Generally, the military has an excellent program for cleaning and inspecting equipment returning to CONUS and unit commanders are responsible for the movement of their personnel and equipment and the prevention of invasive species movement. Cleaning military equipment moving through airports becomes more problematic than movement through seaports. These problems are due to the shorter time frame for air transport, the unavailability of cleaning equipment and water in remote airports of embarkation, and limited area available for operations. Operational considerations do not always allow for cleaning time, particularly where aircraft are landing in a hostile or climate-restricted zone.

Office of Technology Assessment reported in 1993 that 15 percent of invasive plants and animals cause severe economic and environmental harm.

Invasive species occur throughout the lands and waters of the United States, and military lands are no exception. These invaders are a major and growing problem on military lands, impacting the ability to train the nation's armed forces, degrading the ecosystem health of these public lands, endangering native biodiversity, and potentially causing harm to human health. The military faces unique challenges in combating invasive species on their lands – challenges related to their primary goal of maintaining the quality of military lands for realistic training exercises, while also meeting their responsibility to safeguard the quality of natural resources and biodiversity on their lands.

Numerous military installations across the country have employed successful and innovative methods to control invasive species, examples of which will be referred to throughout this chapter and in the case studies. Given the vast amount of land that the military owns and manages in the United States, the military has a unique responsibility in managing invasive species and in helping to prevent new introductions. The U.S. Department of Defense (DoD), however, cannot stop the problem of invasive species on its own. Invasive species are a "beyond the fence line" issue that must be addressed comprehensively by Congress and other state and federal public land management agencies, as well as by private entities and individuals. Given the far-reaching nature of this problem, DoD has formed many diverse partnerships in battling invasive species, some of which are highlighted below.

Impacts on Military Operations

Invasive species affect the nation's military installations and operations worldwide. The National Wildlife Federation's recent report (Westbrook and Ramos 2005) on invasive species on military lands provides twelve cases outlining numerous threats and costs to military operations: from six-foot tall spiky yellow starthistle shredding parachutes that average \$4,000 apiece at Fort Hunter Liggett in California, to Phragmites causing security concerns at Avon Park Air Force Range in Florida. Holloman Air Force Base in New Mexico allocated over a half million dollars to remove invasive species from airstrips to protect the safety of Air Force pilots and to prevent damage to aircraft worth tens of millions of dollars. And in Hawai'i, dense non-native mangrove thickets can breach "line of sight" security for Marines assigned to protect base borders along the shoreline (Westbrook and Ramos 2005).



Air Force C-130 aerial spray operations at Smoky Hill Air National Guard Range, Kansas. DoD periodically uses these operations to control extreme outbreaks of the noxious weed musk thistle on the Range. Photo: Douglas Ripley

Ecological Impacts

Many reports have documented the ecological impacts of these non-native invaders, including citing invasive species as one of the greatest threats to biodiversity (e.g., Stein, et al. 2000). Worldwide, an estimated 80 percent of endangered species could suffer losses due to competition with or predation by invasive species (Pimentel, et al. 2005). In addition to direct competitive impacts to native species, some of the worst invasive species are able to alter native habitats and ecosystems. Invasions by non-native species have been shown to modify ecosystem processes, like nutrient cycling, fire frequency, hydrologic cycles, sediment deposition, and erosion (Kelly 2007). On Marine Corps Base Hawai'i, invasive mangrove stands take over native marsh habitats, converting critical habitat for endangered Hawaiian waterbirds into mangrove thickets that are inhospitable to both native species and to realistic military training exercises on base. On Avon Park Air Force Range in Florida, invasive wild hogs compete with the endangered Florida scrub jay for food and destroy nesting habitat for many other endangered species (Westbrook and Ramos 2005). Such feral hogs are a growing menace at several other military installations. When invasive species cause habitat destruction and harm rare native species, the result can lead to reductions in available training lands on installations.

Economic Impacts

Invasive species impact the U.S. economy in many ways, including negatively affecting economic sectors such as western ranching, Great Lakes shipping, southern forest plantations, and mid-western farming, just to name a few. Within the U.S., the estimated damage and management cost of invasive species is more than \$138 billion annually, more than any other natural disaster (Pimentel et al. 2005). In addition to these costs, many economic losses from recreational and tourism revenues are difficult to calculate (Simberloff 2001); as a result, the \$138 billion estimate may be low.

If monetary values could be assigned to the extinction of species, loss of biodiversity, and reduction of ecosystem services, costs from impacts of invasive species would drastically increase (Pimentel et al. 2005). For the military, the costs related to invasive species are significant and are increasing each year. To name one example, Camp Pendleton in southern California spent approximately \$1.2 million over a five year period trying to control giant reed (*Arundo donax*) and tamarisk or salt cedar (*Tamarix ramossima*) (Westbrook and Ramos 2005). While it also can be expensive to prevent invasive species on military lands – for example, programs to wash tanks and other military vehicles before and after transport – prevention is a critical first-line defense against new invaders on military lands. Once established, managing invaders such as the giant reed and tamarisk can often be a multi-year and multi-million dollar effort.

Recreational Impacts

As many boaters and fishermen can attest, invasive species like water hyacinth (*Eichhornia crassipes*), hydrilla (*Hydrilla verticillata*), Eurasian milfoil (*Myriophyllum spicatum*), and water chestnut (*Trapa natans*) can reduce or prevent access to water bodies. In some cases, it is the recreational activities that introduced or spread invasive species. For example, *Miconia calvescens*, a broad-leaved plant introduced as a handsome ornamental in Hawai'i in the 1960s, produces tiny seeds that must be removed from shoe soles by vigorous brushing, lest they plant themselves elsewhere. It and other invasive species can limit hiking options or reduce the outdoor experience. Conservative estimates of the economic costs from invasive species impacts on wildlife-related recreation in Nevada alone range from \$6 million to \$12 million annually (Elswerth, et al. 2005).



A seriously invasive species. *Miconia calvescens* was intentionally introduced in Hawai'i in the 1960s as an ornamental, but it quickly became an aggressive invader. Its seeds can remain viable in the soil for as many as eight years. The leaves, which can grow to 2.5 feet in length, are dark green on top, often reddish-purple underneath. Photo: Fred Powledge

This article is published with permission and first appeared in Conserving Biodiversity on Military Lands: A Guide to Natural Resource Managers.

This and many other articles of interest can be found at <http://www.dodbiodiversity.org/>. Literature citations are available in the printed version.

Invasive Species Management and Partnerships

By Dr. Peter Egan
DoD Armed Forces Pest Management Board

It stands to reason that no one person can know everything about all subjects. In the invasive species management arena this is also true. It is a daunting challenge to know and understand everything about aquatic weeds, fish, mussels, crabs, terrestrial pathogens, insects, weeds, and vertebrates, as well as the interaction they have with the ecosystem in which they are found. If that is not challenging enough, an invasive species management professional may also have to understand the influence of the interactions among species (both native and non-native), species growing season lengths, alleopathy, soil conditions, means of regeneration, soil moisture, etc. Then add Integrated Pest Management approaches, such as mechanical, cultural, chemical, and bio-control options; the list of complicating factors goes on. And don't forget the restoration of the site.

Further complicating the issue is what are your neighbors doing to manage an invasive species? If your neighbors are doing nothing to manage a species that are found on the lands around yours, then it makes little sense for you to spend time, money and effort to control that particular pest. Oh, my gosh, my head is starting to hurt!

So what to do?

Obviously there must be a starting point. It's called trial and error. But I don't like this method – hard work and sweat sure doesn't sound like fun. Instead, suppose we try networking and partnering. These two are the smart shortcuts and promise the most successful and rewarding approach. So how can an installation-level natural resources manager crack this nut?

Ta Da! The Legacy program to the rescue!

In October and December, the Legacy Program sponsored two Invasive Species workshops: one in Phoenix, AZ, focusing on southwestern invasive species, and one in Chapel Hill, NC, focusing on southeastern invasive species. These two locations obviously have completely different ecosystems, as well as different invasive species problems. You can see the logic of tailoring the workshops to different regions of the country. In this way we can get individuals from a region with somewhat similar invasive species problems and, therefore, better focus the agenda of the workshop.

I attended both workshops and was impressed by the agenda, instructor's breath of knowledge on the subjects covered, and the practical approaches taken by the workshop instructors. The interactions, questions, and sidebar conversations at breaks with the instructors and with fellow attendees were very productive. The classroom exercises in partnership approaches to dealing with real invasive species problems were excellent learning experiences. Field trips provided an opportunity to see invasive species issues first hand; at each stop, instructors led discussions on the problem and some of the practical aspects of solving that problem. Some discussions involved the different methods tried and their failures and successes with each technique.

At the conclusion of the workshop, there was encouragement for installations, federal, state and local governments, NGOs, and private landowners to form Cooperative Invasive Species Management Areas (CISMAs). The Legacy Program has sponsored CISMAs in Florida and the Sand Hills of North Carolina. As I mentioned above, this partnership approach provides the opportunity to develop a regional strategy to halt a specific invasive species problem and to restore the habitat to a more sustainable condition.

The National Military Fish and Wildlife Association's Invasive Species Working Group will meet at the 2010 Annual Meeting in Milwaukee. I hope those of you in attendance will provide us with feedback, discuss the value of the invasive species workshops, and where future workshops can be held. Finally, we can cover the topic of CISMAs and how well they are working. Plus, whatever else comes up in the way of invasive species management.

Please e-mail me at Peter.Egan@osd.mil with your thoughts. See you in Milwaukee!

Natural Resources Professionals Gather to Learn about Invasive Species Management in the Desert Southwest

By Erik A. Lehnhoff
Montana State University

During the last week of October 2009, the Center for Invasive Plant Management (CIPM) presented the Legacy-funded workshop, Strategic Management of Invasive Species in the Southwest U.S. at the BLM National Training Center in Phoenix, AZ. The 5-day workshop provided natural resources professionals with the knowledge to more effectively manage invasive species on DoD installations and adjacent lands. To help participants achieve installation goals for military training and land stewardship, the workshop presented a diverse array of topics including invasion ecology, a framework for invasive species management, specifics of control strategies, species identification, and building partnerships for effective management. While the focus was on terrestrial invasive plants of southwestern desert ecosystems, aquatic nuisance species and insects were also covered. The workshop featured 24 different presenters from across the U.S. and was attended by 43 representatives from various federal, state, and county agencies, as well as tribal nations and non-profit groups.

Day one of the workshop focused on the ecology of invasions and an overview of invasive species issues in the southwest. Presentations included ecological management of invasive species (knowing how ecosystems may be altered by invasion and considering how to effectively respond), the basics of invasion biology, effects of climate change and fire on invasions, and overviews of invasive species identification and distribution in the southwest. A species identification “laboratory” offered participants hands on-experience identifying many different species.

The second day focused on the steps and tools necessary for effective invasive species management. The first session examined early detection, rapid response survey techniques for finding invasive species and prioritizing for management, while the second session provided information on specific tools and application methods for management. During an evening session on restoration, DoD natural resources professionals reported on their restoration projects and got feedback from the group.



Small working groups tackle assigned problems.
Photo: Janet Clark



During the field trip, participants marvel at the icon of the Sonoran Desert. Photo: Janet Clark.

On Wednesday, participants got a welcome break from the classroom and went on a field trip to three sites in and around Phoenix. The first stop was at a city park on the Salt River, where Tamarisk and other invasive plant species had been removed and native vegetation restored. The second stop, at Cave Creek Regional Park just north of Phoenix, was an area of approximately 50 acres affected by a human-caused fire. At this site, there had been some active weed control and re-planting of perennial species. For the final stop, the group braved a brief spat of snow flurries to tour part of the 250,000 acre Cave Creek complex fire site, which burned in 2005 mostly within the Tonto National Forest. This massive burn provided a nice contrast to the smaller fire, as its scale prevented the possibility of most active restoration, although the planting of several hundred saguaro cacti in one location provided an interesting side note. At all of these sites, participants got first-hand knowledge of invasive species issues faced by natural resources professionals.

Thursday was dedicated to building partnerships for effective invasive species management. Topics such as partnerships across spatial scales, specifics on DoD partnerships, and the roles of different federal agencies in invasive species management were covered in the morning. The afternoon consisted of overviews of contracting for invasive species management, regional and national invasive species organizations, case studies, and examples of on-the-ground partnerships. A social was hosted on Thursday evening to bring participants together in an informal setting for partnership building.

The workshop wrapped up on Friday with an exercise allowing participants to draw from their experiences and from new information to consider and plan for an array of real-life invasive species management issues. All attendees left the workshop with bolstered knowledge of how to effectively plan for and manage invasive species. Additionally, each was given a notebook of resources that included copies of all of the presentations, pertinent and timely literature on invasive species management, guides for conducting early detection-rapid response, monitoring and prioritizing, and resources to facilitate the formation of partnerships. Recordings of the workshop presentations will be available this summer on DVD and on the CIPM website (www.weedcenter.org).

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Legacy-Funded Chapel Hill Invasive Species Course is a Success

By Steve Manning
Invasive Plant Control, Inc.

Thanks in large part to funding from the Department of Defense Legacy Program, approximately 70 people participated in the Chapel Hill Conference on Invasive Species Management from December 7-11, 2009. The Carolina Inn and the people of Chapel Hill offered an excellent venue to discuss invasive species management from identification to control. Participants came from as close as Chapel Hill and as far as Hawaii to take part in this event.

Funded by the DoD Legacy Program and hosted by Invasive Plant Control, Inc. with the help of the NC Botanical Gardens and the Town of Carrboro, this venue offered many close and useful field opportunities for participants to get into the field each day to experience the invasive species and their control methods firsthand. Each day, topics were blended into the concept of Cooperative Invasive Species Management Areas (CISMAs), providing an excellent tool to take home and begin management of invasive species on their own properties.



Meegan Wallace offered a presentation discussing mapped methods at various eastern DoD installations.

This invasive species course was designed to provide participants with both hands-on and classroom learning opportunities. Day one of the conference took us from understanding invasive species, prevention and Early Detection Rapid Response (EDRR) led by Dr. Randy Westbrooks from the U.S. Geological Survey, to presentations by Mike Andrejko on Nile Monitors invading the Florida Everglades. Harold Balbach spoke next, discussing research focused on cleaning systems for field equipment. Representatives from Interclean and SK Environmental then discussed specific equipment cleaning tools and the advantages of larger versus portable tools.

Day two transitioned into demonstrations of mapping and monitoring tools used for invasive species led by Dr. Les Mehrhoff from the University of Connecticut and Chuck Barger from EDDMaps. Dr. James Cuda from the University of Florida engaged participants in an excellent presentation concerning biological control for invasive weed management in the Southeastern U.S.

On Wednesday, Dr. Rob Richardson from NC State University led the group into aquatic invasive species management with equipment demonstrations at nearby Jordan Lake. Thursday's focus was on control methods and equipment led by Steven Manning and Lee Patrick, with the majority of the day spent in the field at the North Carolina Botanical Gardens. Friday's talk emphasized restoration and the need for partnerships to create effective invasive species management areas. Each evening, private rooms were set aside so that participants could utilize the instructors' knowledge with one-on-one discussions related to their own installation's issues.

Daily field demonstrations offered participants a look into the equipment and methods currently used for invasive species management, giving the class a firsthand look at what does and does not work in invasive plant management. The town of Carrboro demonstrated its Waipuna hot water equipment which is used to reduce the use of herbicides in maintenance operations. The "Goat Patrol" showed us the abilities of



Students inspecting equipment during field trip to Jordan Lake. Photo: Pedro Morales.

goats to control invasive woody and semi-woody species in a hardwood understory. Gyrotrac cut through a large swath of the NC Botanical Gardens to demonstrate their mulching machine and Diamond Mowers demonstrated the effectiveness of its wetblade operating in a natural area. Many other tools were displayed and demonstrated, from hand sprayers to ATV sprayers. An emphasis was placed on taking students to the field to see infestation levels and discuss control and restoration options. Utilizing this model, students viewed the invasive species in the field and were challenged to think about reasons why the invasive plants are there, how to prevent new introductions and how to effectively control and restore various sites.

To find out more about and to utilize resources from this meeting, please go to www.invasiveplantcontrol.com. Click on events and then on the more info tab. From here you can find an abundance of information taken directly from this conference, including presentations, handouts and useful links.



City of Carrboro maintenance crew demonstrate their hot water spray treatment equipment. Through this technology, the city reduces the use of chemicals in all of its maintenance operations. Photo: Pedro Morales.

Strategic Environmental Research and Development Program Activities Related to Invasive Plants

By John Thigpen¹ and John A. Hall²

¹ HydroGeoLogic, Inc.

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Non-native invasive species (NIS) pose a significant threat to the Department of Defense's (DoD) ability to conduct both its military and stewardship missions. Whether through altering landscapes in a way that renders them unsuitable for training and testing, or through destruction of important habitat occupied by threatened, endangered, or at-risk species (TER-S), NIS continue to be a thorn – literally (see the picture of yellow starthistle, *Centaurea solstitialis*) – in the side of DoD operators and natural resources managers alike.

NIS plants in particular present a difficult challenge to the sustainability of DoD's mission, as many currently employed control methodologies (chemical, biological, and mechanical) either are not effective, or are not specific to the NIS of concern and can therefore cause harmful impacts to the native flora and fauna of an area. For over a decade now, the Strategic Environmental Research and Development Program (SERDP) has continued to invest in research and development efforts designed to address critical science and data gaps needed to effectively monitor, control, and prevent NIS plant invasions. This article will showcase two late-stage SERDP projects whose results can be used to advance our knowledge on the control of NIS plants.

Allelopathy refers to a phenomenon whereby chemical release in one plant species influences the growth and development of other plant species in the area. Drs. Jorge Vivanco and Mark Paschke of Colorado State University and Dr. Ragan Callaway of the University of Montana investigated this phenomenon as a potential NIS control technology through project *SI-1388: Allelochemical Control of Non-Indigenous Invasive Plant Species Affecting Military Testing and Training Activities*. The specific objectives of their research included (1) investigating the chemical properties of allelopathic invasive plants and subsequently using those chemical properties to control the spread of other NIS plants, (2) identifying resistant native species for use in re-vegetating sites dominated by allelopathic invasive plants, and (3) identifying sites where knowledge of allelopathy can be used as an invasive plant control strategy.



Yellow starthistle, an NIS plant notorious for impacting DoD testing and training areas. Photo: Peggy Greb.



Knapweed invasion. In the western U.S., knapweeds are among the more prevalent NIS plants, occupying over 4.3 million hectares in 14 states and 2 Canadian provinces.

Results to date indicate that the presence of allelochemicals in the soil surrounding some invasive plants is cyclic; in other words, the allelochemicals could be found only at certain times of the year. It is not yet clear if the cyclic presence of the compounds in the soil is due to increased secretion by roots, or because of other factors in the soil that could contribute to the stability of these compounds at certain times. A series of greenhouse studies identified several native plant species that would be superior competitors with allelopathic invasive plants, as well as several native allelopathic species that could be used to compete with invasive plants. These native species were evaluated in field studies at military bases where results have indicated that some of these native species can successfully compete with invasive plants. The research team is working on follow-up studies to refine these findings for field applications.

Native plant resistance to NIS plant invasions has yet to be fully examined in research as a phenomenon that can be potentially exploited to control NIS plant spread. Mr. Thomas Smith of the U.S. Army Corps of Engineers, Construction Engineering Research Laboratory, and Dr. Ann Hild from the University of Wyoming are exploring this concept by evaluating the potential for native plant communities to resist NIS plant invasions by becoming more competitive with invading NIS plants over time. Specific objectives of their SERDP project, *SI-1389: Effectiveness of Selected Native Plants as Competitors with Non-Indigenous and Invasive Knapweed and Thistle Species*, included: (1) identifying native plant species that remain in established NIS-invaded areas, (2) collecting and examining these 'experienced' remnant native plant populations to determine if they can be used to manage and control spread of NIS plants, (3) identifying attributes of native plant populations that contribute to resilience and resistance to the competitive effects of NIS plants, and (4) identifying native plant individuals and populations (genotypes) for genetic and phenotypic traits that may prove competitive with NIS plants.



Russian knapweed often forms dense stands in western wildlands and may serve as a selective agent on remnant native plants that survive invasions.

Their examination of native grass Alkali sacaton (*Sporobolus airoides*) suggests that 'experienced' remnant plant populations exhibit different germination, growth, and competitive ability than nearby Alkali sacaton populations that were naïve to the aggressive NIS plant, Russian knapweed (*Rhaponticum [=Centaurea] repens*). In addition, when exposed to a new NIS plant, Canada thistle (*Cirsium arvense*), the 'experienced' population demonstrated superior competitive ability alone and in combination with NIS plant biocontrol agents. The results of these experiments are the first demonstration of the selective force associated with NIS plants and the potential for native community response to NIS plant invasions. Although the project concluded in December 2009, field studies and controlled growth chamber plantings have been initiated to further verify these results and are continuing at F.E. Warren Air Force Base in Cheyenne, Wyoming and on lands held by The Nature Conservancy near Lander, Wyoming. An ultimate goal of these efforts is to develop examples or 'cultivars' of native plants that can compete with and limit the establishment and persistence of NIS plants.

Both of these SERDP projects show promise in developing new NIS plant control techniques that take advantage of the natural properties of native plant communities and the biological characteristics of individual native plants. Although additional research is needed, further refinement and application of these methodologies will enable DoD land managers to control the spread of NIS plants with minimal impact to native flora and fauna. SERDP will continue to invest in research designed to monitor, control, and prevent NIS plant invasions. In addition, the potential exists to transfer advances in invasive plant control science to DoD end users through demonstration efforts under the Environmental Security Technology Certification Program (ESTCP).

The View from Above: Aerial Surveys on the Island of Oahu Reveal the Extent of Weed Spread

By Jane Reppun Beachy
O'ahu Army Natural Resources Program

How do natural resources managers for the Army quickly look for invasive alien weeds across an entire valley? From the air! Staff from the O'ahu Army Natural Resources Program (OANRP) recently conducted aerial surveys across Haleauau, the largest valley in Schofield Barracks West Range (SBW), on the island of O'ahu, Hawaii.

Unexploded ordnance is a hazard for staff as they hike through Haleauau, making it challenging to conduct typical on-the-ground vegetation surveys. So when OANRP staff needed to get a closer look at invasive weeds threatening the area, they took to the air. Phil Taylor, Jane Beachy, and Kaleo Wong targeted their aerial efforts at searching for *Hedygium gardnerianum* (kahili ginger) and *Sphaeropteris cooperi* (Australian tree fern), although they noted other invasive trees, as well.

Detecting species from a helicopter requires practice and expertise. The helicopter must fly slowly, and low to the ground; a seasoned pilot and good weather are crucial. Observers must be familiar with target plants and handy with a GPS marking device. Motion sickness makes it difficult to concentrate on surveying.

Kahili ginger, although gorgeous and fragrant, is highly invasive. The bright orange fruit of kahili ginger is thought to be bird-dispersed, and its rapid spread poses a serious threat to the rare plants that thrive in the unique bog habitat at Kaala, the highest point on Oahu and located at the back of Haleauau valley. Kahili ginger was planted as an ornamental at Kaala many years ago, and has since spread across the bog, colonizing the cliffs and most remote reaches of Haleauau. Control work is ongoing by OANRP staff on the summit of Kaala.

Directing this control work, the crew on the aerial survey discovered that while kahili ginger had indeed spread into Haleauau, its distribution was focused in just a couple of drainages. Two other valleys backing Kaala (Makaha and Waianae Kai valleys) were kahili ginger-free. While control will be challenging, the staff is optimistic that novel weed control techniques will help keep kahili ginger from spreading further.

"After seeing the devastating impact kahili ginger has in other wet forest areas, such as the back of Waikane Valley [in the Koolaus, Oahu's eastern mountain range], we have become inspired and renewed our dedication to eradicate this invasive weed from the Waianae Range," said Wong, commenting on their findings with respect to kahili ginger.

During their survey, the crew was also unpleasantly surprised by the number of Australian tree ferns detected in Haleauau. Another popular ornamental plant, Australian tree fern can grow more than 20 feet tall, and wind-dispersed spores mean that the fern can easily spread across large areas. The Australian tree fern is similar in appearance to the native Hawaiian tree fern known as hapuu; however, it can be distinguished by its height; the white, hairy scales on its fronds; and its distinct, circular frond arrangement. The crew saw hundreds of ferns scattered across the middle and upper reaches of the valley from their vantage point in the air.

In the next year, OANRP hopes to use the data from these aerial surveys to direct additional weed control in Haleauau and to test novel methods of weed control, including remote high-accuracy spot treatment using ball sprayers and herbicide ballistic technology.

Ball sprayers are utilized by slinging them beneath helicopters. The pilot hovers directly over a weed target, placing the sprayer on or within one to two meters of the target and releasing a small amount of herbicide on the target. This technique has been used to successfully combat the highly invasive weed *Miconia calvescens* on the island of Maui.

Herbicide ballistic technology (HBT) is a true paradigm-shift in weed control methodology. Currently under development by Dr. James Leary of College of Tropical Agriculture and Human Resources, at the University of Hawai'i, HBT makes use of recreational paintball systems for the good of conservation: herbicide-filled projectiles are shot at weed targets using paintball guns. Natural resources workers are able to deploy these treatments from high vantage points, or from helicopters. These and other creative weed control techniques are being evaluated by the OANRP to help combat kahili ginger and Australian tree fern in Haleauau.

Jane Reppun Beachy is an ecosystem restoration program manager with the University of Hawai'i, Pacific Cooperative Studies Unit, working for the O'ahu Army Natural Resources Program.

Training, Announcements & Events of Interest

Workshops, Interagency Training Announcements, and Future Events of Interest to the Conservation Community



Funding Available for Environmental Research and Development: The Department of Defense's (DoD) Strategic Environmental Research and Development Program (SERDP) is seeking to fund environmental research and development in the Sustainable Infrastructure focus area. The development and application of innovative environmental science and technology supports the long-term sustainability of DoD's installations and ranges, as well as significantly reduces current and future environmental liabilities. The Sustainable Infrastructure focus area concentrates on natural resources, cultural resources, and the sustainable management of DoD facilities. SERDP intends to fund multiple projects that respond to the following four focused Statements of Need (SON) in Sustainable Infrastructure:

1. Impacts of Climate Change on Alaskan Ecological Systems
2. Behavioral Ecology of Cetaceans
3. Ecological Forestry and Carbon Management
4. Ecology and Management of Source-Sink Populations

Proposals for Fiscal Year 2011 SONs will be selected through a competitive process. Pre-proposals from the non-federal sector are now past due. Proposals from the federal sector are due by **March 11, 2010**. The SONs and detailed instructions for federal and private sector proposers are available on the SERDP web site at www.serdp.org/funding.

FREE Web Seminars on Inventory and Survey Methods for Invasive Plants: There are only three remaining FREE interactive web seminars on inventory and survey methods for invasive plants offered by the Center for Invasive Plant Management during February 2010. There is no fee for the seminars, but advanced registration is required. Participants will be provided with reading materials in advance of each seminar. To learn more and to register, visit <http://www.weedcenter.org/outreach/project-webseminar.html>.

GPS Introduction for Natural Resource Field Personnel (TEC7132): March 16-19, 2010 at the National Conservation Training Center, Shepherdstown, WV. This hands-on field course emphasizes real-world applications of Global Positioning System (GPS) technology for natural resources field personnel. By the end of this course, you will be able to use a multi-billion dollar space based radio positioning and navigation system to document the exact location and spatial configuration of your study plots, bird point-count stations, archeological sites, roads, fence lines, crops, or weed patches on your conservation area. Since field work is only half the picture, this course also covers downloading GPS data and importing into ArcGIS and Google Earth for map use or data analysis, and exporting spatial data back to the GPS receivers for field navigation. Recreational grade GPS receivers such as the Garmin Map76CSx are used exclusively in this introductory class. For information please visit the DOI LEARN Course Public Catalog at <http://doilearn.doi.gov/coursecatalog/index.cfm>.

2010 National Military Fish and Wildlife Agencies Training Workshop: March 22-27, 2010, at the Hilton Milwaukee City Center, Milwaukee, Wisconsin. This workshop provides an excellent opportunity for DoD personnel specializing in fish and wildlife management to meet and discuss challenges and solutions to managing these resources. It also affords an opportunity for DoD natural resources managers to meet with counterparts from the U.S. Fish and Wildlife Service and State fish and wildlife agencies who work on Sikes Act issues and many other areas of common concern. For details visit the National Military Fish and Wildlife Agencies announcement at http://www.nmfwa.org/2010_Meeting/index.cfm

Sikes Act Implementation Course: March 21, 2010 at the Hampton Inn & Suites Downtown Milwaukee, in Milwaukee, Wisconsin. The DoD Natural Resources Conservation: Legacy Program is sponsoring an Sikes Act Implementation course at the 2010 National Military Fish and Wildlife Association (NMFWA) Annual Meeting. This

one day, advanced-level training course is intended for experienced DoD natural resources managers and operations personnel who are familiar with the Sikes Act and have prepared an Integrated Natural Resources Management Plan (INRMP). By the end of the course, you will have a better understanding of INRMP preparation, including structure, content, and sources of preparation; how to update and revise an INRMP; the difference between an annual and a five-year review vs. revision; specific resources to include; and how to monitor and track projects successfully. This interactive course provides plenty of time for questions and answers, and features instructors who are experienced natural resources professionals. For more information or to register for this workshop, please contact DoDNRConservation@bah.com.

Climate Change Tools for Adapting Management Strategies: March 22, 2010 at the Hilton Milwaukee City Center, in Milwaukee, Wisconsin. The DoD Natural Resources Conservation: Legacy Program is sponsoring a Climate Change Tools for Adapting Management Strategies workshop from 8:30-12:30 on the first day of workshops at the 2010 National Military Fish and Wildlife Association (NMFWA) Annual Meeting. This workshop seeks to inform DoD natural resources personnel, as well as range and facilities personnel whose work relates to DoD natural resources issues, about tools that can be used to help inform management strategies in light of climate change impacts. The workshop's focus will be on describing currently available tools and providing information on how and when to appropriately use them. Specifically, the workshop will:

1. educate DoD natural resources personnel about tools that are, or will soon be, available to help them adapt management activities in light of anticipated climate change impacts;
2. describe how and when to use these various tools; and
3. guide them through the use of these tools.

Invited speakers will provide a diverse look at climate change issues, providing assessments of the tools available to better handle changes resulting from our changing climate. There will be an opportunity to view posters and displays, as well as interact with speakers at the end of the session. A draft agenda will be available in January. For more information or to register for this workshop, please contact DoDNRConservation@bah.com.

International Wild Pig Conference: April 11-13, 2010 at the Crowne Plaza Hotel, in Pensacola, Florida. Wild pigs have the potential to cause ecological and economical destruction far surpassing any other invasive exotic vertebrate. The International Wild Pig Conference is the only forum in the world that provides federal, state, and private stakeholders a venue to discuss biological, financial, and social implications specific to wild pig subsistence in our ecosystems. The conference will assemble experienced managers, as well as those new to the wild pig industry in a professional, educational atmosphere. Visit <http://www.wildpigconference.com/> for details.

Law for Non-Lawyers (WLD2134): April 12, 2010 at the National Conservation Training Center, Shepherdstown, WV. Do you know the difference between a law, a statute, and a regulation? What are executive orders, the Federal Register, the Code of Federal Regulations, and the U.S. Code? Using discussion and examples, this one-day session can help those with little or no knowledge of the law. Basic concepts are explained, case law is examined, and participants learn how to read and understand laws and regulations. Using the internet, course participants also access legal resources to find laws, regulations, and current court cases. Tuition is \$190. It is highly recommended that this course be taken in conjunction with Natural Resource Law (WLD2122). For more information, please visit the DOI LEARN Course Public Catalog at <http://doilearn.doi.gov/coursecatalog/index.cfm>.

Natural Resource Law (WLD2122): April 13-15, 2010 at the National Conservation Training Center, Shepherdstown, WV. This course provides an overview of the major federal conservation laws of interest to natural resources professionals. Sessions include information on case laws that are specific to federal species and habitat protection, pollution control, and trust responsibilities. Discussions include an historical overview of the development of wildlife and natural resource laws, legal authorities and development in the courts, as well as current legal issues. Instruction is provided by lawyers and professionals in the field of natural resource law. Tuition is \$570. It is highly recommended that this course be taken in conjunction with Law for Non-Lawyers (WLD2134). For more information, please visit the DOI LEARN Course Public Catalog at <http://doilearn.doi.gov/coursecatalog/index.cfm>.

NatureServe Conservation Conference 2010: Biodiversity Without Boundaries: Celebrating the International Year of Biodiversity:

April 26–28, 2010, in Austin, Texas. The NatureServe Conservation Conference 2010: Biodiversity without Boundaries will explore the issues and solutions to these and related conservation needs on several fronts: the science behind the pressing problems, the information and expertise needed to direct decisions, the tools and methods for setting priorities and tracking progress, and the lessons learned from conservation success, collaboration, and leadership approaches. To register, visit: http://www.regonline.com/natureserve_2010.

Applied Supervision (LED6102): May 3-7, 2010, National Conservation Training Center, Shepherdstown, West Virginia. This course covers those critical skills new supervisors need to successfully and effectively supervise employees in mission accomplishment while building and maintaining a productive work environment. Course topics include transitioning into a supervisory position, roles and responsibilities, developing and motivating staff, handling difficult situations, coaching and counseling, leadership practices, change management, and a day with Human Capital representatives on classification, hiring & recruitment, performance and conduct, diversity and EEO. For information please visit the DOI LEARN Course Public Catalog at <http://doilearn.doi.gov/coursecatalog/index.cfm>.

Plant Invasions: Policies, Politics, and Practices: June 1-4, 2010 at the National Conservation Training Center, in Shepherdstown, West Virginia. Weeds Across Borders is a biennial international conference covering the interests of professionals and organizations involved in weed management and regulation. It is composed of an affiliation of organizations from Canada, Mexico, and the United States with a common interest in sharing information and promoting weed management throughout North America. Because weeds do not respect human-imposed laws or boundaries, we rely on partnerships, information sharing, and cross boundary program coordination. The conference provides a forum for educating, sharing, and disseminating knowledge about weed management, regulatory issues, and concerns regarding weed dispersal across and between jurisdictional boundaries in Canada, Mexico, and the United States. Visit <http://www.weedcenter.org/wab2010/> for details.

37th Annual Natural Areas Conference: Connecting for the Future Across Generations and Disciplines:

October 26 - 29, 2010 at Tan-Tar-A Resort, Osage Beach, Missouri. This national conference will bring together natural resources professionals, students, and volunteers in a forum that provides practical, land management focused information through symposia, workshops, field trips, paper sessions, posters, round tables, and opportunities for social networking. The progressive conference program will connect new tools, places, and faces amongst a diverse audience of land managers, university faculty and students, researchers, planners, and administrators from throughout the nation who are involved with the conservation and management of natural communities. The mainstay of this annual national conference has been strong participation from local, regional, and national organizations and agencies. For more details visit: <http://www.naturalarea.org/> or contact Mike Leahy at (573-522-4115, ext. 3192) or mike.leahy@mdc.mo.gov.

CALL FOR POSTERS! 5TH National Conference and Expo on Coastal and Estuarine Habitat Restoration;

“Preparing for Climate Change: Science, Practice, and Policy”: November 13-17, 2010, at the Galveston Island Convention Center, Galveston Island, Texas. Proposals for Sessions, Presentations, and Posters are **due by March 2, 2010**. This is the only national conference that focuses exclusively on coastal habitat restoration. Healthy coasts and estuaries are essential to the social, economic and ecological well being of everything that depends on them. Successful habitat restoration at all scales is critical to ensuring vibrant coasts. For more information please visit <https://www.estuaries.org/conference/>.



Recent Natural Resources Documents Online

Reports, Fact Sheets, Photos, Videos



This section highlights recently uploaded reports and factsheets on the Legacy Tracker or on the DENIX website. For Legacy related products, please visit https://www.dodlegacy.org/Legacy/intro/ProductsList_NU.aspx. All Legacy products and many more are available at <https://www.denix.osd.mil/portal/page/portal/denix/environment/NR>. In addition to these two websites, bird-related products are also posted on <http://www.DoDPIF.org>.

Listed Plant Species Evaluation: (Legacy 07-368) This Legacy-funded project evaluates the status of existing ex situ plant material of 185 federally listed and candidate plant species occurring on DoD sites. The resulting report details the species and accompanying species information with existing ex situ plant material, existing ex situ plant material from multiple collection sites (DoD and non-DoD), and species without ex situ plant material. The species information will facilitate setting priorities, budgets, and planning for any future ex situ work by individual DoD services and on specific DoD installations. <https://www.denix.osd.mil/portal/page/portal/NaturalResources/ThreatenedEndageredandAtRiskSpecies/FederallyListed>

Fact Sheet: Support Southwest Strategy Threatened and Endangered Species Program Managers (TEPM) Team: (Legacy 05-258) The Southwest Strategy (SWS) provides an opportunity for DoD and other land-management agencies in Arizona and New Mexico to address issues of shared importance, such as management of federally listed species and species-at-risk. In 2000, a SWS workgroup was formed to develop and implement strategies for streamlining Endangered Species Act section 7 consultations and species management in New Mexico and Arizona. This group was first called the Threatened and Endangered Species Program Manager's Team, and is now the Southwest Endangered Species Act Team. <https://www.denix.osd.mil/portal/page/portal/NaturalResources/ThreatenedEndageredandAtRiskSpecies/FederallyListed>

Establishing American Chestnut Test Orchards on Two Tennessee Army National Guard Installations: (Legacy 08-401) Contributing to the Efforts to Restore an Ecological and Cultural Giant to the Forest Ecosystems of the Eastern United States, Report, October 23, 2009. American chestnut (*Castanea dentata*) was once one of the dominant trees in the eastern forests of the United States. By 1950, this keystone species on an estimated 9 million acres of eastern forest had all but vanished as a result of blight infection. The purpose of this project is to contribute to the efforts to develop a blight-resistant American chestnut that may be reintroduced into its former habitat across the eastern United States by establishing seed orchards on two Tennessee Army National Guard facilities: VTS-Milan and VTS-Catoosa. This report describes the methodologies in producing the crosses and establishing the orchards. Deliverables for this project include a report, fact sheet, brochure and a slide show; all of which can be found at: [https://www.denix.osd.mil/portal/page/portal/NaturalResources/OtherConservationTopics\(A-H\)/HabitatRestoration](https://www.denix.osd.mil/portal/page/portal/NaturalResources/OtherConservationTopics(A-H)/HabitatRestoration)

Proof of Concept of The Range Ignition Probability (RIP) Tool: (Legacy 07-374) Wildfires resulting from military training pose a significant threat to training realism and land use capabilities, natural and cultural resources, infrastructure, and human/soldier safety. Assessing incendiary munitions wildfire risk and determining best management practices requires accurate information about where fires are likely to start, as ignition location can make a dramatic difference in fire outcomes. The RIP Tool is designed to fill the information gap caused by the lack of actual ignition location data. [https://www.denix.osd.mil/portal/page/portal/NaturalResources/OtherConservationTopics\(A-H\)/Disturbance](https://www.denix.osd.mil/portal/page/portal/NaturalResources/OtherConservationTopics(A-H)/Disturbance)

Invasive Species Guidebook for Department of Defense Installations in the Delaware River Basin: (Legacy 08-328) This report provides a guide for invasive plant species identification, management techniques, a how to guide on preventing recurring invasive species and restoring historical plant communities, forming cooperative partnerships to achieve management goals, and case studies. https://www.dodlegacy.org/Legacy/intro/ProductsList_NU.aspx



Photo of the Month

Capturing the beauty of our natural resources



February 2010 Photo of the Month Winner!

Mountain goats, introduced at Mt. Ellinor, 75 miles northwest of Ft. Lewis, Washington.

Submitted by *Natural Selections* reader: Rod Gilbert

Contract Biologist, VERSAR, Inc, supporting Ft. Lewis, Washington

Did You Know?

Invasive Species Outreach Toolkit:

This project collected non-native invasive species-related resources and created outreach delivery tools into a single toolkit. The Invasive Species Outreach Toolkit includes components tailored to various audiences, including commands, soldiers/residents, and natural resources managers. Invasive species can significantly impair the military's ability to conduct training and testing activities. This Toolkit can help prevent the loss of biologically appropriate training lands, provide access to information that can enhance management decisions at all levels, and helps DoD's natural resource managers educate leadership, servicemen, and civilians about what they can do to help fight the spread of invasive species. The Toolkit contains modifiable templates for brochures, posters, reference cards, and a PowerPoint presentation, as well as a resources booklet and Commander's Guide. Additional resources can be created and posted as needed. The Invasive Species Outreach Toolkit is available at <http://www.dodinvasives.org/>.

Did You Know?

Little Did You Know Conservation Could Be So Much Fun!



Invasive weeds are not the only threat to the health of our ecosystems! Invasive feral or wild boars (*Sus scrofa*) have become free-ranging animals and their numbers continue to grow throughout portions of the Midwest, West Coast, and southeastern United States. Explorers from Europe introduced hogs into the Americas during the 15th and 16th centuries. They were then introduced into Florida in 1593 and free-ranging populations spread into the southeast United States, as well as other locations across the country during the next few hundred years. Because of their destructive feeding habits and potential to spread disease (including swine brucellosis, pseudorabies, trichinosis and leptospirosis), feral hogs are considered a substantial liability to agriculture and forestry production, as well as to native wildlife. Feral hogs can include Eurasian or “Russian” wild hogs, and an assortment of hybrids (Yorkshire, Hampshire, Durocs and others) that have escaped into the wild or have been released for hunting purposes.

Their size and color depend on their breed and the quality of nutrition during development. Feral hogs can reach a size of 3 feet in height, 5 feet in length and more than 400 pounds in weight. However, most sows will average about 110 pounds and boars will weigh an average of 130 pounds. Feral hogs have the capacity to breed at any time of the year when abundant food supplies are available. Sows can begin breeding at six months of age and can potentially produce up to two litters of four to 10 piglets every 12 to 15 months. With this high breeding potential, the population can double in about four months. Feral hogs are also very social animals and tend to travel in family groups consisting of several sows and their offspring. Weaned pigs usually stay with their mother until another litter is born or until they mate. Adult boars are usually solitary, joining the group only to mate or to use a food source.



Feral hogs and non-native wild boars cause damage to levees and dikes, uproot vegetation and destroy the habitat of other animals.
Photo: USFWS.

The home range for feral hogs varies in size and usually depends on the availability of food, water, and cover. Where food is abundant, hogs occupy a smaller area than where food is scarce. Feral hogs, particularly boars, have been known to have a home range of more than 15 square miles when food is limited. A sow's home range is much smaller and may cover 2 to 5 square miles, depending on habitat quality.

Feral hogs are highly adaptable. They can use nearly every type of habitat, but prefer moist bottomland forests and areas around streams and creeks where mud for wallowing and foods such as acorns are plentiful. These brushy areas provide the dense vegetation that feral hogs need for cover. During the summer months, feral hogs are most active at night. During the cooler seasons, they are most active in early morning or late afternoon.

Feral hogs are omnivorous, which means they will eat almost anything from grain to carrion. The largest portion of their diet includes vegetable matter; when available, acorns are a preferred food item. They have a strong sense of smell, which they use to locate food items. They will consume roots, eggs of ground-nesting birds, and invertebrates such as centipedes, leeches, earthworms and crayfish. In agricultural areas, they will consume cultivated crops. Wild hogs will also prey on young native wildlife, livestock and other small vertebrates.

The occurrence and establishment of feral hogs has been on numerous military installations. The short and long term effect of these invasions is at best poorly understood. None the less, the potential impacts of hogs on native ecosystems, particularly those that support at-risk, threatened, or endangered species is of considerable concern for land managers. Hog activity such as rooting and wallowing can cause erosion, soil compaction, siltation, and degraded water quality. Hog rooting negatively affects herpetofauna and invertebrate communities by removing habitat and combined with trampling and foraging compromises vegetation regeneration and community maintenance.

Excerpts of this month's Did You Know? are from <http://extension.missouri.edu>.

Links of Interest on the Web

Useful URLs



DoD Natural Resources Conservation Program: <http://www.DoDNaturalResources.net> The DoD's NR Program provides policy, guidance, and oversight for management of natural resources on all land, air, and water resources owned or operated by DoD.

DoD Legacy Resource Management Program: <https://www.dodlegacy.org> DoD program that provides funding to natural and cultural resource projects that have regional, national, and/or multi-Service benefits. The Legacy Tracker lets you download fact sheets and reports for completed Legacy funded projects.

DoD TER-S Document Repository: http://www.nbio.gov/portal/community/Communities/Ecological_Topics/Threatened_&_Endangered_Species/DoD_TES_Document_Repository/ A compilation of DoD Threatened and Endangered Species documents and data made available online through National Biological Information Infrastructure. The information contained within these documents is considered "gray" literature (i.e., not peer reviewed).

Biodiversity Handbook: <http://www.dodbiodiversity.org> On this website you will find a thorough introduction to biodiversity and how it applies to the military mission; the scientific, legal, policy, and natural resources management contexts for biodiversity conservation on DoD lands; and practical advice from DoD natural resources managers through 17 case studies. A Commander's Guide to conserving biodiversity on military lands is also available.

DoD Partners in Flight: <http://www.dodpif.org> The DoD PIF Program supports and enhances the military mission while it works to develop cooperative projects to ensure a focused and coordinated approach for the conservation of resident and migratory birds and their habitats.

DoD Pollinator Workshop: <http://www.DoDpollinators.org> Provides an overview of pollinators and the reasons they are important to DoD. This website highlights the 2009 NMFVA workshop on pollinators, and has many useful resources, including factsheets and technical reports, pocket guides to identifying pollinators, and links to other websites on pollinators.

DoD Invasive Species Outreach Toolkit: <http://www.DoDinvasives.org> To help installation natural resources managers protect the natural resources on our nation's military lands, the Legacy Program funded the Invasive Species Outreach Toolkit. The Toolkit is an education and outreach tool to help DoD land managers communicate about invasive species. It contains modifiable outreach materials such as posters, brochures, reference cards, and a PowerPoint presentation. A list of resources to help identify information and funding sources is also included.

DENIX: <https://www.denix.osd.mil> DENIX is an electronic environmental bulletin board that provides access to environmental information, such as Executive Orders, policies, guidance, INRMPs, fact sheets, and reports. This website is under reconstruction. We will advise you when it is fully operational. In the meantime, we suggest you visit these other Natural Resources Links.

DISDI Portal: <https://rsgis.crrel.usace.army.mil/disdicac> (DoD only, CAC required) The DISDI Portal offers high-level geospatial data on DoD's installations, providing strategic maps of installations and information on how to access more detailed data. IVT data forms the foundation for the DISDI Portal, which is accessible to DoD staff with a common access card.

Strategic Environmental Research and Development Program (SERDP): <http://www.serdp.org/> SERDP identifies, develops, and transitions environmental technologies that relate directly to defense mission accomplishment.

Environmental Security Technology Certification Program (ESTCP): <http://www.estcp.org/> A DoD program that promotes innovative, cost-effective environmental technologies through demonstration and validation at DoD sites.

Cooperative Ecosystem Studies Unit Network (CESU): <http://www.cesu.psu.edu/> This network of 17 cooperative units provides research, technical assistance, and training to federal resource and environmental managers. DoD is a member of 12 units of the CESUs National Network.

Bat Conservation International: <http://www.batcon.org> BCI, based in Austin, Texas, is devoted to conservation, education, and research to protect bats and their ecosystems around the world.

PARC - Partners in Amphibian and Reptile Conservation: <http://www.parcplace.org/> Partners in Amphibian and Reptile Conservation (PARC) is an inclusive partnership of individuals and entities dedicated to the conservation of amphibians and reptiles (i.e., herpetofauna) and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public/private partnerships.

Contact Us

Who we are and where to find us!



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For additional information about DoD's Natural Resources, please contact the [Deputy Director, Natural Resources](#) or the [DoD Natural Resources Conservation Staff](#).