

Natural Selections

Department of Defense Natural Resources Program



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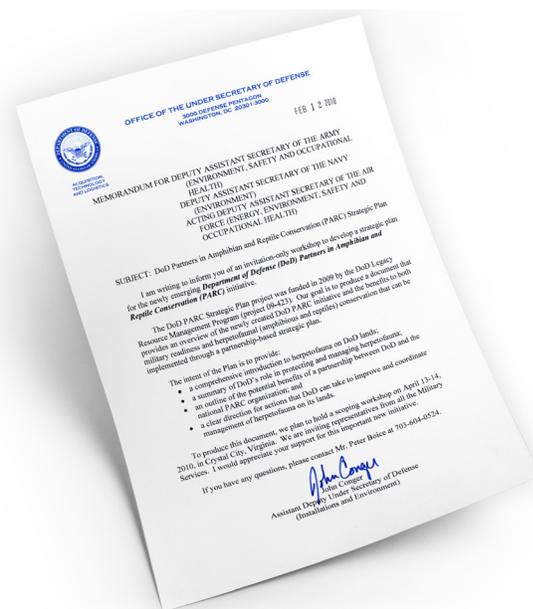


SPOTLIGHT: THE ROOTS OF DOD PARC

By L. Peter Boice, DoD Natural Resources Program (Retired)

The stars aligned in 2009 to jump start one of the DoD Natural Resources Program's most successful ventures – DoD PARC. During this time, amphibian and reptile species were declining globally and going extinct at unprecedented rates. The number of species at-risk was staggering. Habitat loss, fungal disease, and other factors, exacerbated by the realities of a changing climate, accelerated these trends. These growing threats to herpetofauna species had the potential to place several new species under Endangered Species Act (ESA) protections, which could restrict critical training areas on military installations across the country. These issues combined to be the critical driving force behind DoD PARC's creation.

With the Office of the Secretary of Defense (OSD) leadership supporting our efforts to launch DoD PARC, we convened several dozen policy and subject matter experts from all four Military Services, national PARC, the Association of Fish and Wildlife Agencies, Bureau of Land Management, and local universities in Arlington, Virginia, in April 2010 to develop a vision for a DoD PARC Strategic Plan and to solicit participation from the Military Services. The Strategic Plan would serve as a framework for the Military Services on how to effectively manage herpetofauna on DoD lands, providing expertise and guidance on regulatory compliance, landscape-level planning, conservation partnerships, and minimizing environmental impact. We acted quickly and decisively to avoid potential future restrictions on military testing and training missions from herpetofauna species listings. After some initial skepticism, all Military Services signed on. As a result, DoD PARC has developed an array of management tools, technical analyses, species-specific



2010 memo from the Assistant Deputy Under Secretary of Defense for Installations and Environment to the Deputy Assistant Secretaries of the Military Departments informing them of the April 2010 meeting to develop a vision for the DoD PARC Strategic Plan and solicit participation from the Military Services.

fact sheets, and education and awareness materials over the last decade that have helped natural resources managers and other installation personnel gain an understanding of the amphibians and reptiles present on DoD installations.

To understand DoD PARC's success, it's necessary to step back to 2005, and see how it evolved via my role as DoD's representative to the national PARC committee. We were working with patchwork funding, so the group was only able to produce a set of regional habitat management handbooks, nothing as comprehensive as the Strategic Plan and Annual Reports. In 2007, DoD went a small step further by signing the PARC Federal Agencies Steering Committee Memorandum of Understanding to provide a framework for cooperation and coordination among federal agencies in achieving the objectives of the PARC Federal Steering Committee to conserve amphibians and reptiles and their habitats.

MESSAGE FROM THE NR PROGRAM

By Alison A. Dalsimer, Program Manager

Welcome to the Spring 2019 Edition of *Natural Selections*!

In honor of DoD Partners in Amphibian and Reptile Conservation's (PARC's) 10th anniversary, this issue focuses entirely on the achievements of one of our most successful initiatives. Launched in 2009, DoD PARC provides leadership, guidance, and support for the conservation and management of amphibians and reptiles on DoD lands in ways that help ensure that DoD has the operational and logistical flexibility necessary for testing, training, and operational activities.



Herps and their habitats contribute to the natural landscapes that the Military Services rely on. Unfortunately, herpetofauna face increasing threats from disease, habitat destruction, and a changing climate. Approximately 32% of the world's amphibians and 20% of the world's reptile species are threatened or extinct; for turtle species it's 61%, making turtles the most threatened group of animals on the planet – more than mammals, birds, amphibians, or fish.¹

Because DoD lands are home to 66% of all native herpetofauna species and 41% of all federally-listed herpetofauna species in the continental U.S., what happens to them is important to us. DoD PARC represents a unique collaboration among DoD natural resources managers and with the national PARC network. By conducting research, monitoring and management user guides; and educating stakeholders, DoD PARC helps all our natural resources personnel sustain mission flexibility and enable readiness.

¹ Newsweek, 9/12/2018.

The articles in this issue provide insight into how DoD PARC came to be the award-winning and highly successful network it is today. Through the creative and tireless leadership provided by Chris Petersen (Naval Facilities Engineering Command (NAVFAC), Atlantic) and Rob Lovich (NAVFAC Southwest (SW)), DoD PARC has grown from a small grass-roots network of dedicated military biologists to a DoD-wide network of herp experts. Using DoD Partners in Flight (PIF) as their model, Chris and Rob have created an efficient and streamlined collaborative network that works across geopolitical boundaries to manage and conserve reptiles and amphibians across DoD lands.



Rob Lovich (left) and Chris Petersen (right) pose with Oliver, a Southern Isabela Island Galápagos tortoise (*Chelonoidis vicina*). Source: Kim Lovich.

From its formative meeting, to developing and implementing the *Strategic Plan for Amphibian and Reptile Conservation and Management on Department of Defense Lands*, to conducting cutting edge research and monitoring on high priority and pressing concerns, to creating a wealth of informational and educational resources, DoD PARC's activities have and will continue to directly support DoD Natural Resources Program priorities and DoD's mission.

So, sit back and enjoy this edition of *Natural Selections*. And, check out the [DoD PARC 10-Year Report](#), hot off the press! Our next newsletter will focus on the Cooperative Ecosystem Studies Units (CESUs) National Network so, if you have a good DoD CESU story to tell, please contact NaturalSelections@bah.com.

As always, thank you for the work you do! I hope to see you at the March 4-8 National Military Fish and Wildlife Association (NMFWA) training workshop in Denver, Colorado.

(The Roots of DoD PARC, continued from page 1)

As these early milestones increased engagement with national PARC, Joe Hautzenroder began building funding and momentum for a DoD PARC initiative. As the former Director of Environmental Planning and Conservation at NAVFAC, Joe convened a meeting of a half dozen Navy natural resources experts, including Rob Lovich and Chris Petersen, as well as Ernie Garcia and Priya Nanjappa from national PARC, to outline the steps needed to increase DoD Legacy Program funding for herpetofauna projects. The Navy proposals sparked OSD's interest and resulted in OSD funding three projects in fiscal year (FY) 2009, including administrative and logistical support to develop the *Strategic Plan for Amphibian and Reptile Conservation and Management on DoD Lands*. Joe was critical to the development of the Strategic Plan in two other key ways. First, he garnered the support of Don Schregardus, the Department of the Navy's top environmental official at the time, to speak with his counterparts in the other Military Departments. Second, Joe and Alison Dalsimer shared 20 years of prior work creating and implementing a similar initiative, DoD Partners in Flight (PIF). They used their knowledge from DoD PIF, both successes and lessons learned, to help structure a kickoff meeting and to guide many other decisions over the four years it took to finalize the Strategic Plan.

The Strategic Plan and other initial projects served as the framework for future DoD PARC efforts by outlining early challenges to DoD and creating plans to overcome those challenges. The Strategic Plan became a formative document for DoD PARC. The Plan summarizes current herpetofauna challenges and concerns on DoD lands, and highlights reptile and amphibian strategies and priorities that can inform and enhance DoD's natural resources conservation and management activities. The Plan served as the first DoD-specific strategy to manage and plan for herpetofauna, approaching conservation from the perspective of ensuring mission fulfillment. It is especially useful because, while many documents discuss herpetofauna management and threats, the Strategic Plan also details the roles and responsibilities of OSD and the Military Services. This approach facilitates information sharing across DoD to ensure that personnel are knowledgeable about emerging herpetofauna threats, best practices, and policy.

Over the past decade, DoD PARC has proven to be amazingly productive. In addition to the Strategic Plan, the group's *Annual Report* is an excellent example of its progress. It contains an array of tools that DoD PARC representatives produced to support mission readiness. DoD PARC's future focus will be overcoming the growing challenges and threats to amphibian and reptile species on DoD installations, and preventing biodiversity loss that could impact the military mission. Using this foundational knowledge and the various tools that DoD PARC has developed over the years, the group has already taken great strides to ensure herpetofauna conservation. I look forward to seeing what the future holds for DoD PARC.



A DECADE OF DOD PARC ACCOLADES

By David McNaughton, Pennsylvania Department of Military and Veterans Affairs, Fort Indiantown Gap National Guard Training Center

Throughout 10 years of service to the defense community, DoD PARC has performed important and innovative work. Many stakeholders have given DoD PARC accolades, both to personal representatives and collectively to the entire group. The following paragraphs provide a few award highlights.

The first award came during the group's early years as the Steering Committee was forming and members were writing the *Strategic Plan for Amphibian and Reptile Conservation and Management on Department of Defense Lands*. DoD PARC's Legacy Program-funded project, *Do Amphibians Still Get Their Kicks on Route 66?*, made the first transcontinental attempt to survey for chytrid fungus, a fungus that can decimate entire amphibian populations. The project results were influential, showing both seasonal and geographic patterns in the presence of chytrid fungus on military lands. The Public Library of Science published the results from this project, and DoD PARC received its first major award, the NMFWA Military Conservation Research Award, in 2011.



DoD PARC accepting the NMFWA Military Conservation Research Award in 2011. From left to right: Dave McNaughton, Chris Petersen, Rob Lovich, Priya Nanjappa, Mike Lannoo. Source: DoD PARC

NMFWA also recognized the group's first champion and PARC Federal Agencies Coordinator, Ernesto "Ernie" Garcia from the Department of the Interior. Ernie received the NMFWA Laurence R. Jahn Award in 2012 for his innovative efforts to expand the partnership between DoD and national PARC regarding their organization and efforts. This partnership allowed DoD PARC to expand and improve herpetofaunal conservation on military installations.

DoD PARC partnered and worked closely with other federal agencies over the last 10 years to advance conservation initiatives. For example, DoD PARC shared the *Strategic Plan for Amphibian and Reptile Conservation and Management on Department of Defense Lands*, the first federal agency strategy for herpetofauna conservation, with the Bureau of Land Management (BLM). BLM used that document and information from the PARC Federal Agency Steering Committee (FASC) to craft a strategic plan of their own. BLM issued the United States Forest Service-BLM Conservation Leadership Partner Award in 2017 to the entire PARC FASC, which included DoD PARC, to reward them for their help with BLM's strategic plan.

Not only have external agencies recognized DoD PARC with prestigious awards, but the Navy has recognized DoD PARC leadership several times for contributions to military objectives. For example, DoD PARC won the Peer Appreciation Award for Outstanding Poster Presentation at the Environmental Planning and Readiness Sustainment Training Symposium in 2012.

These honors not only highlight DoD PARC's achievements, but they also promote defense resource management and emphasize DoD's leadership in the greater conservation community. Internally, DoD PARC helps sustain and enhance the mission through cutting edge research and management recommendations, all working to preserve herpetofauna on military installations. Externally, DoD PARC promotes the excellence that DoD offers to partners and stakeholders, and the success that these partnerships can bring.

DOD PARC EXEMPLIFIES THE MISSION OF NATIONAL PARC

By Whit Gibbons, University of Georgia's Savannah River Ecology Laboratory; Priya Nanjappa, Amphibian and Reptile Conservancy; and Ernesto Garcia, U.S. Fish and Wildlife Service (USFWS) (Retired) and former PARC National Federal Agencies Coordinator

Over the past decade, through strong leadership and dedicated efforts, DoD's chapter of PARC has set high standards for others to follow. DoD PARC has been exemplary in carrying out PARC's mission of "forging proactive partnerships to conserve amphibians, reptiles, and the places they live." The initiative has accomplished an extraordinary melding of efforts by civilian and military personnel and their partners to address conservation on military lands, the paragon of partnership.

The men and women who serve as DoD PARC's practitioners realize their conservation efforts through habitat and species management, research, inventory and monitoring, education, outreach, and training. Given DoD's natural resources stewardship policy the approximately 25 million DoD acres where herpetofauna are found, and the number of listed and endemic amphibian and reptile species that live on military lands, DoD finds species conservation justifiable, practicable, and necessary. DoD initially embraced broad conservation partnerships with the creation of DoD PIF in 1991. DoD PIF was a precursor to DoD PARC, serving as an example of how DoD could partner to conserve imperiled species groups, in this case birds, while fulfilling the mission. Eighteen years later, DoD PARC followed this blueprint to promote the conservation of the most imperiled taxa among all classes of vertebrates on the planet: herpetofauna.



Before the creation of DoD PARC, DoD PIF served as a model of how DoD could partner to conserve imperiled species groups.

Military lands are prime locations for herpetofaunal conservation. They contain major amphibian and reptile sanctuaries while simultaneously accomplishing the Military Services' operational goals for testing, training, and operational activities. Numerous rare or otherwise sensitive species,

including those protected under the ESA, are found on military lands. In fact, DoD has the highest density of species listed as threatened or endangered under the ESA of any federal land managing agency and has taken this great responsibility to heart by leading in rare species conservation. DoD PARC has collaborated with state, local, and nonprofit partners to document species and habitats, and implement subsequent species management plans on various military sites.

PARC's current strategic areas are species and habitat conservation, and the development and augmentation of a partnership network. DoD PARC has successfully carried out these key national PARC initiatives with its own [Strategic Plan](#) tailored specifically for herpetofauna conservation on military lands. Notably, all the Military Services approved this Plan, demonstrating DoD's collaborative approach to conservation. One of DoD PARC's critical accomplishments in implementing this Plan has been several herpetofaunal inventories across military installations, vetted by state agency and local experts, as a necessary first step preceding monitoring and research projects. DoD PARC also paved the way in accomplishing one of the original Priority Conservation Needs identified by PARC at its 1999 inaugural meeting: to "educate the public about herpetofauna and conservation" via public programs and trainings for military personnel, publishing and distributing outreach materials, and more. DoD PARC's Strategic Plan for establishing partnerships nationwide, the overriding principle of PARC for two decades, incorporates opportunities for engaging federal, state, local and nonprofit partners, and serves as a model for other federal and regional amphibian and reptile conservation efforts.

*Another program well positioned to support DoD's mission through partnerships with private conservation groups and state and local governments is the **Readiness and Environmental Protection Integration (REPI) Program**. REPI projects support military readiness by allowing an installation to cost-share the acquisition of suitable private lands and easements near or adjacent to its property boundaries. These acquired non-DoD properties can then offset the impact of land uses like training, testing, and operating within DoD properties. In essence, the partnership helps avoid or reduce restrictions on military land use by protecting nearby habitat from development. These nearby lands remain available to species, including herpetofauna, providing healthy habitats unimpacted by military activities.*



The REPI Program protects habitat like the desert landscape surrounding Fort Huachuca, AZ. Source: Witold Skrypczak

Finally, PARC’s vision is one of creating a society that values and appreciates amphibians and reptiles, where they “are considered in all conservation and land management decisions.” For the last decade, DoD PARC has continued to make this vision a reality. The partnership between DoD and national PARC that paved the way for DoD PARC 10 years ago continues to serve as a model for people inside and outside military boundaries. DoD PARC has become the driving force of herpetofauna initiatives within DoD, highlighting the importance of herpetofauna to DoD’s mission and healthy ecosystems, and ensuring continued mission fulfillment and promotion of some of the planet’s most vulnerable species.

CATALOGING HERPETOFAUNA DIVERSITY ON DOD LANDS WITH THE DOD PARC INVENTORY

By Chris Petersen, NAVFAC Atlantic and Robert E. Lovich, NAVFAC SW

In DoD PARC’s early years, our team discovered a general lack of data on the distribution and overall diversity of amphibians and reptiles (herpetofauna) on DoD properties. Natural resources managers at many DoD installations had conducted herpetofauna surveys to help inform their INRMPs. However, these individual datasets were not standardized and did not feed into a single inventory to catalog herpetofauna biodiversity at an agency-wide level. In 2013, the DoD PARC team took on the enormous task of developing the first ever agency-wide inventory of amphibians and reptiles on DoD lands.

This five-year effort resulted in the *DoD PARC Amphibian and Reptile Inventory* – the first comprehensive inventory and evaluation of herpetofauna biodiversity completed by any federal agency. This inventory is one of the most important products DoD PARC has produced because it shows the full diversity and distribution of herpetofauna on DoD lands. The inventory confirms that there are 440 herpetofauna species on DoD properties, and an additional 86 species potentially present. In December 2018, the journal *Herpetological Conservation and Biology* published “Amphibians and Reptiles of United States Department of Defense Installations,” sharing our inventory results with the scientific community. Cataloguing herpetofauna allows natural resources managers to identify imperiled species and carry out conservation initiatives to avoid mission restrictions from potential listing actions associated with the ESA.

From 2013 to 2016, we updated the amphibian and reptile species lists for Army, Navy, Marine Corps, and Air Force installations in the continental United States that required an INRMP (see [Department of Defense Legacy Reports](#)). The DoD PARC team also incorporated data from a variety of sources into these lists including installation-specific surveys, field guides, museum records, HerpMapper, and more. We then designated each species on an installation list as either confirmed present, or unconfirmed with the potential to be present. Our team further categorized all species as ESA-listed, state-listed, at-risk, nonnative, or venomous. State wildlife agency biologists/herpetologists, regional experts, and military natural resources managers conducted a technical review of our lists and, by 2017, the DoD PARC team successfully updated the species list for 415 military properties, and merged all the datasets into a single inventory.

This inventory confirms that military lands contain significant herpetological biodiversity. Specifically, 66% of all native herpetofauna species in the continental U.S. are confirmed present on DoD lands. Snakes are the most widespread group found on DoD lands. There are 24 federally-listed (threatened or endangered), 55 state-listed, and 70 at-risk species confirmed present on DoD lands. Thirty non-native and native transplant amphibian and reptile species/subspecies were also confirmed present on DoD property. Of all the Military Services, Army properties have the greatest number of confirmed species, federally listed, state-listed, and at-risk herpetofauna species at 355. Last, we verified that approximately half of the military lands surveyed are home to at least one venomous snake species.



The loggerhead sea turtle is the most common federally-listed species confirmed present on DoD lands (16 properties). Source: Jeff Seminoff



The copperhead is the most common venomous snake confirmed present on DoD lands (81 properties). Source: Chris Petersen

Our inventory dataset is the foundation for a variety of DoD PARC products.

For example, we developed 45 species fact sheets, including 30 in 2017 and 2018 on the most common species on DoD lands. We also developed a *Venomous Snakes on Department of Defense Installations* poster and a *Herpetofauna Conservation Status Summary* document. Furthermore, our inventory is helping to increase communication and partnering efforts with other federal agencies. For

Eastern Red-backed Salamanders and the Department of Defense

The Eastern Red-backed Salamander (*Plethodon glutinosus*) is one of the most commonly found salamanders in the southeastern United States and the third-most common salamander species on DoD installations. The Latin word, *glutinosus*, means “sticky coated” and refers to the dark coloration of the red-backed phase.

Description: Adults are typically 2.75 to 4.0 (3.75 to 4.0) inches long. They are typically 18-20 centimeters. They are olive to dark purple in this species. The striped or mottled dorsal pattern is the most common, and consists of a broad orange-red, light tan or red dorsal stripe that extends from the base into the tail. The sides of the body are dark and the ventral is usually black and white. The mottled or barred dorsal pattern is variable, but with an entirely red-colored dorsal. The orange-red dorsal is the least common, and is extremely rare.

Habitat: This species occurs from southern Quebec and the Maritime Provinces, westward to western and northwestern U.S. and westward to eastern Illinois.

Habitat: Preferred habitats include leaf litter, rocks, and woody debris in mature deciduous, northern conifer, and mixed deciduous-conifer forests with well-drained, deep soils. Populations are usually absent or in low densities in soils that are associated with wetlands (e.g., highly acidic and poorly drained or oxygen-depleted bogs or peats (e.g., shallow wet rocks). Soils that retain abundant moisture in the surface (both on floodplains and in wetland areas) support the largest populations of Eastern Red-backed Salamanders.

Reproduction: Eastern Red-backed Salamanders mate from October to April. Females breed internally and make broad nests. Eggs are laid in the crevices of rocks, logs, or twigs from May to July. The newly-hatched are 3-4.2 cm, and the family with parents will stay with the young until late August to September. This species reaches maturity over during the day, and emerges at night to forage and mate when weather conditions are favorable (e.g., cool and damp). Small invertebrates make up its diet, including beetles, flies, earthworms, and spiders, with a preference for ants and crickets. Adults are most active on the surface during the spring and fall. This species will move to overland flows with the onset of flooding temperatures or drought conditions, and emerge in its aquatic early spring and fall as temperatures become more or more again. Adults seek to lay their eggs and will frequently inhabit areas, most likely for the purpose of foraging and breeding.

Military Interactions: This species commonly occurs on DoD properties that have mature, wooded habitats. It is most commonly associated with rocky and wooded sites, including forested lands and leaf litter.

Conservation Status: The Eastern Red-backed Salamander is not federally or state listed, or state listed as threatened or endangered. Subsistence lists this species as “S.” Susans, and the U.S. lists the species as Least Concern. It is a Species of Greatest Conservation Need (SGCN) in Washington D.C., Kentucky, and Missouri.

Threats/Listing Considerations: Habitat fragmentation, deforestation, intensive timber harvest, and damming are all threats to this species. Military natural resources managers should be aware of their habitat and have strong efforts on the ground.

An eastern red-backed salamander fact sheet that DoD PARC published. Source: DoD PARC

example, in 2018, DoD and the U.S. Fish and Wildlife Service produced *Recommended Best Management Practices for the Gopher Frog on Department of Defense Installations*, and DoD and the U.S. Geological Survey National Wildlife Health Center produced *Salamander Chytrid Fungus Risk Assessment on Department of Defense Installations*. By collaborating with other federal agencies, we continue to identify herpetofauna species locations and work to conserve their populations to avoid potential mission impacts.

DoD and our partners use the inventory DoD PARC developed as a management tool to support amphibian and reptile conservation across our lands. Specifically, DoD natural resources managers use the inventory to better plan, budget, and prioritize management actions to support military readiness. The inventory is an asset for DoD natural resources managers that will continue to support mission readiness for many years.

HOW DOD IS USING COMPREHENSIVE MANAGEMENT TO CONTROL ONE OF THE WORLD'S MOST IMPACTFUL INVASIVE SPECIES: THE BTS

By Marc A. Hall and Stephen M. Mosher, NAVFAC Marianas

After 25 years of continuous management, DoD natural resources managers are envisioning a future with suppressed BTS populations at the landscape level. Since its accidental introduction after World War II, the BTS has devastated Guam's ecosystem, completely eliminating 10 forest bird species and significantly reducing 17 lizard species populations. The snakes pose a significant threat to native Pacific ecosystems, including Hawaii and the Commonwealth of the Northern Mariana Islands (CNMI), and they remain a barrier to ecosystem recovery on Guam. Economic analyses estimate that the BTS could cause \$593 million to \$2.14 billion in yearly damages on Hawaii alone if the species ever established itself on the Hawaiian Islands.



Brown treesnake. Source: U.S. Department of Agriculture (USDA)

Preventing the BTS's spread is critical to habitat conservation, ecosystem preservation, and DoD operations sustainment in the region. Military training on Guam requires extra layers of biosecurity and invasive species management to help prevent the accidental transportation of BTS off the island. In addition to natural resources impacts, the BTS presents minor health hazards from its mild venom that has the potential to harm infants and elderly humans. The BTS also poses an economic risk to Guam's residents due to power grid impacts. The nocturnal, arboreal, and cryptic behavior of the BTS requires natural resources managers to continue researching and creating new techniques to control the snakes on Guam. Some of these research and management efforts include the following:

- Since 1993, the USDA-Wildlife Services (USDA-WS) and the Department of the Navy have cooperatively funded an integrated wildlife damage management program to interdict the BTS population on Guam. USDA-WS deploys hundreds of snake traps and bait stations, and conducts nighttime hand capture efforts with spotlights (spotlighting) around ports of exit to remove the BTS. In FY2017, trapping intercepted 4,688 BTS and nighttime spotlighting captured 803 BTS on Andersen Air Force Base and Naval Base Guam.

- USDA-WS uses 16 canine teams to inspect aircraft, equipment, cargo, household goods, munitions, and vehicles. Preventing the spread of the BTS off Guam via the DoD transportation network is critical. This last line of defense detects any BTS that may have circumvented preliminary defenses. These specialized detector dog teams inspect nearly all outbound military items, no matter their destination around the globe.



A USDA canine handler and his partner inspect a KC-135 Stratotanker for BTS. Source: U.S. Air Force photo by Senior Airman, Benjamin Wiseman

- Launched by Strategic Environmental Research and Development Program (SERDP) project RC-200925, BTS research continued to demonstrate the potential of aerial baiting at the landscape level in 2018. Using an automated delivery system, a Department of the Navy-funded initiative delivered nearly 6,600 bait capsules over three drops in a fenced 135 acre (55 ha) research plot with less than three hours of flight time. Six more drops are scheduled for 2019. Results indicate that aerial bait distribution can help suppress the BTS in areas inaccessible to other management techniques. Aerial bait application could be especially critical in forested habitat adjacent to cargo areas, helping to reduce BTS dispersal risk off Guam and supporting future ecosystem recovery efforts.

Islands are one of the most vulnerable environments to non-native invasive species. Invasives can cause the greatest ecosystem and economic impact on an island. The previously mentioned collaborative efforts are important initiatives to control BTS populations on Guam.

ADDRESSING REPTILES AND AMPHIBIANS IN INRMPS

By Tammy Conkle, NAVFAC Headquarters and Chris Petersen, NAVFAC Atlantic

The Sikes Act (16 U.S.C. 670a- 670o) requires DoD to carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. Sikes Act amendments in 1997 and 2012 required DoD and state-owned National Guard installations with significant natural resources to prepare and implement INRMPS. Each INRMP, consistent with the use of the installations to ensure the preparedness of the Armed Forces, is to address 10 program areas and four primary pillars, including fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation.



INRMPS help managers at installations like Marine Corps Base Camp Lejeune ensure that DoD fulfills the mission while conserving and rehabilitating natural resources. Source: U.S. Marine Corps (USMC)

Depending on the resources, habitat, and species found on an installation, fish and wildlife management can be addressed in an INRMP in different ways and with the support of a variety of tools. One of these tools is DoD PARC's *Guidelines for Updating and Enhancing Amphibians and Reptiles Sections of Integrated Natural Resources Management Plans (Guidelines)*. The DoD PARC network developed these Guidelines to help installation natural resource managers manage their herpetofauna (amphibians and reptiles), and ensure that these classes of animals and the ecosystems that support them are integrated into INRMPS. The *Guidelines* provide recommendations and references to support the amphibian and reptile sections of INRMPS and to develop installation-specific management action or projects.

Another ready reference DoD PARC developed for installation personnel is the herpetofauna inventory *Performance Work Statement Template*. The template can be modified for installation specific needs all while maintaining a common standard across DoD.

As INRMPS are updated or revised, and new installation-specific amphibian and reptile surveys are conducted, these data can be used by DoD PARC to update their inventory database (see "*Cataloging Herpetofauna Diversity on DoD Lands with the DoD PARC Inventory*" in this issue). The inventory database is an excellent resource for installation natural resources managers. It contains information on the amphibian and reptile species confirmed and unconfirmed on more than 400 military sites.

Keeping the database current is a high priority of DoD PARC, and provides a DoD agency-wide view of the herpetofauna on military lands. In concert, the DoD PARC



Species like the threatened eastern indigo snake (*Drymarchon couperi*) benefit from up-to-date INRMPS. DoD PARC resources like the *Performance Work Statement Template* support robust INRMP development. Source: Roy King

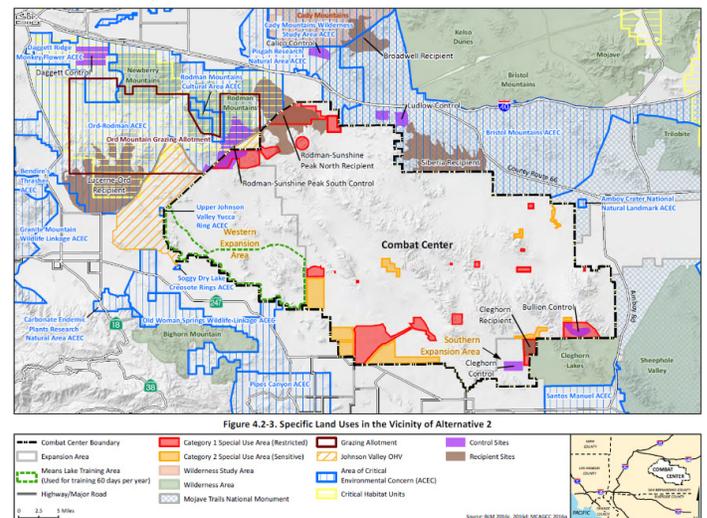
INRMP Guidance, *Performance Work Statement Template* and *Inventory Database* are tools installation natural resource managers can use to increase effectiveness; ensure high-quality data standards; and share information with each other and with our Sikes Act partners. Together, these tools provide the foundation for an ecosystem-based program that sustains the military mission.

So, before you update or revise your next INRMP, please ensure you review these tools to adequately address amphibians and reptiles in your INRMP.

MARINE CORPS AIR GROUND COMBAT CENTER DESERT TORTOISE RELOCATION

By Major David L. Tran, Marine Corps Air Ground Combat Center 29 Palms

Through the FY2014 National Defense Authorization Act, Congress authorized a 109,840-acre parcel of land to accommodate the Marine Corps Air Ground Combat Center 29 Palms (Combat Center) expansion. The Combat Center required the expansion to support sustained combined-arms, live-fire, and maneuver training for roughly 15,000 marines. However, the area provided habitat to for desert tortoises, which directly impacted the Marine Corps' plans to acquire and use this land. Before training could begin on the new lands, the Combat Center needed to identify strategies to mitigate all potential impacts to the native desert tortoise population. Once extremely common in the Mojave Desert area where the Combat Center is located, the desert tortoise is now listed as threatened under the ESA.



A map of the Combat Center and the 2014 expansion area. Source: USMC Public Affairs

With ESA restrictions in place, the Marine Corps had to protect this species to support training efforts on the newly acquired land. To do this, the Marine Corps decided to remove and relocate tortoises from the Combat Center. Data collection, analysis, and planning were key elements to successfully relocating approximately 1,100 adult tortoises – the largest relocation of this species ever proposed. The relocation was complex, involving numerous agencies and stakeholders focused on protecting the desert tortoise and expanding the Marine Corps's training capabilities.

To select the best site to receive the tortoises, the Marine Corps assessed and balanced multiple habitat quality criteria, including but not limited to vegetation, water resources, and biodiversity.



Veterinarians and biologists conduct health assessments, hydration, and data collection in preparation for desert tortoise movement. Source: USMC Public Affairs

Biologists and veterinarians conducted a full health assessment on every tortoise eligible for relocation, including a physical examination and blood tests. If a tortoise was healthy enough for relocation, the staff then fitted it with a radio transmitter to track its location on a weekly basis. This tracking allowed staff to monitor the tortoises after relocating them to determine if the individuals remained healthy and viable in their new locations.



Crews prepare and stage desert tortoises affixed with radio transmitters for movement via helicopter to pre-selected recipient sites. Each container is labeled with information to identify the exact location where the tortoise will be relocated. Source: USMC Public Affairs

During the Combat Center's relocation planning, the USFWS acquired new information indicating substantial range-wide declines in desert tortoise populations. Most populations, including the recovery unit where the Combat Center is located, were below the minimum viable population threshold. This meant that, despite relocating the Combat Center's desert tortoises, the species would be extremely vulnerable to outside risks making future generations less likely to survive. This new information drove USFWS to re-initiate consultation with the Marine Corps under Section 7 of the ESA. Adapting to this new population density information, the Combat Center shifted its approach to favor population augmentation. Under the augmentation model, relocation site selection would target high quality habitat areas in which local populations had declined below the minimum viable threshold. This approach would hopefully lead to the highest rate of tortoise population survival because of the favorable conditions in those areas.

Throughout the project planning process, DoD and USFWS consulted with external stakeholders to ensure tortoise relocation success. Local Native American tribes with cultural affiliation to Combat Center lands presented their concerns with the relocation project, identifying the desert tortoise as a cultural resource and requesting consultation under Section 106 of the National Historic Preservation Act (NHPA). The tribe felt that relocating the tortoises might jeopardize its status as a cultural resource. The Combat Center engaged the tribe in government-to-government consultation, and was able to resolve their concerns without setting the precedent of identifying a natural resource as a cultural resource under NHPA. Both the Combat Center and the federally-recognized Native American tribe agreed that the desert tortoise relocation was critical to the species' survival, which was the goal of both parties. By working with the tribe to resolve this issue, the Marine Corps was able to move ahead without further delaying the relocation.

After more than two years of planning, coordination, and preparation, the Combat Center successfully completed the desert tortoise relocation. The relocated tortoises had a survival rate of over 95% in the first year thanks to the rigorous planning and careful monitoring of researchers and DoD natural resources managers. Ultimately, this effort allowed for large-scale military exercises to occur on the newly acquired land within only three months of the relocation. This crucial training venue significantly enhances the Marine Corps' ability to prepare for deployment and respond to crises. The long-term impact of this effort to the species remains unclear, but if the first-year survival rates are any indication, the project will be a triumph for desert tortoise populations and military readiness at the Combat Center for years to come.

The Combat Center earned the 2018 Secretary of the Navy Environmental Award for Natural Resources in recognition of its efforts and its success for this project.

PROTECTING AT-RISK TORTOISES WITH A CCA

By Susan Gibson, Office of the Assistant Secretary of the Army for Installations, Energy and Environment

In 2005 a multi-state, multi-agency team of DoD, biologists from the state department of natural resources, and USFWS staff began working together to keep the gopher tortoise (*Gopherus polyphemus*) off the federal list of threatened and endangered species. The gopher tortoise is a candidate species for listing under the ESA. Gopher tortoise habitat extends through multiple military installations in the Southeast U.S., and therefore it's listing under the ESA could require DoD to curtail training to initiate protection measures. None of the agencies monitoring the gopher tortoise's status wanted to repeat the activities that took place in 1990 when training at Fort Bragg came to a halt after USFWS listed the red-cockaded woodpecker as an endangered species.



A baby gopher tortoise affectionately referred to as "Bob." Source: Chris Potin

continued on page 10



This comic series began as a companion to Dr. Sean Graham's submissions to Jon Jensen, Georgia Department of Natural Resources, for new Georgia Herp Atlas county records. Dr. Graham later developed the Natural Resources Man character at the request of Rob Lovich and Chris Petersen for inclusion in DoD PARC outreach items in regular installments. Source: Sean Graham, Ph.D., Assistant Professor, Sul Ross State University.

(Protecting At-Risk Tortoises with a CCA, continued from page 8)

The agencies determined they could prevent listing the gopher tortoise under the ESA by sharing conservation measures, collaborating on common survey methodology, sharing population data, and meeting as a group annually to improve the tortoise's habitat and mitigate threats. The gopher tortoise team initiated a CCA to formalize their gopher tortoise conservation strategy. DoD, USFWS, and all interested parties including tribal nations, Military Services, federal and state conservation agencies, and non-governmental organizations (NGOs) signed the CCA in 2008 as a voluntary, flexible conservation tool.

The goal of the CCA was to organize a cooperative, range-wide approach to gopher tortoise conservation and management throughout the species' eastern range. This CCA was the first of its kind to address species conservation across four state boundaries, and government and privately-owned property. The CCA covered Alabama, Georgia, South Carolina, and Florida, and the Army, Navy, Air Force, and Marine Corps installations; Poarch Creek Indian Nation; USFWS refuges; and U.S. Forest Service property within those states.

"The gopher tortoise initiative is one of the most innovative and collaborative conservation programs in the country and our DoD partners are playing an extraordinary role in its progress," said Leopoldo "Leo" Miranda, regional director for the USFWS's Southeast Region. "The at-risk species conservation effort we are working on at installations like Eglin Air Force Base and Fort Benning, among others, is crucial to achieve the conservation needed to ensure sustainable populations of the eastern gopher tortoise and ultimately prevent the need to protect it under the ESA."



A gopher tortoise walking in a relocation pen at Eglin Air Force Base. Source: Florida Fish and Wildlife Conservation Commission

Oftentimes, agreements with numerous stakeholders that sometimes have competing priorities meet the dusty grave of a bookshelf. However, the gopher tortoise team that created this CCA ensured its success by meeting annually to share conservation data that was then captured in a formal report to USFWS. The report reflects conservation strategies, survey results, prescribed fire statistics, and other guidelines set forth in the CCA. The team instituted management decisions such as what constitutes a viable population, and common sampling protocols so that all parties involved would use the same scientific methods to survey the gopher tortoise.

The team's collaboration provided the foundation for even broader initiatives within the Southeast. Understanding the value of such collaboration, the Southeast Regional Partnership for Planning and Sustainability agreed to provide additional resources to protect the gopher tortoise. In 2015, DoD and USFWS began developing the Gopher Tortoise Crediting

System, which could eventually provide DoD regulatory relief if the species is ever listed as threatened or endangered under the ESA. Many of the CCA partners from the public, private, and NGO sectors implemented initiatives that raised over \$100 million to protect private lands, that are home to gopher tortoise populations, from future development and other adverse activities.

Thanks in large part to the collaboration and proactive efforts that grew from the positive impacts of the CCA, USFWS determined in 2011 that listing the gopher tortoise under the ESA was not warranted. Although USFWS still considers the gopher tortoise a candidate species for listing in the eastern U.S., it remains relatively low on the priority list for further consideration and therefore, poses a minimal threat to the military mission. Continued cooperation around the CCA model could continue to preclude the need to list the species as threatened or endangered. This type of partnership that supports conservation and military readiness demonstrates continued and wide-ranging success. It is a model that natural resources managers should consider using to manage and conserve other imperiled species.

COMBATING DISEASE ON DOD LANDS

By Michael J. Lannoo, Indiana University School of Medicine and Chris Petersen, NAVFAC Atlantic

In the late 1980s, at the First World Congress of Herpetology, scientists began discussing the wave of mysterious amphibian declines hitting regions such as Central America and eastern Australia. About 10 years later, researchers identified and targeted the chytrid fungus (*Batrachochytrium dendrobatidis*) (*Bd*) as the culprit. Chytridiomycosis is an infectious disease caused by chytrid fungi that affects amphibians. This disease has the potential to cause sporadic death and, in some cases, can kill an entire population of amphibians.

Not only does *Bd* threaten amphibian populations, but it also jeopardizes the military mission at installations where amphibians reside. If amphibian species began declining as rapidly in the U.S. as they were in other countries, they would require protection under the ESA. Having additional listed species on installations could restrict access to testing and training ranges, thus hindering the ability for Military Servicemen and women to carry out their readiness activities. Only after determining the scope of *Bd* in the U.S. could researchers effectively address this threat to the military mission and to amphibian species. DoD PARC began addressing *Bd* about 10 years ago with the objective of determining if the *Bd* pathogen was present on DoD lands, how it was impacting amphibian populations, and whether this disease could diminish military readiness. The DoD Legacy Program funded multiple DoD PARC projects to address these questions and several others related to disease surveillance.

DoD PARC's first study, published in 2011, was a west-to-east survey of 15 DoD installations along Route 66 and Interstate 64, extending from Marine Corps Base Camp Pendleton in California to Naval Air Station Oceana in Virginia. Researchers sampled amphibians for *Bd* three times on each installation, collecting 1,306 samples from 30 species (or 10% of known U.S. amphibian species). Half of these species included individuals that tested positive for *Bd* with 17% of total samples coming

back positive. Most of the positive samples came from spring or early summer, suggesting a possible seasonal trend in *Bd* transmission. Location also appeared to be a factor in *Bd* prevalence, as installations with a temperate climate had higher *Bd* rates (21%) than arid installations (9%). Unfortunately, this study confirmed the presence of *Bd* on DoD lands across the U.S. with only a few remote populations free of infection.

In the group's second study, published in 2016, researchers sampled the prevalence and intensity of *Bd* along north-to-south sampling lines at 15 DoD installations. These installations included five each along the West Coast, Midwest, and East Coast. Sampling occurred in two periods during late-spring/early summer and mid- to late summer. Comparable to the Route 66 survey results, this study showed seasonal and geographic patterns in the presence and intensity of the *Bd* pathogen. Of the 28 amphibian species sampled, 15 (54%) tested positive for *Bd*. Early season samples showed no trends. In late season samples, the proportion of infected individuals decreased with increasing temperature and drier conditions, as well as decreasing latitudes (which tend to be hot and dry). This result is consistent with the results from the first study, showing that *Bd* is not as prevalent in hot, dry conditions.

The third study, published in 2017, heavily relied on voluntary sampling. DoD PARC mailed *Bd*-swabbing field kits, each containing 20 swabs and vials, as well as gloves and other supplies to biologists at DoD installations. Volunteers collecting samples viewed a short video clip explaining the sampling protocol and attended workshops to answer questions. Of the 70 kits issued, biologists returned 51 kits from 48 installations containing a total of 925 swabs. Of these samples, 24% tested positive for *Bd*, representing 17 infected species. This outcome further expanded our understanding on where *Bd* is located, particularly on DoD installations, and its impacts to amphibians on DoD lands and the military mission. It also was the first study of its kind to use in-house military expertise to conduct a wide-scale data collection effort.



A *Bd*-swabbing field kit containing all necessary equipment for volunteers to collect samples from amphibian species. Source: DoD PARC

More recently, DoD PARC has worked on several other disease prevention initiatives including a Snake Fungal Disease (SFD) survey on military lands and a salamander chytrid fungus risk assessment. Using a voluntary sampling approach to collect data, similar to the approach with *Bd* in 2017, DoD PARC

provided 80 military installation personnel with field materials necessary to conduct SFD sampling in 2018. SFD negatively impacts many snake species in the U.S., with wide-ranging impacts similar to those of chytrid fungus. Approximately 50 military sites submitted data, and DoD PARC will provide the laboratory results from collected swabs soon.

Additionally, DoD PARC and the U.S. Geological Survey National Wildlife Health Center performed a risk assessment of the salamander fungal pathogen *Batrachochytrium salamandrivorans* (otherwise known as *Bsal*) on over 200 military installations (see our [report](#)). *Bsal* has similar impacts to its relative, *Bd*, targeting salamander populations. Results show that most military lands are within a medium-risk category for *Bsal* introduction based on *Bsal* characteristics and distribution, spatial data on salamander imports and pet trade establishments, and salamander species diversity.



Species like the brightly-colored eastern newt (*Notophthalmus viridescens*) are susceptible to the deadly *Bsal* fungus. Source: Jon van de Venter

Amphibian and reptile diseases have the potential to cause rapid population declines on military lands and threaten ecosystem health. Disease also can increase the number of ESA-listed species on military lands, which has the potential to impact mission readiness. Collectively, DoD PARC's studies offer the first high level view of disease dynamics for herpetofauna on military lands. These initiatives improved DoD's response to disease outbreak by educating DoD natural resources managers of these potentially deadly pathogens. Most importantly, these efforts enhanced military readiness by promoting healthy landscapes that support long-term testing, training, and operational requirements. Thriving herpetofauna populations preclude the need for additional land use restrictions associated with federal listings, while disease eradication ensures the species diversity required for realistic habitats that DoD personnel rely on for testing and training activities.

FUNDING INNOVATION THROUGH DOD PARC

By Robert E. Lovich, NAVFAC SW and Ian Trefry, NAVFAC Mid-Atlantic

Effective management and conservation of herpetofauna and other natural resources requires a significant investment. Over the years, DoD PARC has worked with its partners to ensure that DoD funding and other investments benefit the military training and testing mission while conserving species. Specifically, DoD PARC provides recommendations to address emerging threats, develop proactive partnerships, and optimize conservation efforts for herpetofauna. These efforts are diverse, but all serve to support mission readiness, information sharing, and long-term natural resources planning.

One of DoD PARC's main priorities is to provide technical expertise to both installation and headquarters level personnel. DoD PARC's composition of regional subject matter experts (SMEs) and natural resources personnel helps accomplish this goal. These SMEs provide inputs to herpetofauna conservation plans across all Military Services. They also review proposals and make program funding recommendations, including for the [DoD Legacy Resource Management Program \(Legacy\)](#), to help ensure that military funding goes to initiatives that best support current and anticipated mission objectives.

Another priority for DoD PARC is monitoring and responding to emerging threats to minimize biodiversity loss on military lands. National projects like the comprehensive [DoD herpetofauna species inventory](#) help natural resources managers by providing population and occurrence data for use in military species conservation planning. Covering all 415 DoD installations that have an INRMP, the inventory provides information on species populations and distribution across installations. As mentioned earlier in the newsletter in the "[Addressing Reptiles and Amphibians in INRMPs](#)" article, having accurate and current species data helps installations work with the USFWS to prevent unnecessary petitions for species listings under the ESA. ESA listings can result in land use restrictions on testing and training areas. Coordinating with USFWS to determine if a species warrants federal listing status is critical to sustaining military readiness and conservation objectives.



The DoD PARC Inventory documented the American alligator (*Alligator mississippiensis*) at 49 DoD sites. Source: Paul Block

Nationally, nine of the 34 amphibian species, and 15 of the 40 reptile species federally listed as threatened or endangered under the ESA are found on DoD lands. To tackle the emerging threats to these species, DoD PARC continues to create innovative tools through technological advances such as Environmental DNA (eDNA), which can provide quality data with reduced costs and labor investment. Unlike traditional sampling methods that require DNA from an animal, researchers collect eDNA samples passively from the environment in which the target species is present – detecting trace amounts of species DNA. Although eDNA began as a resource to detect rare or cryptic species, it is now commonly used to assess the presence of native species, non-native species, and environmental pathogens. eDNA sampling can be



Collecting eDNA samples, as seen here, is less time intensive than other conventional sampling methods. Source: Kellie Carim

especially useful for evaluating species populations because it can help determine if unique genetic variations or new species exist. DoD has worked with eDNA from the start, and DoD PARC has continued to use the tool to expand its capabilities.

In addition, DoD PARC has made tremendous steps in venomous snake awareness and education. While the DoD PARC species inventory details the distribution of venomous snakes on military lands, SMEs developed products like maps, posters, and identification materials to help educate personnel about venomous snakes in their region. DoD PARC also revised the venomous snakebite and antivenom protocol for Marine Forces in Europe and Africa. These materials increase awareness and knowledge



Venomous snake inventories and outreach campaigns can help prevent snakebites during testing and training. Here, a PARC representative holds a large eastern diamondback rattlesnake (*Crotalus adamanteus*) on Marine Corps Base Camp Lejeune. Source: Carmen Lombardo

of native venomous snakes on military properties, helping reduce the chance of venomous snakebites, and improving responses when snakebites occur. If these efforts help save even one life, then they are truly the greatest victory that DoD PARC can achieve for DoD.

DoD PARC efforts also lead to cost savings. One example is the INRMP template language for herpetofauna. INRMPs are foundational planning documents, and their development often requires a significant time and cost investment. DoD PARC's INRMP template saves time and improves consistency across installations by eliminating the need to repeatedly rewrite generic language. DoD PARC developed a similar template for a Performance Work Statement for conducting herpetofauna inventories. DoD PARC also takes advantage of various cost effective field tools like automated acoustic loggers, or "frog loggers." These loggers are used to record frog/toad calls. They can be deployed at numerous locations and installations simultaneously to detect species thereby saving time and associated labor costs. By using these products, DoD natural resources managers can increase efficiencies while fulfilling their dual readiness and conservation missions.

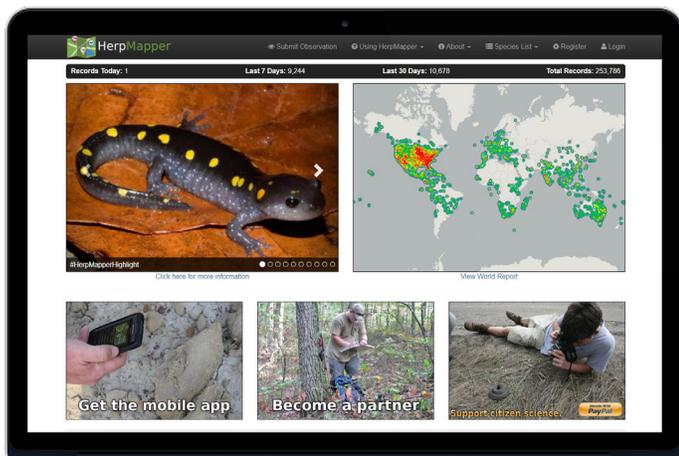
As DoD PARC has expanded over the last decade, personnel have solidified and focused the in-house expertise in herpetology into one dynamic network. This growing network has contributed substantially to inventory and monitoring efforts across installations. Teams of herpetofauna SMEs have been able to travel and provide updated surveys on DoD lands worldwide. DoD PARC representatives continue to make advances in research, monitoring, management, and technology that support current and planned herpetofauna projects. Like the projects detailed in this article, future DoD PARC initiatives will help ensure that DoD's herpetofauna species conservation efforts are coordinated across DoD lands.

BRINGING HERPMAPPER TO LIFE

By Mike Pingleton, HerpMapper

HerpMapper launched as a 501(c)(3) nonprofit organization in September 2013 through the willingness of everyday people to record their reptile and amphibian observations in nature. One of the most basic needs of DoD natural resources managers, conservation organizations, and research biologists is access to high-quality location data of amphibians and reptiles, or herpetofauna (herps). Fortunately, there are many herpetofauna enthusiasts who are willing to record their field observations in a citizen-science capacity. Many other nature enthusiasts, such as birdwatchers, also are inclined to record their amphibian and reptile observations. With a goal to provide a platform to share high-quality herp location data, HerpMapper has helped DoD facilitate targeted conservation management and cost savings to support the realistic habitat necessary for military testing and training.

HerpMapper is an interactive online database that allows users to record herp observations in real-time using a mobile device application (app). First-time users must register for an account on the HerpMapper website or through the app by providing their name and email address. After creating an account, the user can sign-in to HerpMapper and record a reptile or amphibian sighting simply by “adding a new record” from the user home page. Recording a HerpMapper record requires two things: the exact location of the species sighting, and a voucher photo of the species to confirm its identification. The mobile app uses a phone’s built-in GPS functionality and its camera to create the record. A new record prompts the user for information including, but not limited to, the species name, date and time of the sighting, sighting location, and altitude.

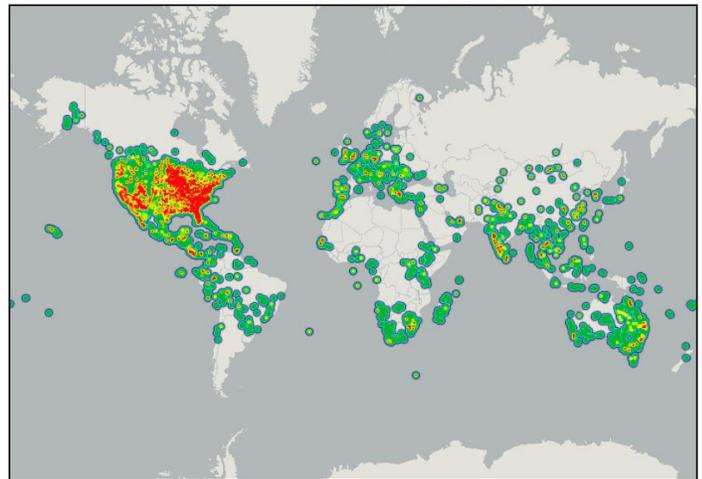


HerpMapper.org gives citizen scientists the opportunity to contribute to a database of over 250,000 amphibian and reptile sightings. Source: HerpMapper.org

Using HerpMapper to pinpoint the exact location of different species is a valuable tool for managing lands and ecosystems. For example, DoD natural resources managers can use the location data to re-survey for species and study the surrounding habitat. Knowing the types of herp species residing in various habitats informs DoD’s species management and decision making, and enables the Military Services to maximize funding, labor, and time to conserve herps and enable the military mission. HerpMapper also is beneficial to biologists who want to learn species location trends. Determining what species are

present in specific areas can change how DoD manages those areas. If DoD natural resources managers can identify why certain areas appeal to a particular species, they can use the information to encourage species growth and expansion in areas away from testing and training ranges.

Since the fall of 2013, more than 3,000 participants have recorded nearly a quarter million herp observations records around the world. All of these observations are stored in the HerpMapper central database. HerpMapper data partners – currently 84 vetted researchers, conservation groups, and state and federal agencies – can access these records for use in their research and programs. In 2016, HerpMapper established a data sharing partnership with DoD. Since the beginning of this partnership, DoD personnel have entered more than 3,400 records at DoD installations across the U.S., greatly expanding the HerpMapper database. Exact location data for species records on military installations are not available in the same way as records off DoD properties, but the general species location information is still extremely useful.



This map shows the distribution of HerpMapper observations around the globe. Source: HerpMapper.org

One of the challenges with citizen science is to keep large numbers of people interested and engaged in long-term projects. HerpMapper developers have addressed this issue by making the tool useful to the people who use it. While agreeing to make their records available to HerpMapper data partners, users also retain access to all the records they create, and thus can use HerpMapper as a personal record repository. Another user-engaging feature of HerpMapper is an auto-updated life list based on recorded observations, and achievement badges for reaching certain record levels (e.g., number of data entry records, number of species).

A small group of volunteer biologists, developers, and herpetofauna enthusiasts operate HerpMapper. This database is a continuously evolving tool in herpetofauna conservation. Continued data collection and tracking on HerpMapper enables DoD to better understand species statuses at the landscape-level, and support conservation efforts to minimize training limitations from species listings under the ESA. To learn more about the project or to create your own HerpMapper profile, visit www.herpMapper.org.



DoD PARC TOOLS

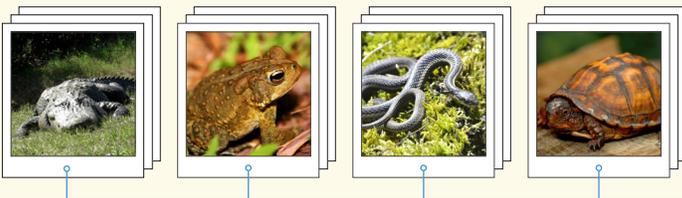
DoD PARC has developed several helpful tools for professionals and the public to educate stakeholders and encourage herpetofauna conservation.

These resources are all easily accessible from the DoD PARC website.

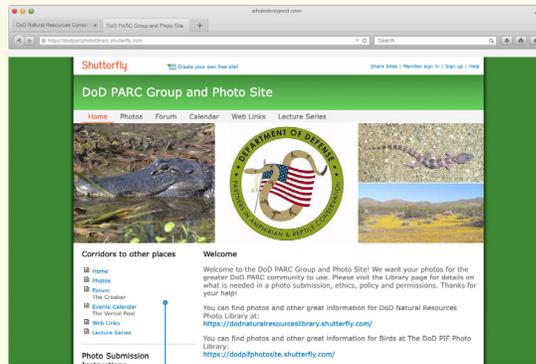


PHOTO LIBRARY

The DoD PARC Shutterfly site is a great visual resource that DoD PARC representatives frequently update with the latest pictures and videos of herpetofauna on DoD installations. This site also features a forum where users can participate in fun trivia, learn about DoD PARC research tools, and engage in questions and answers about important herpetofauna topics.



Alligators, frogs and toads, salamanders, snakes, turtles and tortoises, lizards, and more!



EDUCATION/OUTREACH MATERIALS

DoD PARC develops fact sheets, species posters, informational videos, and more. In 2018 alone, DoD PARC representatives published 45 species fact sheets! These resources are a pivotal component for educating the public about how to conserve amphibian and reptile species. The fact sheets also highlight proper species identification and safety measures to avoid human injuries as a result of encounters with venomous snakes or other harmful species.

FACT SHEETS



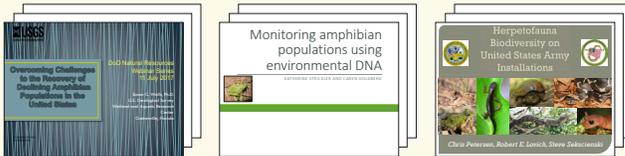
POSTERS



REPORTS



VIDEOS



NEW!

One of DoD PARC's new initiatives is developing short biographies featuring veteran herpetologists and their innovative work to support the military mission through amphibian and reptile conservation. *Look out for more of these biographies later this year!*



DOD PROJECT HIGHLIGHTS

Following are a few project summaries that DoD installation natural resources managers may find of interest. Find more projects on the Natural Resources page of the DoD Environment, Safety and Occupational Health Network and Information Exchange ([DENIX](#)) site.

Legacy Project 16-818: Gopher Tortoises and Test Ranges: Developing an Understanding for the Wildlife-Habitat Relationships of this Novel Habitat

This project investigated gopher tortoise burrow densities across Eglin Air Force Base, comparing population structure and burrow use between test ranges and forested areas. Collecting this information will allow researchers to predict how much of the gopher tortoise population is located within test ranges. Results from this research can help improve management plans by focusing on ecological conditions that promote gopher tortoise population growth, while also minimizing impacts to the military mission.



Col. Matthew Higer, 96th Test Wing vice commander, bends down to release a gopher tortoise into its new home deep within Eglin Air Force Base. Source: Samuel King Jr.

SERDP RC-2119: Conspecific Attraction as a Management Tool for Endangered and At-Risk Species on Military Lands

The movements and habitat colonization of federally listed or at-risk species can be unpredictable and therefore can interfere with military training. Management tools are vital to provide cost-effective oversight for species on military lands. This project demonstrates the use of conspecific attraction for endangered and at-risk bird and amphibian species. To attract animals to settle near other members of their species, the project team broadcasted prerecorded vocalizations of the target species from a playback system within the focal area. The team broadcast these vocalizations throughout the focal species breeding season from the restored habitat, thereby encouraging individuals to settle and breed near the playback system. By using this tool, managers can help control threatened and endangered species movements on military lands.

SERDP RC-2328: Controls Regulating Biological Nitrogen Fixation in Longleaf Pine (*Pinus palustris*) Ecosystems: The Role of Fire and Military Training

Recent studies have shown that longleaf pine ecosystems located on military installations have lower than normal nitrogen levels. Nitrogen is an important component of a healthy and growing ecosystem. The primary pathway for nitrogen to enter the ecosystem is through a process called biological di-nitrogen (N_2) fixation mediated by various soil-dwelling microorganisms. This project investigated the importance of biological di-nitrogen fixation in longleaf pine ecosystems impacted by military training. This knowledge can lead to effective management strategies for ecosystem rehabilitation using biological di-nitrogen fixation.

ANNOUNCEMENTS

Environmental Security Technology Certification Program (ESTCP) FY2020 Request for Proposals

The DoD ESTCP is seeking formal demonstrations to rigorously evaluate innovative technologies.



DoD facilities and sites host ESTCP demonstrations to document improved efficiency, reduced liability, improved environmental outcomes, and cost savings in the Resource Conservation and Resiliency program area.

In FY2020, ESTCP has issued two topic areas for the Resource Conservation and Resiliency program area through a Broad Agency Announcement to the private sector, as well as one topic area of general interest:

- DoD Infrastructure Resiliency Arctic Engineering Design Tool
- Advanced Brown Treesnake Control Tools
- Innovative Technology Transfer Approaches

All pre-proposals are due to ESTCP no later than 2:00 pm E.T. on March 7, 2019. Detailed instructions are available on the [ESTCP website](#).

National Public Lands Day (NPLD) – September 28, 2019

Be on the lookout for the National Environmental Education Foundation's (NEEF's) request for proposals for [2019 NPLD projects on DoD lands](#). The deadline to submit pre-proposals to NEEF is May 14, 2019.

SERDP RC-201302: Demonstration and Validation of a Linked Watershed-Riverine Modeling System for DoD Installations

This project covered multiple DoD installations to demonstrate and validate a modeling system for linked watersheds and rivers. The modeling system is applicable across varying climatic regions and hydrologic regimes. It is an effective tool to help land managers assess any potential watershed impacts from military activities. This tool also can support sustainability efforts by informing water, contaminants, and land-use management in watersheds. If watershed mitigation is necessary, the system also can help land managers assess which measure will provide the most environmental benefits with the least financial cost.



Calleguas Creek Watershed, CA, was part of the project to evaluate a linked watershed and riverine modeling system. Source: U.S. Army Engineer Research and Development Center

SERDP RC-2709: Useful Prediction of Climate Extreme Risk for Texas-Oklahoma at 4-6 Years

The impacts of extreme floods and hurricanes on DoD facilities located in the southeastern U.S. has increased in recent years. These water cycle extremes put a strain on infrastructure and operational capabilities on DoD sites. This project focused on tracking the 4-6 year weather pattern El Nino-Southern Oscillation (ENSO), as well as characterizing any uncertainty within the timeframe. This data can provide an extended prediction window for extreme flood risk events.

UPCOMING EVENTS, CONFERENCES, WORKSHOPS, AND TRAINING

NMFWA Annual Training Workshop

March 4-8, Denver, CO

Held in conjunction with the North American Wildlife and Natural Resources Conference, the 84th NMFWA annual training workshop is the primary event where installation natural resources managers meet to discuss key concerns and opportunities, recent policy and legislative changes, ongoing activities and recent accomplishments, and emerging issues and potential new challenges. This year's training will include workshops on the new Legacy-funded Climate Adaptation for DoD Natural Resource Managers guide, which will offer a step-wise approach for incorporating climate considerations into INRMPS; Advanced Endangered Species Act: How to Effectively Write a Biological Evaluation to Get the Results You Want; and Integrated Monarch Monitoring Across DoD Properties and Nationwide.

North American Wildlife and Natural Resources Conference

March 4-8, Denver, CO

This conference brings together natural resources professionals from all sectors to exchange knowledge and best practices on issues such as endangered species, migratory birds, and landscape management through workshops and meetings. The event serves as the annual forum to set conservation policy in North America and includes conference sessions, workshops, and more than 150 separate meetings and functions.

Naval Civil Engineer Corps Officers School (CECOS) Natural Resources Management and Compliance Course

March 18-21, Joint Base San Antonio, TX

This course offers instruction in specific natural resources laws, regulations, policies, Executive Orders, DoD Instructions, and other guidance, noting Military Service-specific requirements. The course addresses stewardship, preservation, and process; fish, game, and wildlife management laws; protection of wetlands, waterways, and other ecological areas; forest and land use management laws; Sikes Act and INRMPS; and inter-service cooperation.

Northeast Association of Fish and Wildlife Agencies Annual Conference

April 14-16, Groton, CT

This event attracts over 500 natural resources professionals in the fields of wildlife biology, fisheries and fisheries management, education, and law enforcement. The event provides opportunities for education, discussion, and exchanging of ideas. Highlights include over 50 workshop sessions, keynote speakers, poster displays, and social networking events.

Earth Day

April 22, Global

Since 1970, Earth Day has been the worldwide celebration of saving the planet. Join the 22,000 partners in 192 countries working to promote environmental conservation across our planet. Volunteer for the globe. Find an event near you or host one yourself!

World Migratory Bird Day

May 11, U.S. and Canada

World Migratory Bird Day celebrates the many ways in which birds matter to the earth, to ecosystems, and to us. Some bird species provide practical solutions to problems, such as the need for insect and rodent control. Others disperse seeds, helping to re-vegetate disturbed areas, or help pollinate flowering plants, trees, and shrubs. This year's theme will focus on solutions to plastic pollution, which has become a worldwide epidemic and a primary threat to birds across the globe. So, join or host a World Migratory Bird Day event near you to learn about and develop solutions to this growing problem.

Endangered Species Day

May 17, Global

Recognize the national conservation efforts to protect our nation's endangered species and their habitats. Celebrate and HELP save the planet one species or habitat at a time! Join the many zoos, aquariums, botanic gardens, wildlife refuges, conservation groups, national parks, museums, and schools throughout the country holding tours, open houses, special presentations, exhibits, milkweed plantings/butterfly garden installations, habitat clean-ups/other restoration events, children's activities, and more on May 17. You can also volunteer for or host an event near you!

American Ornithological Society 2019 Meeting

June 24-28, Anchorage, AK

This conference gives ornithological professionals, amateurs, and students an opportunity to gather and discuss the recent climate-driven decline of endangered and migratory bird species. More importantly, the conference will facilitate discussion of new avian research to help conserve and protect these endangered and migratory bird species.

Western Association of Fish & Wildlife Agencies Summer Meeting

July 11-16, Manhattan, KS

The Western Association represents 19 U.S. states, 3 Canadian provinces, and 1 Canadian Territory. Its annual conference will feature speakers and workshops that promote sound natural resources management and partnerships at all levels to conserve wildlife for the use and benefit of all citizens.

Conservation Medicine and Diseases of Amphibians and Reptiles Course

July 21-27, Portal, AZ

This unique course will introduce students in veterinary medicine, wildlife science, conservation ecology, and biology to a variety of topics relevant to field and laboratory health issues of amphibians and reptiles. The course will include both formal lectures by experts in the field, along with hands on laboratory and field procedures.

Joint Meeting of Ichthyologists and Herpetologists

July 24-28, Snowbird, UT

The Joint Meeting of Ichthyologists and Herpetologists is an annual meeting of three scientific societies – the American Society of Ichthyologists and Herpetologists; the Herpetologists' League; and the Society for the Study of Amphibians and Reptiles – to share current research and network with professional peers.

LINKS OF INTEREST

DoD Natural Resources Program (NR Program)

DoD's NR Program provides policy, guidance, and oversight to manage natural resources on approximately 25 million acres of military land, air, and water resources. Visit the NR Program website for more information on DoD's natural resources initiatives, policy updates, presentations, and links to other conservation and natural resources sites.

DoD Environment, Safety and Occupational Health Network and Information Exchange (DENIX)

The DENIX Natural Resources website is another resource that provides access to natural resources information. Specifically, the website includes DoD Legacy Resource Management Program (Legacy Program) fact sheets and reports, as well as other natural resources materials.

Armed Forces Pest Management Board (AFPMB)

AFPMB recommends policy, provides guidance, and coordinates the exchange of information on pest management throughout DoD. Their mission is to ensure that environmentally sound and effective programs are in place to prevent pests and disease vectors from adversely affecting natural resources and DoD operations.

Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP)

SERDP and ESTCP are independent DoD research programs that use the latest science and technology to develop innovative solutions to DoD's environmental challenges. They promote partnerships and collaboration among academia, industry, the Military Services, and other federal agencies that support military readiness and mission capabilities, quality of life, compliance with legislation and policy, and natural and cultural resources management.

Readiness and Environmental Protection Integration (REPI)

Under REPI, DoD partners with conservation organizations, and state and local governments to preserve land around military installations to combat encroachment. REPI promotes innovative land conservation, which preserves the military's ability to train and test on its lands now and into the future.

Cooperative Ecosystem Studies Units (CESU) Network

DoD participates in the CESU Network, which is a national consortium of federal agencies, tribes, academia, state and local governments, and non-governmental organizations working together to provide research, technical assistance, and training to federal agencies and their partners. DoD's CESU projects have netted savings of approximately \$51 million through combined efforts and a pre-negotiated, lower overhead rate for federal agencies. The CESU Network also provides managers with the adaptive management approaches necessary to preserve installation natural resources.

DoD Partners in Flight (PIF)

DoD PIF consists of natural resources personnel from military installations across the U.S. and works collaboratively with partners throughout the Americas to conserve migratory and resident birds and their habitats. In addition, DoD PIF supports and enhances the military mission through proactive, habitat-based management strategies that help protect birds on DoD lands and maintain healthy landscapes and training lands. Visit the DoD PIF website for fact sheets, reports, and other materials with information about DoD's migratory bird conservation efforts.

DoD Partners in Amphibian and Reptile Conservation (PARC)

DoD PARC is a partnership dedicated to the conservation and management of herpetofauna (reptiles and amphibians) and their habitats on military lands. DoD PARC membership includes natural resource specialists and wildlife biologists from the Military Services, and individuals from state and federal agencies, museums, universities, and environmental consultants. Visit the DoD PARC website for information about herpetofauna management projects on DoD lands.

DoD Pollinator Initiatives

Visit this website for an overview of pollinators and why they are important to DoD. The website also contains information on how people can help protect pollinators and their habitat, including fact sheets, technical reports, and how-to guides.

DoD Invasive Species Outreach Toolkit

This toolkit has materials to help DoD natural resources managers communicate with agencies, organizations, and the public about invasive species issues on DoD lands. Specifically, the tool kit includes modifiable outreach materials, such as posters, brochures, reference cards, and a PowerPoint presentation.

DoD Biodiversity Handbook

The DoD Biodiversity Handbook contains a thorough introduction to biodiversity and how it is essential to support the military mission. It also details the scientific, legal, policy, and natural resources management contexts for biodiversity conservation on DoD lands, and includes 17 case studies with practical advice from DoD natural resources managers.

DoD PARC Photo Library, DoD PIF Photo Library, and DoD Natural Resources Photo Library

Visit these three websites to share pictures, news, information, and ideas with the DoD Natural Resources, DoD PARC, and DoD PIF communities. Please review the [photo policy](#) and [photo submission instructions](#) to contribute your images. In addition, account users can download photographs for reports, Power Point presentations, and educational materials such as brochures and posters.





DOD NATURAL RESOURCES PROGRAM

Enabling the Mission, Defending the Resources

www.denix.osd.mil/nr

<http://twitter.com/#!/DoDNatRes>

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