

# Natural Selections



Department of Defense Natural Resources Program



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## RECOVERING ONE OF THE COUNTRY'S FIRST ENDANGERED SPECIES THROUGH PARTNERSHIPS AND STEWARDSHIP

The US Fish and Wildlife Service officially removed the Delmarva Peninsula fox squirrel from the list of Threatened and Endangered Wildlife in December 2015. Larger than other squirrel species and generally not found in suburban or urban areas, the Delmarva Peninsula fox squirrel ranged throughout the Delmarva Peninsula of Maryland, Delaware, and Virginia before experiencing a sharp decline in the mid-20th century due to forest clearing for agriculture and development, short-rotation timber harvest and over-hunting. With its range reduced more than 90 percent, the squirrel was one of 78 species listed under the Endangered Species Preservation Act in 1967, the predecessor of the Endangered Species Act enacted six years later.

Since listing, the squirrel's range has increased from four to 10 counties, and a population of up to 20,000 squirrels

now covers 28 percent of the Delmarva Peninsula, primarily in Maryland.

Efforts contributing to recovery include translocation of animals to establish new populations, closing of the targeted hunting season, growth, and dispersal of the population, and protection of large forested areas for habitat. To learn more about the Delmarva Peninsula fox squirrel, visit [www.fws.gov/chesapeakebay/EndSppWeb/DFS/index.html](http://www.fws.gov/chesapeakebay/EndSppWeb/DFS/index.html).



*The Delmarva Peninsula fox squirrel is larger than the common gray squirrel and has a full, fluffy tail.*

## SPOTLIGHT: PLANNING FOR CLIMATE CHANGE

By Wanda Johnsen, Office of the Assistant Secretary of the Army (Installations, Energy and Environment), Lorri Schwartz, Office of the Assistant Chief of Staff for Installation Management, and Kelly Pew, Office of the Deputy Chief of Staff, G-3/5/7

Installations across the Army reported effects from recent weather-related events, from droughts and flash floods in the arid southwest, to winter storms in the northeast. While some weather-related effects can cause minor disruptions, other events have direct impacts on Army operations, including costly repairs to cantonment and training range infrastructure, and loss of valuable training time for Army units.

In August 2013, an extreme rainfall event at Fort Irwin, CA, caused severe erosion, washed out roads, and toppled structures and support electronics in the training range. Fort Irwin is in the middle of the Mojave Desert, yet the deluge was so intense that the installation conducted several swift water rescue missions during the storm, and floodwaters in one barracks building reached 15 feet. The event caused \$64 million in damages and almost delayed an incoming 28-day training event for an Army tactical unit.

Intense rainfall events have caused extensive erosion in Army training ranges in the Southeast, while thawing permafrost affects our training ranges in Alaska. Heat stress conditions (high

# NATURALLY SPEAKING

From the Desk of Alison Dalsimer, Senior Research Associate, DoD Natural Resources Program and L. Peter Boice, Deputy Director, DoD Natural Resources Program; Director, Legacy Program



Alison and Peter study the impacts of climate change on the desert ecosystem in the Sonoran Desert, AZ.

This issue of *Natural Selections* focuses on the most significant threat to the long-term sustainability of our Nation's and the world's natural resources – our changing climate and its impacts. In the face of what can seem potentially overwhelming challenges, many are responding. As DoD natural resources managers, you have significant roles to play in this important and long-term battle.

So, what can I do, you may ask? How do I know what is most important? And, perhaps even more importantly in a tight fiscal environment, how can I argue

effectively for needed resources? There is no one answer to any of these questions, but there are many tools and partnerships available, and more on the horizon.

The authors in this issue do a great job describing the problems and challenges posed by a changing climate, as well as some of the resources available to help address those issues. They describe threats at both site-specific and broader scales, and how to address those threats using various tools and methods to assess and quantify risks.

Climate change is having significant and growing impacts on our often-irreplaceable resources – loss of habitat and species, diminished ecosystem services, increased threats to human health and safety, lost property values, decreased quality of life. It also is having significant and growing impacts to our ability to conduct test, training, and operational activities. It is both national and DoD policy to plan for and, as possible, mitigate for these impacts. The key, as Wanda Johnsen points out, is to take a holistic approach and share information. This shared, holistic approach must necessarily encompass management, policy, research, and coordinating with off-base partners.

This also will be the key to addressing the Administration's latest memorandum, issued on October 7, 2015, [Incorporating Ecosystem Services into Federal Decision Making](#). As it happens, the DoD Natural Resources Program was ahead of the curve on

this one, having included the requirement to consider ecosystem services in [DoDI 4715.03](#) (2011). How to do this, however, was not addressed.

This latest memo not only explicitly recognizes the vital contributions natural resources make to our economic and social well-being, it requires federal agencies to

1. incorporate the value of natural, or "green," infrastructure and ecosystem services into federal planning and decision making;
2. develop and institutionalize policies that promote consideration of ecosystem services; and
3. develop a guidance on integrating ecosystem-service assessments into relevant programs and projects to help maintain ecosystem and community resilience, sustainable use of natural resources, and the recreational value of the Nation's unique landscapes.

There is no doubt that in climate change we face an extremely difficult set of challenges, one that will demand our combined willpower, talents, and resources. In response, governmental agencies and nongovernmental organizations at all levels are tackling these challenges. The real danger lies not in the monumental nature of the challenges, but in the danger that as individuals and as an international society we will fail to take strong actions soon enough. Our children and grandchildren deserve and demand that we meet climate change head-on while there still is time to protect our natural heritage.

In DoD, you – the installation natural resource managers – are the front line of defense. Through your planning and implementation, you help keep our lands mission-ready.

Climate change is an increasingly challenging issue that we are facing; it forces us to search for innovative solutions to its growing effects of sea-level rise, increasing temperatures, and water shortages. These effects pose serious impacts on diverse ecosystems and the wildlife that reside there. Explore this issue's *Natural Selections* as we highlight several species that are feeling climate changes' impacts. Photos courtesy of the [US Department of the Interior](#), visit [www.doi.gov/climate](http://www.doi.gov/climate) to learn more about the Agency's work on climate change.



The snowshoe hare developed its fur to blend in with the winter snow. Rising temperature is causing snow to melt earlier than the hares have grown accustomed to, leaving them vulnerable in snow-less landscapes. This vulnerability can cause declines in their populations, which could cause declines in other species that rely on them as a food source.

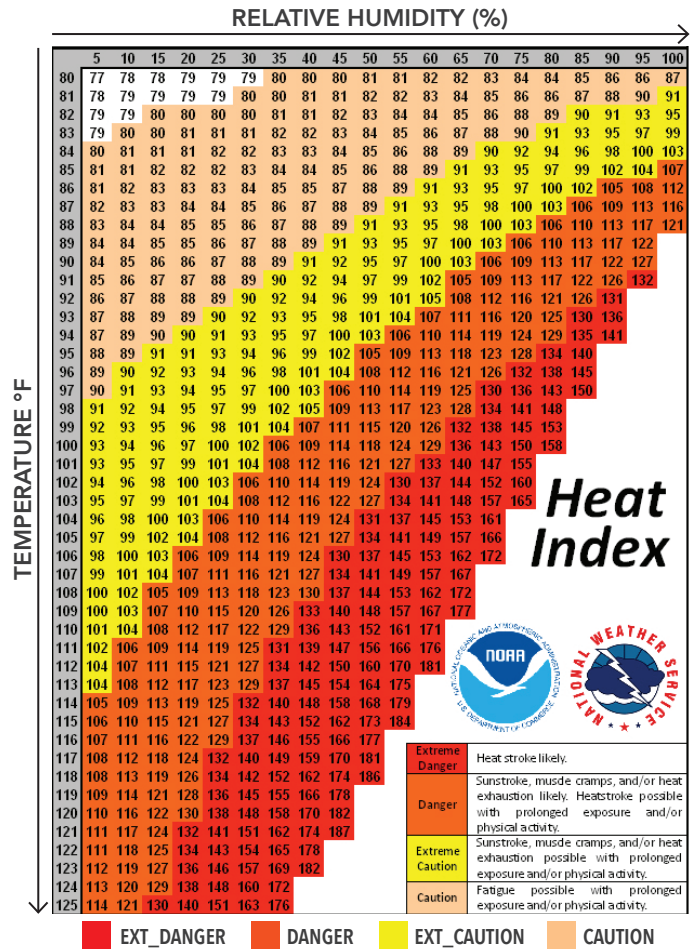
temperatures combined with high humidity) can cause changes in field training activities to mitigate potential heat-related injuries. Prolonged drought conditions in the Southwest also affect Army installations. While most installations already implement water conservation, efficiency, and reuse measures, the drought brought renewed emphasis for those measures to maintain mission-critical operations. Drought conditions in the Southwest and elsewhere are causing restrictions in live-fire training due to concerns of ammunition or tracer rounds sparking wildfires in tinder-dry environments. In addition, dust storms from drought conditions in Hawaii negatively affect helicopter training. The Army deployed Soldiers to help with wildland fire suppression activities in Washington State. These events highlight the need to manage risks to Soldier health, infrastructure, tactical equipment, and the surrounding community.

As recently as October 2015, intense rainfall in South Carolina flooded much of Fort Jackson, disrupted the power supply and potable water system, and damaged the live-fire ranges. While the power supply was quickly restored, the water supply disruption continued for several days. At the same time, Fort Jackson supported local and regional disaster response. The Army is still assessing the cost to repair damage to the cantonment and range infrastructure.

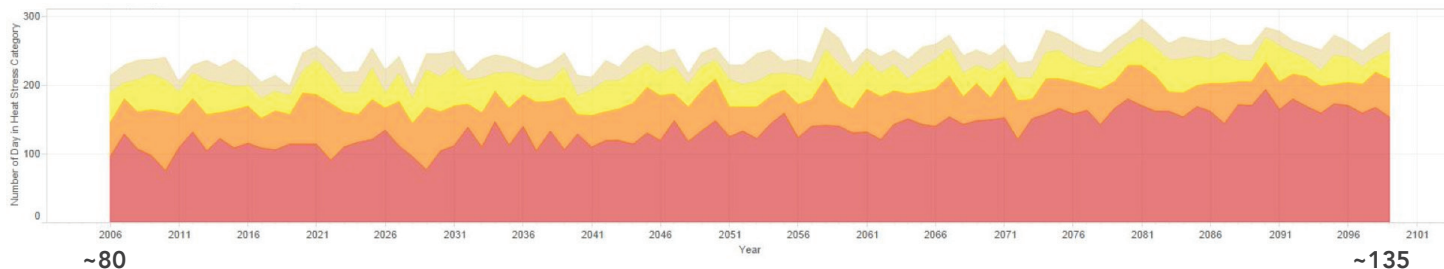
The National Climate Assessment projections indicate that our installations can expect an increase in the frequency and intensity of these events in the future. This could represent a potential increased risk to Army operations. As prudent military mission planners, the Army is identifying potential risks associated with climate change, and will adjust our plans accordingly. In fiscal years 2014-2015, the Army mapped climate-related factors in several installation plans, including Integrated Natural Resource Management Plans (INRMPs), real property management plans, and range complex master plans. Mapping for emergency response plans and potable water system planning is underway. Now we are developing guidance for incorporating climate change considerations into those plans, starting with INRMPs. The guidance will include recommendations for the appropriate types of information and climate projections to use (e.g., regional scenarios from the National Climate Assessment or downscaled projections), where to find the data, and agencies/planning partners that could provide expertise and regional data. The potable water system planning guidance will address source water supplies, water treatment, distribution systems, and operation and maintenance practices. Incorporating these climate change considerations will increase installation resilience.

In planning for climate change, the Army is also looking at the data we already routinely collect, and sharing that information

across business lines. In some cases, data that can enable more informed planning and management decisions has not been consistently collected and reported to the enterprise level. Examples include the cause, length, and impact of weather-related disruptions, the cost of recovery, and the impact to Army operations. This data, combined with climate projections, could inform the development of future Program Objective Memoranda/budget requests, cost savings evaluations, and equipment purchase requests, as well as the design of more resilient cantonment and range infrastructure.



*If projections for other Army training areas in the Southeast indicate similar increases in days/year of heat stress conditions, would stationing decisions be affected or would training activities need to be moved to other regions during the summer months? Similarly, would prolonged drought and wildfire conditions necessitate the relocation of live-fire related training events or water-intensive cantonment operations?*



*Enterprise-level climate change vulnerability assessments might also inform stationing decisions. For example, projections for one Army training range in the Southeast indicate that heat stress conditions could increase from the current average of 80 days/year to 135 days/year by 2100.*



Flooding in the training area at Fort Jackson, SC. Source: US Army Photo

The Army is engaging across our land-based planning (e.g., natural resources, real property, and range management) and operations to support a holistic approach and shared information. The goal is to more effectively plan for future weather/climate related vulnerabilities to infrastructure, natural resources, and range management. We are collaborating with the Office of the Secretary of Defense, Air Force, and Navy on several SERDP-sponsored projects to help define how military installations can use climate-related information in the planning processes. These projects will help us further refine the Army planning guidance in development, and support future Army operational and training needs.

## NUISANCE OR NEW NORMAL? THE IMPACT OF TIDAL FLOODING GROWS EACH YEAR

By E. Rebecca Patton, PMP, Climate Change Adaptation Integration, OASD (EIE)/ESOH

Scientists from National Oceanic and Atmospheric Administration's National Ocean Service recently completed an analysis of "nuisance flooding" in 27 US cities. Their report includes the number of nuisance flood days each location experienced in 2014, how nuisance flooding has changed since 1950, and how El Niño is likely to boost the number of nuisance flood days for many cities through spring 2016. A press release and link to the report is available at [www.noaanews.noaa.gov/stories2015/090915-noaa-report-finds-el-nino-may-accelerate-nuisance-flooding.html](http://www.noaanews.noaa.gov/stories2015/090915-noaa-report-finds-el-nino-may-accelerate-nuisance-flooding.html). The lead investigator, Dr. William V. Sweet works with Dr. John Hall of DoD's Strategic Environmental Research and Development Program (SERDP) as part of the whole of government Coastal Assessment Regional Scenario Working Group that is developing sea level rise scenarios for DoD sites world-wide.



Nuisance flooding in Annapolis, Maryland, in 2012. Nuisance flooding has increased rapidly along the US Mid-Atlantic Coast. Source: Amy McGovern

## DOUBLE TROUBLE: CLIMATE CHANGE AND INVASIVE SPECIES ON MILITARY LANDS

By Douglas A. Burkett, PhD, DoD Armed Forces Pest Management Board

Successful introductions and the expansion of invasive species in the wake of climate change produce extraordinary military readiness and ecological challenges to the world today. While not fully understood, the effects of invasive species exacerbated by climate change pose a substantial threat to DoD's training landscapes. These impacts include the degradation of essential training areas, loss of training opportunities, restriction of troop and cargo movement, increased regulatory pressures, line of sight security threats, and stresses on threatened, endangered, and at-risk species. Examples of mission hindering invasive species on western training ranges, exacerbated by climate change, include yellow star thistle, tamarisk, cheatgrass, and spotted knapweed.

Climate change also can result in native species becoming invasive (e.g., mountain and southern pine beetle infestations), thereby disrupting ecosystems and creating fire hazards (increasing wildfire threats). Invasive species out-compete native species for scarce water resources, and generally disrupt entire ecosystems by changing non-fire adapted ecosystems into fire-prone landscapes that harm native flora and fauna. The DoD is using C-130 aircraft to help control live fire operations on several western military ranges to control cheatgrass, halogeton, musk thistle, tamarisk, tumbleweed, and Sahara mustard populations.



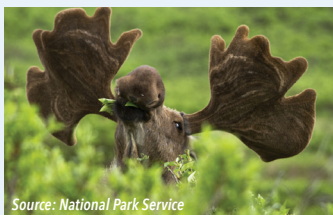
US Air Force Reserve (910th Airlift Wing) using C-130 aircraft to control musk thistle at Smoky Hill Range, KS. Source: Ron Nehrig

Land use challenges associated with invasive species made worse by climate change can also cause distribution shifts for threatened, endangered, and at-risk species. For example, military installations in Hawaii must cope with the interaction of threatened endemic honeycreeper bird species and non-native mosquitoes that transmit exotic avian pox and malaria. In response, honeycreepers have increasingly moved to higher elevations, where cooler temperatures limit the spread of the mosquitoes.

Integrated Natural Resource Management Plans, National Environmental Policy Act documents, and Endangered Species Act consultations should address mission impacts due to invasive species and climate change. A growing number of resources related to climate change and invasive species are available to natural resources and pest managers. For example, the National Invasive Species Council published an overview, [Bioinvasions in a Changing World: A Resource on Invasive Species-Climate Change Interactions for Conservation and Natural Resource Management](#). This document contains an extensive bibliography and outlines growing challenges associated with managing invasive species and climate change. Other noteworthy DoD-

produced climate change resources covering natural resources management include the [Climate Change Adaptation Roadmap](#), and the Congressional Report's [National Security Implications of Climate-Related Risks and a Changing Climate](#).

The varying dynamics associated with invasive species and climate change will require military natural resources and pest managers to assess situations on a case-by-case basis, often with the task of determining how to best balance trade-offs of mission needs, regulatory requirements, mitigation strategies, funding challenges, and cooperative efforts with local, state, regional and federal partners.



Source: National Park Service

Rising temperatures and increasing tick populations are causing moose to move farther north into colder climates. The ticks can weaken the animal's immune system and cause death.

## SEA-LEVEL RISE WILL LIKELY MAKE MANY ATOLLS UNINHABITABLE

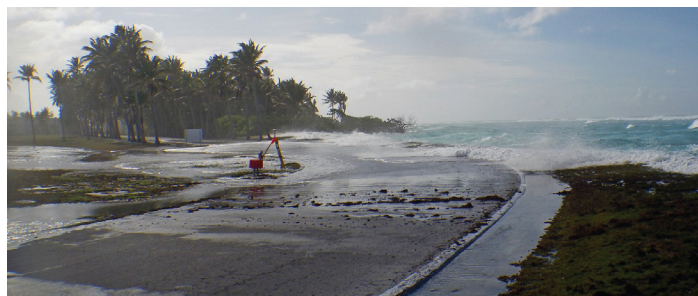
By Curt Storlazzi, PhD, US Geological Survey, Pacific Coastal and Marine Science Center

The unprecedented sea-level rise (up to 1 centimeter per year) observed in the central and western Pacific Ocean over the past two decades makes low-lying islands increasingly vulnerable to storm waves, and today's models suggest that global sea level will be considerably higher by 2100. Pacific atolls, where maximum elevations commonly do not exceed 4 meters above present mean sea level, provide a natural laboratory to understand the impacts of high rates of sea-level rise on tropical reef-lined islands globally. These coral reef-lined islands have supported civilizations for millennia, yet the areas hospitable for human occupancy in terms of water and food supplies, and adaptability of terrestrial ecosystems, are limited and thus particularly susceptible to sea-level rise impacts.

Sea-level rise will cause a reduction in wave breaking over coastal coral reefs and as a result, contribute to larger waves over the reefs. Larger waves over coastal reefs will directly affect atolls' coastlines by causing greater wave-driven flooding.

Wave-driven flooding not only threatens terrestrial infrastructure and critical habitats, but can also contaminate an island's freshwater supply, making such areas unsuitable for habitation and agriculture for days to months. In 2008, 2009, and 2011, storm-driven large wave events ruined freshwater supplies, destroyed crops, demolished infrastructure, and killed hundreds of thousands of federally protected animals on Pacific atolls. The susceptibility of these islands to sea-level rise represents a threat to food and water security, public safety, and environmental health. Because of this, researchers at the US Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), Deltares, and academia are developing assessments and forecasts to anticipate the consequences of more frequent and extreme marine flooding on atoll communities and the natural resources on which they depend.

To forecast how sea-level rise will affect infrastructure and natural and freshwater resources on atoll islands, our team is using a suite of physics-based, numerical oceanographic and hydrogeologic models. We conducted a field campaign on Roi-Namur, a low-lying island on Kwajalein Atoll in the Republic of the Marshall Islands, from November 2013 through May 2015, to collect data for validation and calibration. Our research selected Roi-Namur because it has a history of wave-driven flooding and a suite of monitoring wells that provide a detailed description of the atoll's hydrogeology and groundwater resources.



Wave-driven flooding/overwash event on Roi-Namur Island on Kwajalein Atoll, Republic of the Marshall Islands, in March 2014. The photos are looking west and show waves driving seawater up over the lip of the island and the seawater running inland (to the left) over the island. Sea-level rise will make these once infrequent events more and more frequent in the future, impacting island inhabitants, infrastructure, freshwater availability, and critical habitats for threatened and endangered species.

Roi-Namur is part of the US Army-Kwajalein Atoll (USAKA)/Ronald Reagan Ballistic Missile Defense Test Site (RR-BMDS). Source: Dr. Peter Swzenski, US Geological Survey

Building on our 18 months of observations, we are using Intergovernmental Panel on Climate Change's AR5 model scenarios to drive coupled oceanographic-hydrogeologic models calibrated and validated for Roi-Namur using field data. With these coupled models, we are (1) assessing the status of natural resources and hazards to island communities, and (2) developing projections as to the effects of sea-level rise on marine flooding and the resulting impacts to habitats, infrastructure, and freshwater availability under a variety of sea-level rise and climate change scenarios.

This effort will also provide information on which coastal morphologies are most vulnerable to sea-level rise over the next few decades, making it possible for managers to prioritize funding for restoration and adaptation efforts. Furthermore, this study will provide critical information for understanding the impacts of climate change on tropical islands if it becomes necessary to abandon and relocate island-states.

## STEPPINGSTONES CORNER: VIEW FROM THE EYRIE



By Richard A. Fischer, PhD, DoD Bird Conservation Program Coordinator



A recent Audubon report proposed that climate change, at the current pace, would negatively affect more than half of North American breeding bird species, and 314 bird species will lose more than 50 percent of their current climatic range by 2080. American Bird Conservancy expresses similar concerns, and cites climate change as one of many stressors affecting the future viability of bird populations. Debates waver whether observed climatic patterns are human-induced or caused by natural climatic variation. Regardless of the cause, natural resources managers must plan for change, and rely on data and sound science to drive management decisions for the organisms we manage, their habitats, or to protect infrastructure from sea-level rise and storm damage. The science is clear that climate change is affecting global bird populations through warming, sea-level rise, and increased storm frequency.

A recent article in *PLOS One*, a source for the Audubon report, suggests that the persistence of many North American breeding birds is dependent on the ability of birds to adapt and colonize "climatically suitable areas outside of current ranges and management actions that target climate adaptation." Is it possible that we will achieve recovery of species like the Red-cockaded Woodpecker and Golden-cheeked Warbler, only to see those populations steadily decline due to climate-induced habitat changes? Are there other listed or at-risk species whose ranges will expand onto DoD lands and for which DoD will see increased regulatory pressure to manage for their recovery? I have had several discussions with DoD natural resources managers about how to incorporate potential climate change impacts into their Integrated Natural Resource Management Plans. For many of us, this is new territory and it is difficult, at best, to determine how to include information about climate sensitivity of the wildlife populations we manage, and the plant communities they rely on as habitat in our conservation planning. Climate change and shifting plant communities pose potential problems and conflicts with our mission, particularly with managing federally listed and at-risk species.

To help DoD natural resources managers with these issues, the DoD Bird Conservation Program recently initiated a Climate Change Working Group comprised of members from the DoD Bird Conservation Steering Committee. As science becomes increasingly available, we will work to identify questions, issues, and potential management recommendations relevant to the DoD mission. The National Military Fish and Wildlife Association also recently reinvigorated their Climate Change Working Group. Both of these working groups act as information sources, and include internal subject matter experts. I encourage your input to these working groups as we begin to address some very difficult and complex topics. To become involved, please contact one of the DoD Bird Conservation regional representatives or me by visiting [our website](#).

## QUANTIFYING RISKS TO COASTAL COMMUNITIES THREATENED BY CLIMATE CHANGE AND SEA LEVEL RISE: NAVAL STATION NORFOLK CASE STUDY

By Kelly A. Burks-Copes, PhD, US Army Engineer Research and Development Center

Rising seas now threaten the resilience and sustainability of our nation's coastal zones. While coastal communities are likely aware of their vulnerabilities under today's climate, demonstrable risk-based tools are needed to help proactively adapt their systems to meet the increasing risks under the "new normal" future climate change poses. To meet this challenge, the US Army Engineer Research and Development Center (ERDC) (with funding from the Strategic Environmental Research and Development Program – SERDP) developed a method to quantify risks of coastal storm impacts on critical infrastructure for the new norm. Their [report](#) describes the development of a rigorous, yet flexible solution – a risk-based assessment that quantitatively evaluates threats under a range of sea-level rise scenarios (ranging in half-meter increments from 0.0 meters (m) – 2.0 m) in combination with a series of coastal storms (ranging from 0- to 100-year return intervals).

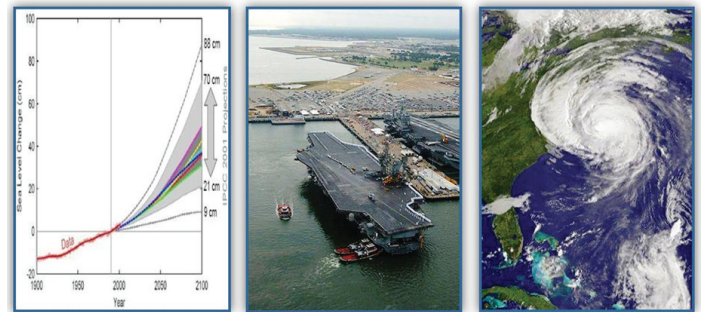
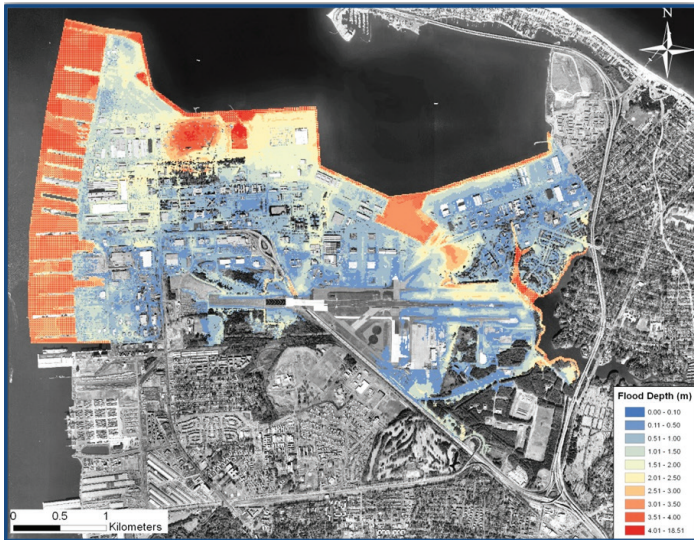


Photo of sea level rise, Naval ships, and storms. Source: Kelly A. Burks-Copes

Using Naval Station Norfolk (NSN) in Virginia as a test case, ERDC deployed a series of coastal storm models to characterize the magnitude and intensity of the threats, and assigned fragility values to their critical infrastructure to capture the risks to system resilience using a customized Bayesian network. ERDC's results show that sea level rise will be a significant and pervasive threat multiplier to installation sustainability, significantly increasing loadings on built infrastructure, and dramatically reducing their ability to continue operations. Mission performance on NSN decreases considerably when sea level increases from 0.5 m to 1.0 m, which indicates that a threshold or "tipping point" exists where the majority of the base's systems are likely to be incapacitated once sea levels exceed 1.0 m. In other words, minor impacts to critical infrastructure under today's conditions might cause 1 to 2 hour delays in operations, but under the new normal of 1.0 m sea level, these impacts could result in a catastrophic event requiring weeks or even months to recover system operability.

*ERDC's results show that sea level rise will be a significant and pervasive threat multiplier to installation sustainability...*



100 year storm with 0m sea level rise. Source: Kelly A. Burks-Copes



100 year storm with 2.0m sea level rise. Source: Kelly A. Burks-Copes

The findings support a shift from the status quo to a more proactive management strategy that anticipates and prevents system downtime. The capabilities developed in this study allow natural resources managers to evaluate relative performance under a variety of scenarios, including adaptive measures that would sustain critical infrastructure and improve system-wide resilience. Managers now have a scientifically defensible method to communicate potential risks that justify proactive change, and support policymakers in developing guidance to promote sustainability in the face of coastal storms and rising sea levels.



Alaskan caribou are constantly on the move, traveling long distances in search of adequate food. Rising temperatures are causing hotter wildfires in Alaska, which could change the caribou's habitat and winter food sources.

Source: Jacob W. Frank

## PILOT WORKSHOP HELPS DEVELOP A CLIMATE INFORMED MONITORING STRATEGY IN RESPONSE TO CLIMATE CHANGE

By Dawn M. Lawson, SPAWARSCEN Pacific, Environmental Sciences, and Applied Systems Branch; Carolyn Enquist, Department of the Interior Southwest Climate Science Center, US Geological Survey, Tucson, AZ; Robert Wolf, Tierra Data, Inc.; Christy M. Wolf, Conservation Program Manager, Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, CA; Julie Lambert and Lisa Ordoñez, Soil Ecology Research Group, San Diego State University, CA

Climate Informed Monitoring (CIM) is a climate change adaptation strategy that supports development and delivery of essential climate and biodiversity data sets that, ultimately, enable more robust decision-making in the face of climate change. The approach includes a process for evaluating,

adjusting, and optimizing existing monitoring programs to facilitate tracking ecological change and evaluating efficacy of management actions. This article provides an overview of CIM, and describes the use of a pilot workshop to test methods and a process for implementing it, and evolving nature of climate science, regulatory imperatives, budgets, and day-to-day demands, land managers are struggling with adaptation planning and implementation (Stein et al. 2014). DoD natural resource programs face a particular challenge from climate change due to: (1) the high density of endangered species on DoD lands (Stein et al. 2008), (2) a military readiness mission that can make avoiding impacts to listed species difficult, and (3) the need to comply with endangered species regulations.

With the uncertainties surrounding climate change and its effects on biological systems, monitoring is more important than ever, and existing natural resource monitoring programs offer an excellent platform to improve DoD's adaptive capacity to address climate change. Endangered species conservation programs include surveys and monitoring, which allow DoD to minimize and, in some cases, avoid mission impacts, and to track management decision effectiveness over time. DoD natural resource programs can implement CIM to take advantage of existing monitoring programs while focusing on mission priorities and threats.

The CIM programs will strengthen interactions with the US Fish and Wildlife Service, who is committed to taking the threat of climate change into account in the Endangered Species Act-driven consultations. The information developed will help focus on the actual threats to listed species and thus, redirect priorities if threats shift. Supporting optimal decisions for conservation and ecosystem management, CIM will promote cost-effective programs and ultimately enhance military mission sustainment.

Lessons learned from two test cases in coastal southern California form the basis of how to implement the CIM approach in a workshop format. The CIM development team held an initial two-day Climate Change Adaptation workshop at Naval Weapons Station Seal Beach Detachment Fallbrook (Enquist et al. 2013, Lawson et al. 2014), followed by a second one-day CIM-specific workshop at Marine Corps Base Camp Pendleton

(MCBCP). Both workshops focused on coastal sage scrub and riparian habitats as management priorities. Seventeen people from MCBCP, Marine Corps Air Station Miramar, US Fish and Wildlife Service, US Geological Survey, and University of California-San Diego participated. When finalized, a detailed summary of the CIM workshop (Lawson *in prep*) will be uploaded to the [DENIX Natural Resources site](#).

### Approach

Our framework for CIM includes the following steps:

1. Develop a conceptual (basic) model of ecosystem function under existing threats and stressors.
2. Modify the basic model (extended model) to include plausible scenarios of projected threats and stressors from climate change.
3. Develop a comprehensive summary of current monitoring efforts related to potentially affected natural resources (focal resource(s)), and select a subset for evaluation.
4. Evaluate the selected subset of monitoring efforts against suite of "essential" climate and biodiversity variables.
5. Identify gaps in existing monitoring programs and potential new monitoring initiatives in light of anticipated effects of climate change.

### Conclusion

Climate change adaptation planning and implementation is particularly challenging due to high complexity and high uncertainty. A CIM approach can help reduce the uncertainty associated with climate change. The military's conservation programs are already laden with regulatory driven monitoring programs resulting in limited flexibility. The CIM framework allows us to work within that reality, ensuring that monitoring remains focused on current priorities while developing information on emerging threats.

CIM workshops can help installation managers evaluate their existing natural resources programs by using climate-monitoring data to develop adaptation strategies for addressing climate change impacts to DoD facilities and resources. Regional efforts would identify opportunities for installations to collaborate on data collection and analyses and help DoD natural resources managers prepare for and cope with the challenges of current and future climate change.



Source: US Fish and Wildlife Service

Puffins are experiencing population declines in the United States due to difficulties in finding their two major food sources: white hake and herring. As ocean temperatures increase, these fish species are moving into deeper waters or further north, making it harder for puffins to catch their prey.

### WEBINAR SPOTLIGHT

## IDENTIFYING CLIMATE RESILIENT TERRESTRIAL LANDSCAPES IN THE PACIFIC NORTHWEST

By Chris Khoury, Booz Allen Hamilton

The Nature Conservancy (TNC) released a [report](#) in July 2015 that details a new approach to identifying key areas for conservation based on land characteristics such as soil, topography, and landforms, which increase diversity and resilience and that will not be adversely affected by climate change.



Pacific Northwest regions included in the study.

Source: The Nature Conservancy

TNC's goal with this project is to identify areas in the Pacific Northwest that collectively and individually best sustain native biodiversity, even as the changing climate alters current species distribution patterns, to guide future conservation investments. By mapping key geophysical features and evaluating all occurrences of those features that

buffer against climate change impacts, stakeholders can identify land characteristics that are most resilient to climate change.

The mapping effort focused on two central premises: (1) land characteristics that underlie the distribution of biodiversity, and a region's biological richness is due, in part, to this geophysical diversity; and (2) topoclimate diversity and local permeability convey a level of resilience to a landscape or site.

Stakeholders can use this information for conservation planning in a variety of ways, including using resilience data to update ecoregional assessments and inform conservation/management actions on public lands. Stakeholders can also use this information to help assess the conservation status of resilient land facets in existing conservation portfolios, and prioritize under-protected land based on conservation risk, resilience, and ownership patterns.

For more information on the project and a full version of TNC's report, please visit <http://nature.ly/resilienceNW>.



The Readiness and Environmental Protection Integration (REPI) program's Webinar Series is brought to you by the DoD in partnership with the Land Trust Alliance. REPI's webinar series features best practices, tutorials and knowledge sharing on REPI partnerships that support the military mission and accelerate the pace and rate of land conservation. Visit [REPI's web portal](#) for information on upcoming webinars.

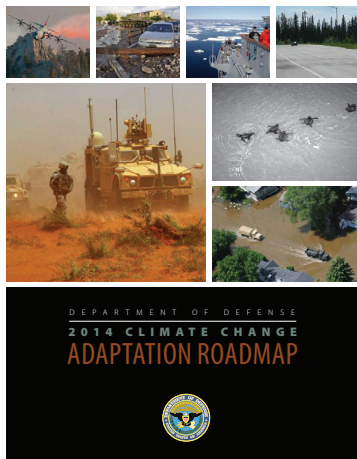
The DoD Natural Resources (NR) Program's webinar series aims to share interesting and informative topics and projects related to natural resources with the larger DoD NR community. The webinar series features bimonthly presentations from speakers representing DoD Partners in Amphibian and Reptile Conservation, DoD Partners in Flight, and Legacy, Strategic Environmental Research and Development Program, and Environmental Security Technology Certification Program projects. Visit the [DoD NR Program](#) and [DoD PARC](#) web portals for information on upcoming webinars.

## DOD'S CLIMATE CHANGE ADAPTATION AND RESILIENCY EFFORTS

by E. Rebecca Patton, PMP, Climate Change Adaptation Integration, OASD (EIE)/ESOH

The foundation for DoD's strategic policy on climate change adaptation began with the publication of the [2010 Quadrennial Defense Review \(QDR\)](#) report, which recognized that climate change was a threat to national security. The [2014 QDR](#) reaffirms DoD's position: "The impacts of climate change may increase the frequency, scale, and complexity of future missions, including Defense Support to Civil Authorities, while at the same time undermining the capacity of our domestic installations to support training activities."

The third [National Climate Assessment](#), published in May 2014, notes that certain types of weather events have become more frequent and/or intense, including heat waves, heavy downpours and, in some regions, floods, and droughts. Sea levels are rising, oceans are becoming more acidic, and glaciers and arctic sea ice are melting. Scientists predict these changes will continue and even increase in frequency or duration over the next 100 years.



Cover of the 2014 DoD Climate Change Adaptation Roadmap. Source: US Navy photo

In the 2014 DoD Climate Change Adaptation Roadmap, DoD recognized these climate-related effects are already being observed at installations throughout the US and overseas, and affect many of DoD's activities and decisions related to future operating environments, military readiness, stationing, environmental compliance, natural resources stewardship, and infrastructure planning and maintenance.

Specifically, climate change is predicted to affect DoD impacting low-lying coastal installations and ranges from coastal erosion and inundation due to sea-level rise and storm surge;

- Limiting outdoor training due to projections of more frequent and extreme heat conditions (heat conditions and shifts in precipitation patterns may also intensify the risk of wildfire, which can have direct impacts to fidelity of training ranges);
- Increasing threats to federally protected species which may affect natural resources management obligations at military installations and ranges; and
- Limiting the availability and quality of ranges and other lands needed for training operations, which may impact military activities and operations.

During the past year, DoD has completed an inventory of all DoD-level directives, instructions, and procedures to identify where climate change considerations should be incorporated. DoD screening level vulnerability assessment surveys are underway world-wide, and were completed in September 2015. During fiscal year 2014, DoD updated its Climate Change Adaptation Roadmap and identified specific actions to strengthen planning for natural resource management efforts. DoD's long-standing stewardship of its natural resources is articulated through its Integrated Natural Resource Management Plans. As appropriate, DoD will seek refinements to existing processes and develop new climate-specific plans and guidance to ensure a ready and resilient DoD for the future.



Source: National Park Service

In 2008, polar bears were the first species to be listed as threatened under the Endangered Species Act because of projected population declines from the effects of climate change. They are impacted

by the loss of sea ice habitat attributed to Arctic warming, which they rely on for hunting and for traveling across large home ranges they require for foraging habitat.

## ENCOURAGING CLIMATE-SMART CONSERVATION ON MILITARY INSTALLATIONS

By Bruce A. Stein, Senior Director, Climate Adaptation and Resilience, National Wildlife Federation

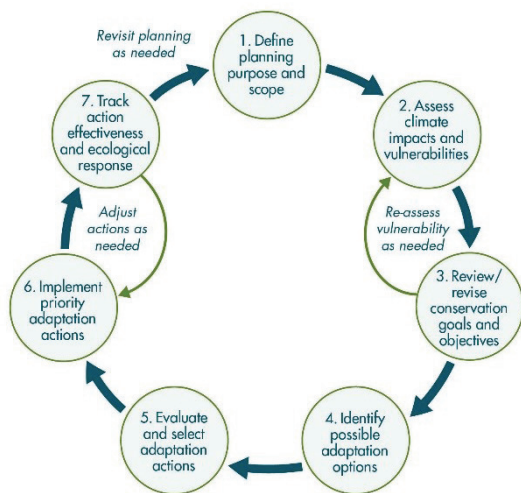
With climate change already affecting military installations across the country, the Department of Defense (DoD) natural resources managers need to incorporate climate considerations into their planning and management. Climate adaptation, a newly emerging discipline, focuses on preparing for and adjusting to these climatic changes and their impacts, but it is not yet widely understood. For instance, how does adaptation differ from current conservation approaches? Similarly, what existing practices continue to make sense in the face of climate change, and when are new or novel strategies necessary?

To encourage adoption of climate-informed natural resources management, an interagency Climate-Smart Conservation Workgroup developed the guide [Climate-Smart Conservation](#):

Putting Adaptation Principles into Practice (Stein, et. al, 2014). Since there is no one-size-fits-all solution to adaptation, the guide offers a generalized framework that natural resources managers can draw on to incorporate in their own planning processes. In this way, resources managers can integrate climate adaptation into existing planning efforts (e.g., Integrated Natural Resource Management Plans), taking into account the local ecological, climatic, and social context. Above all, natural resources managers should understand adaptation as an ongoing process, rather than as a fixed endpoint.

At the heart of the climate-smart approach to conservation are four overarching principles:

- Act with intentionality; link actions to climate impacts
- Manage for change, not just persistence
- Reconsider goals, not just strategies
- Integrate adaptation into existing work



The climate-smart conservation cycle offers a generalized framework for adaptation planning and implementation.

These principles provide high-level guidance for how to think about and carry out adaptation, but the guide also offers a stepwise process for putting these principles into practice. The climate-smart conservation cycle (see figure) offers a generalized framework for adaptation planning and implementation. By design, the cycle is similar to many existing conservation planning and adaptive management approaches, but includes some explicitly climate-oriented elements. Assessing climate change vulnerability (Step 2), for instance, serves as the basis for “linking actions to climate impacts.” Similarly, reconsidering goals and objectives in light of climate vulnerabilities (Step 3) provides a needed check on whether existing management goals are feasible in light of climate impacts, or whether they may require refinement or modification.

Adapting to a changing climate is essential for military installations to continue supporting the nation’s military readiness needs. Doing so requires a willingness to be both intentional and innovative in constructing forward-looking and climate-informed management strategies. The adaptation guidance offered in *Climate-Smart Conservation* can help military resource managers successfully rise to this challenge.

**Note:** The US Fish and Wildlife Service’s National Conservation Training Center offers a [training course in Climate-Smart Conservation](#) based on concepts from the guide.

## CLIMATE CHANGE PREPAREDNESS & RESILIENCE PLANNING: ARMY’S PARTICIPATION IN THE DOD PILOT INITIATIVE

By E. Rebecca Patton, PMP, Climate Change Adaptation Integration, OASD (EIE)/ESOH

The DoD is hosting a series of pilot projects to support the Council on Environmental Quality’s initiative to help prepare communities for the impacts of climate change. Through these pilots, DoD is collaborating with other federal and state agencies, and their surrounding communities to assess region-specific vulnerabilities to climate change, and to develop adaptation plans aimed at increasing their collective resilience. This effort will advance preparedness planning and create models for other agencies and communities to follow.

The Michigan Army National Guard (ARNG) was selected as the Army’s pilot (the Navy pilot is in conjunction with the Greater Hampton Roads, Virginia effort led by Old Dominion University and the Air Force pilot is Mountain Home Air Force Base in Idaho). In September 2014, the Michigan ARNG reached out to representatives from government agencies at the federal, state, and local levels, academic institutions, and non-governmental organizations to request their participation in this collaborative planning effort. Many of these organizations, together with the Michigan ARNG, participate in the Michigan Climate Coalition. Based on those early discussions with their planning partners, the Michigan ARNG determined that Fort Custer, Camp Grayling, and Selfridge Air National Guard Base would undertake sequential planning efforts for the three primary National Guard land assets in Michigan, each with different geographic settings and potential climate change vulnerabilities.

The Michigan ARNG is completing a robust adaptation plan for the three sites, using the information developed during their respective planning charrettes. The plans will include an overview of the three sites, stand-alone sections for each site that summarize the site’s vulnerabilities, and lay out adaptation strategies and actions to address those vulnerabilities. While the plan is specific to the Michigan ARNG, it will address shared vulnerabilities and is intended to support greater resilience for the military installations and agencies that participated in the planning process. The Michigan ARNG will make the plan publically available to other agencies, organizations, and interested citizens via their [website](#).

## ASSESSING IMPACTS OF CLIMATE CHANGE ON COASTAL MILITARY INSTALLATION: A SHORT HISTORY FROM THE R&D PERSPECTIVE

John A. Hall, Ph.D., Program Manager for Resource Conservation and Climate Change, Strategic Environmental Research and Development Program (SERDP)/Environmental Security Technology Certification Program (ESTCP)

Toward the end of George W. Bush Administration’s second term, the DoD Strategic Environmental Research and Development Program (SERDP) was green-lighted to move into the area of climate change-related research as it affected DoD interests. Where to start with such a complex issue was answered in part by asking the question: Where does DoD have the most

obvious and broadly applicable vulnerability? The answer: the coastal environment. As a result, SERDP began a series of research projects in 2009 to identify the types of data, models, and tools, as a function of coastal site setting and regional climate (e.g., different storm environments), needed by the Military Services to conduct climate change vulnerability and impact assessments for coastal military sites. Study areas included:

- Sites with different types of barrier islands and coastal marsh dynamics (Eglin Air Force Base, FL, and Marine Corps Base Camp Lejeune, NC),
- Tidal basin areas subject to recurrent flooding issues (Hampton Roads area and Naval Station Norfolk, VA) (please see Kelly A. Burks-Copes' article, Quantifying Risks to Coastal Communities Threatened by Climate Change and Sea Level Rise: Naval Station Norfolk Case Study on page 7), and
- Southwestern California sites subject to unique wave forcings (Naval Base Coronado and Marine Corps Base Camp Pendleton).

SERDP synthesized the policy, technical, and institutional considerations from the research in an early 2013 report [Assessing Impacts of Climate Change on Coastal Military Installations: Policy Implications](#). Some of the key considerations SERDP identified included the need for selecting and applying future condition scenarios (including for sea-level rise), accounting for regional variation, and addressing data quality and uncertainty issues. When DoD was considering what initial directions to take under its [Climate Change Adaptation Roadmap](#), the SERDP coastal studies provided sufficient background information to support conducting vulnerability assessments at DoD coastal sites. Initially, this involved a baseline survey approach that queried installations about current vulnerabilities and asked "what if" questions.

To understand how sea-level rise affects coastal DoD installations, global sea-level rise scenarios must be adjusted so they can be applied at the regional/local level. Therefore, the DoD Climate Change Adaptation Working Group chartered a multiple agency working group, the Coastal Assessment Regional Scenario Working Group (CARSWG), to develop regionalized scenarios of sea level change and extreme water levels (i.e., storm surge relative to average high water for different annual exceedance probabilities or return intervals). The CARSWG prepared regionalized scenarios for 1,774 coastal or tidally influenced military sites worldwide. Office of Secretary of Defense and Military Services personnel recently completed Beta testing a database and associated Graphical User Interface containing scenario information. Concurrently, the CARSWG has been completing work on an accompanying technical document and preparing for its external peer review. SERDP expects the CARWG will complete the entire effort by early 2016.



Source: US Geological Survey

Sea turtles and their nesting sites are vulnerable to climate change impacts including sea-level rise, increased storminess, and changing temperatures. Current nesting and foraging sites

could become unsuitable for federally threatened and endangered sea turtle species, including endangered loggerhead sea turtles.

## AIR FORCE PLANNING FOR CLIMATE CHANGE

By Daniel Kowalczyk and Michelle Brown, Office of the Assistant Secretary of the Air Force (Installations, Environment and Energy)

US Air Force (USAF) installations around the country experience, plan, and prepare for the effects of extreme weather events and other natural hazards to minimize their disruptive impact on USAF operations. Changing climate conditions such as rising temperatures, changing precipitation patterns, drought, wildfires, rising sea levels, and other climate stressors will have both direct and indirect impacts on USAF operations and the built and natural infrastructure that supports them. The National Climate Assessment predicts such climate stressors will increase in frequency and intensity in the coming decades. This will challenge our ability to maintain the efficiently operated, ready, and resilient installations that provide for current and future mission capabilities. Summarized below are several examples of planning activities and actions the USAF has initiated to understand, prepare for, respond to, and adapt to changing climate conditions.

### The Changing Arctic and Coastal Erosion: Alaska Coastal Erosion Study

A historical trend analysis at the Point Lonely Former Short Range Radar Site observed little erosion prior to 1979, but from 2011 to 2014, erosion rates were over 100 feet per year in specific areas of the installation's shoreline. This observation prompted the Air Force Civil Engineer Center (AFCEC) to conduct a preliminary coastal erosion study. AFCEC developed a scientifically repeatable process to characterize and forecast the vulnerability and risk that climate-induced accelerated erosion rates have on the long-term viability of three Air Force early warning locations on the Arctic coast – Barter Island Long Range Radar Site (LRRS), Oliktok LRRS, and Cape Lisburne LRRS. In assessing the vulnerability and risks, the study considered the impact to airfields, radomes (a structural, weatherproof enclosure that protects a microwave [e.g., radar] antenna) and other infrastructure assets that are fundamental to the LRRS mission. The study also considered the impact to areas of environmental concern such as landfills, threatened and endangered species and their habitats, cultural resources, and other sites regulated by state and federal officials. AFCEC will use information from the study to update existing land use management plans, and potentially support more detailed vulnerability assessments for installations determined to be most at-risk. Ultimately, the process will help the 611th Civil Engineer Squadron evaluate the long terms risks from coastal erosion and make management decisions to enhance the resiliency of USAF early warning assets.



Coastal Erosion near an Air Force Early Warning Site. Source: US Air Force

## Planning and Installation Development Plans (IDPs)

Similar to local government master plans, USAF installation development plans (IDPs) are an integral part of the comprehensive planning process that guides development on USAF installations. The IDP provides a complete view of installation systems, and helps personnel understand opportunities and constraints associated with siting new facilities. Plan development is “top down” with the IDP prepared first, then area development plans, then site-specific plans. The concepts and principles of sustainable planning are mandatory elements of the USAF planning process, and IDPs evolved to include Sustainability Development Indicators (SDIs). SDIs and their associated metrics serve to integrate sustainability into planning processes. USAF can use SDIs as measurement and predictive tools along with other information to inform the planning process and assess the impacts of planning actions. There are 18 SDI categories to address a number of sustainability areas, including energy, water, solid waste, facilities, and space optimization, to name a few. The USAF recently added climate vulnerability to the External Sustainability category. Climate metrics address factors such as flooding, temperature rise, changing precipitation patterns, water supply stress, and droughts.



Source: US Fish and Wildlife Service

Piping plovers breed and nest along the Atlantic Coast, the Great Lakes, and the Great Plains. This shorebird's nesting grounds, located along the Atlantic Coast, are being increasingly degraded due

to sea-level rise and storm surges, which contribute to coastal erosion.

## Installation Complex Encroachment Management Action Plans (ICEMAPs)

In the USAF, the “installation complex” constitutes the land, facilities, airspace, and ranges that provide direct mission support or are managed by the installation. The USAF Installation Complex Encroachment Management Action Plan (ICEMAP) initiative assists Headquarters Air Force and installation commanders and staff in understanding potential threats to the installation's mission. ICEMAP assists in developing comprehensive action plans to deal with encroachment challenges on and off installations. ICEMAPs have 13 encroachment and sustainment challenge areas that address natural factors and climate effects. The natural factors/climate effects category encompasses weather or disasters (both short- and long-term), including severe weather (e.g., hurricanes, tornados and wildfires), natural disasters (e.g., earthquakes), and coastal erosion.

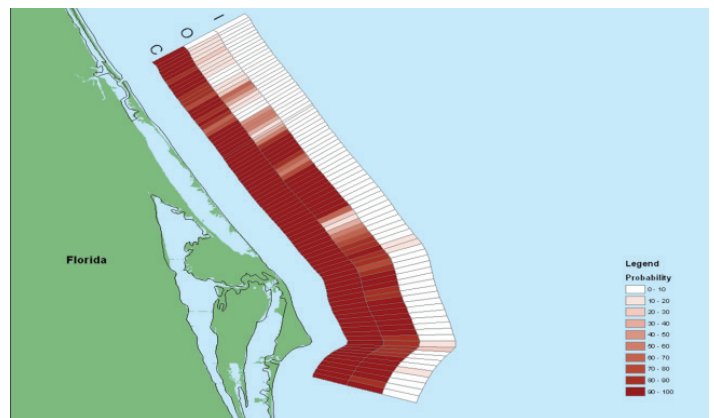
### Cape Canaveral Air Force Station

Cape Canaveral Air Force Station (CCAFS) is the operational hub for the USAF's Eastern Range, managed by the 45th Space Wing (45SW). Naturally occurring coastal processes routinely influence the installation's dune and coastal habitats that are home to 11 federally listed, threatened, and endangered species, including two globally threatened and state imperiled plant communities. Impacts associated with climate change can further increase risk to this fragile barrier island ecosystem and could result in significant effects to infrastructure, national access to space,

the DoD mission, and threatened and endangered species' habitat. In collaboration with the National Aeronautics and Space Administration (NASA) Kennedy Space Center (KSC), the 45SW developed a comprehensive list of vulnerabilities common to the launch/launch support complex, operations, and natural resources on the Florida space coast, and began development of flexible adaptation strategies.

One outcome focused on storm surge and coastal erosion, and their impact both on protective sand dunes managed for threatened and endangered species purposes, and impacts to the built infrastructure that supports launch operations. Breaching of these dunes, which currently occurs during some storm events, could result in catastrophic overwash of the barrier island; this could also threaten critical rail and other infrastructure on CCAFS and KSC. As an adaptation measure, the 45SW constructed a dune feature adjacent to the shoreline at Launch Complex 37, the Delta IV launch facility. The USAF and NASA cooperated on a construction project to build a secondary protective dune adjacent to the Space Shuttle launch pads on KSC. The dune was stabilized with vegetation, which also increases its resiliency to the erosive effects of wind, rain, and wave action.

45SW personnel also evaluated historic hurricane and storm surge information, identifying launch site locations that could be at risk from projected climate change. Armed with such information, the portion of the IDP governing long-term development was modified to locate future Launch Pad and support facilities further away from the shoreline. The area has a very complex offshore region consisting of near-shore sand bars, oblique sand ridges (north of the Cape), and vast shoals that extend from the Cape itself. Knowing how these sand bodies interact with waves and the coastline is crucial for any type of reasonably accurate prediction of short-term (e.g., hurricane, tropical storm, etc.) and long-term (e.g., sea-level rise) erosion and storm surge hazards. To develop this information, the 45SW contracted with the US Geological Survey to conduct a detailed bathymetric survey to provide details of the underwater topography. The bathymetry maps can be used for storm surge prediction, coastal inundation risk assessment, highlighting areas particularly susceptible to erosion, and general evaluation of associated coastal vulnerabilities and hazards.



Category 1 Hurricane Probability at CCAFS Based on Bathymetric Survey. Source: US Air Force

### Eglin Air Force Base (AFB)

The DoD Strategic Environmental Research and Development Program funded a study to develop a comprehensive database on historic changes in shorelines and barrier island morphology for Eglin AFB's Santa Rosa Island. Understanding the local

geomorphology, as well as the flooding, overwash, erosion, and sedimentation impacts of previous storms informed the development of predictive models for future large storms or hurricanes. When coupled with future sea level rise scenarios, the models can characterize the level of storm event impacts to natural systems, built infrastructure in the coastal zone, and assess the intrusion of salt water into freshwater aquifers.

## CLIMATE CHANGE TOOLS

There are a lot of climate change modeling tools out there. Here are a few:

- [Atlas Almanac](#) is a reference and research tool, containing 63 plates that display various types of climate change and weather graphics, information, and resources including graphs, charts, and maps. (NASA)
- [Climate Registry for the Assessment of Vulnerability \(CRAVe\)](#) is a web-based community resource that houses information on the climate related vulnerability of various natural and human resources. (USGS)
- [Climate Wizard](#) displays maps containing historic data and future predictions for temperature and rainfall events. (TNC)
- [Collaboratory for Adaptation to Climate Change](#) serves as a research, education, and collaboration resource for climate change data. (NSF)
- [Integrated Climate and Land use Scenarios \(ICLUS\)](#) explores different projections for future changes in human population and housing density using peer-reviewed storylines of population growth and economic development. (EPA)
- [Riparian Restoration Tool](#) allows natural resources managers to identify areas vulnerable to climate change along the banks of streams, rivers, and lakes to coordinate and implement restoration projects in those areas. (Appalachian Landscape Conservation Cooperative)
- [US Climate Resilience Toolkit](#) provides information and scientific tools to the public to help manage climate-related risks, opportunities, and improve resilience to extreme events. (NOAA)

## 2016 NMFWA ANNUAL TRAINING WORKSHOP

By Todd Wills, Immediate Past President, National Military Fish and Wildlife Association

The [National Military Fish and Wildlife Association \(NMFWA\)](#) will hold its annual training workshop March 14-18, 2016, in Pittsburgh, Pennsylvania, in conjunction with the [81st North American Wildlife and Natural Resources Conference](#). NMFWA provides a unique and valuable training opportunity for DoD natural resources professionals. The workshop allows attendees to maintain their professional certification, facilitate compliance with Sikes Act requirements, discuss program accomplishments and challenges, and meet and share information related to DoD conservation programs on military installations with other DoD natural resources professionals. The current workshop allows military natural resource professionals the opportunity to interact face-to-face with federal and state fish and wildlife agencies and non-governmental organization stakeholders and partners.

The annual training workshop will include Military Service breakout sessions during which leadership from each Service will engage participants by providing program updates, priorities, and issues of interest. There will be workshops and technical sessions related to climate change, pollinators, invasive species, endangered species, bats, marine conservation, forestry, migratory birds on DoD lands, conservation law enforcement, and recreational hunting and fishing. Also planned are a daylong training course taught by US Fish and Wildlife Service instructors from the National Conservation Training Center, and meetings of the DoD Partners in Amphibian and Reptile Conservation and DoD Bird Conservation.

The workshop agenda and registration information are available at [www.nmfwa.net](http://www.nmfwa.net).



Salmon require cold, fast-flowing streams to spawn. Climate change is impacting salmon by changing stream flow and warming waters in the Pacific Northwest.

## WHAT'S HOPPIN' IN DOD PARC: FALL 2015 UPDATE

By Robert E. Lovich, Ph.D., DoD PARC National Technical Representative and Chris E. Petersen, DoD PARC National Representative

It has been a year of accomplishments for DoD Partners in Amphibian and Reptile Conservation (DoD PARC), and 2015 was filled with progress on a number of important projects. With the endorsement of the *Strategic Plan for Amphibian and Reptile Conservation and Management on Department of Defense Lands* early this year, we are finalizing the formatting and layout of this important document. We have made great progress on this task, and the Plan is nearing completion. We anticipate having printed versions of the document available at the 2016 National Military Fish and Wildlife Association meeting, and digital versions online at the [DoD Natural Resources website](#) this fall.

As we reviewed dozens Integrated Natural Resource Management Plans (INRMPs) to develop lists of amphibians and reptiles for our inventory of herpetofauna on military lands, we found that there was significant variation in the treatment of amphibians and reptiles in these important documents. As a result, we drafted guidelines and recommendations for updating and revising INRMP sections pertaining to herpetofauna. We intend to finalize the guidelines by the end of the year, and make them available to natural resources managers to use when updating and developing INRMP sections specific to amphibians and reptiles.

Training is important, and helps us stay educated and relevant on respective topics. We recognize that the natural resource community would benefit from an online training course regarding the conservation and management of amphibians and reptiles on military lands. Therefore, over the next year, DoD PARC will develop an online training course on amphibians and reptiles. The course will present information about the basics of herpetology, and how to manage and conserve amphibians and reptiles on DoD lands.

DoD PARC members have nearly completed a yearlong effort to update the herpetofauna species lists for 80 US Air Force installations having analyzed data based on species occurrence (number of confirmed or potential [unconfirmed] species); federal, state, and NatureServe status; and occurrence of non-native species. Members also documented the presence or absence of venomous reptiles on each installation. Recently, we submitted draft project deliverables (updated species list spreadsheet, summary report, and venomous snake poster) to the Air Force for review. Final products should be available by December 1, 2015.

Our analysis revealed that Air Force installations support 442 species (336 confirmed and 106 potential) making herpetofauna biodiversity on Air Force installations greater than that of both the US Navy and Marine Corps individually. Of those populations, approximately one-half of the total native biodiversity of all herpetofauna species documented in the continental United States inhabit Air Force installations.



*Don't Tread On Me Marine Corps Logistics Base Albany poster.*  
Source: DoD PARC

*Detector Dog Surveys for Eastern Indigo Snakes on three Navy Installations in Northern Florida* webinar on October 15, or *Using the Endangered Species Act to Protect Rare Amphibians and Reptiles* on November 5, you can [view the recording](#). We hope you will join us for our December and January webinars. We have exciting speakers and topics lined up for several months to come.

If you would like more information on any of the projects listed above, or if you would like to participate in any DoD PARC related projects or activities, please contact [Chris Petersen](#) or [Rob Lovich](#) or visit the [DoD PARC website](#).

## NATURAL RESOURCES DOCUMENTS

Highlighted here are reports, fact sheets, spreadsheets, and presentations on the Natural Resources page of the [DENIX site](#). These documents are designed to provide direct benefit to the mission and installation Natural Resource Managers by transferring knowledge and results of high priority natural resources efforts.

### [Seed Banking Federally Listed Mainland Plant Species on DoD Lands – Fact Sheet and Report \(Legacy 10/11/12-101\)](#)

The Center for Plant Conservation (CPC) conserves species from extinction through active programs in seed banking, plant propagation, and other related conservation work. CPC

programs collected and secured seed material from federally listed mainland plant species that occur on DoD lands. The organization, through its network of participating institutions, successfully collected 148 seed samples from over 60 rare plant species found on federal lands. CPC efforts will increase DoD's flexibility to manage future biodiversity on DoD lands.

### [Evaluation of Mechanical Mid-story Removal as a Tool to Restore Endangered Species Habitat– Fact Sheet, Report, and Tech Notes \(Legacy 12-109\)](#)

This project investigates the role of fire as an important disturbance in pine flatwood wetlands in the southeastern United States. Researchers focused on the effects of fire suppression on breeding habitats of reticulated flatwood salamanders, a federally endangered species, and other rare and declining amphibians. A century of fire suppression caused wetlands to produce high canopy cover and low herbaceous groundcover, which these species tend to avoid. Researchers evaluated potential vegetation management treatments and mechanical removal methods to see whether these techniques can mimic the effects of fire to create high-quality breeding habitat.

### [Meta-population Dynamics of Le Conte's Thrasher \(\*Toxostoma lecontei\*\): a Species At Risk on Three Southwestern Military Installations – Fact Sheet, Report, and Survey Protocol \(Legacy 12-343\)](#)

The Le Conte's Thrasher (LCTH) is considered a DoD Partners in Flight bird species of concern and is on the Tier 1 (high overall priority) Partners in Flight watch list. In the third year of this project, researchers sought to determine the distribution and occupancy of LCTH on southwestern military installations. Researchers studied movement patterns at Yuma Proving Ground and Barry M. Goldwater Range (BMGR) and used this data to improve the Prediction of Occurrence Model. This model will be used to identify areas where thrasher occupancy will most likely to occur. Researchers also studied juveniles' home ranges and moving patterns inhabiting BMGR to guide appropriate management decisions to reduce conflicts of this at-risk species while maintaining military readiness.

### [Identifying Migratory Routes and Wintering Grounds of Burrowing Owls that Breed on DoD Installations throughout the western US – Fact Sheet and Report \(Legacy 12-604\)](#)

This project focuses on the migratory routes and wintering grounds of burrowing owls that breed on DoD and partner properties. The project leverages DoD funds to foster partnership among national and international organizations to investigate these mysteries. Researchers coordinated with 20 partners in the western United States and Canada to deploy geolocators and satellite transmitters on 228 breeding burrowing owls at DoD installations and other sites. These two technologies allow the researchers to document migratory routes, migratory timing, and wintering grounds of burrowing owls that breed at each of these study sites.

### [Leveraging Land Condition Trend Analysis Data to Understand Vegetation Change on Military Installations – Fact Sheet, Report, and Transfer Plan \(Legacy 13-623\)](#)

The project explores how disturbances from military training, fires, and livestock grazing altered the vegetation on Yakima Training Center. Researchers applied new analytical techniques to leverage historical data to understand how these activities affect plant communities. The project identified and classified

## UPCOMING EVENTS CONFERENCES, WORKSHOPS, AND TRAINING

The Strategic Environmental Research and Development Program (SERDP) released its Fiscal Year 2017 Federal Call for New Start Proposals. The SERDP [memorandum](#) references 10 Statements of Need (SONs) for the Core Solicitation and three SONs for the SERDP Exploratory Development (SEED) Solicitation. Core pre-proposals are due no later than 2:00pm ET on **January 7, 2016**. SEED full proposals are due **March 8, 2016**. Please submit pre-proposals directly to SERDP via their [website](#). Complete proposal and submission instructions are available on the SERDP [website](#).

### 3rd Sea-Level Rise Summit

February 3-4, Ft. Lauderdale, FL

This meeting, with the theme "A Warming Arctic: Shared Futures from Alaska to Florida," will convene leading researchers, decision-makers, and other interested stakeholders to discuss the state of sea-level rise science, and how public policy and private adaptation efforts can lessen the impacts everywhere.

### 81st North American Wildlife and Natural Resources Conference

March 13-18, Pittsburgh, PA

Join the Wildlife Management Institute as they celebrate a century of conservation with other industry leaders dedicated to conservation, enhancement, and management of North America's wildlife and other natural resources. Special sessions include *Effects of Climate Change on Inland Fish and Fisheries: Looking Back and Moving Forward*, *2020 Vision: Federal Forest Management into the Next Decade*, and *Wildlife Governance Principles – Guidance for More Effective Wildlife Management*.

### 2016 DoD Natural Resources Annual Training Workshop

March 14-18, Pittsburgh, PA

The National Military Fish and Wildlife Association (NMFWA) will hold its annual training workshop in conjunction with the 81st North American Wildlife and Natural Resources Conference. This event provides a unique and valuable training opportunity for DoD natural resources professionals. Read more about the Workshop, on [page 13](#).

### Environmental Film Festival in the Nation's Capital

March 15-26, Washington, DC

The film festival includes showings and discussions of diverse environmental documentaries, narratives, animations, and short films throughout DC.

### Climate Leadership Conference

March 8-10, Seattle, WA

The annual Climate Leadership Conference convenes a global audience of climate, energy, and sustainability professionals to address climate change through policy, innovation, and business solutions. The 2016 event will accelerate climate solutions and a low-carbon economy.

### 26th Annual International Conference on Soil, Water, Energy, and Air

March 21-24, San Diego, CA

For the past 25 years, this conference has brought the environmental science community together by providing a forum to facilitate the exchange of information technological advances, new scientific achievements, and the effectiveness of standing environmental regulation programs.

### National Conference on Ecosystem Restoration (NCER)

April 18-22, Coral Springs, FL

NCER is a forum to share results on what restoration fundamentals and practices have worked, and bring new focus on those remaining challenges. It will allow for collaboration across agencies, non-governmental organizations, and the private sector, bringing together in one location the nation's leading experts in ecosystem restoration to ford new insights and advances to restore and protect ecosystems and habitats nationwide.

plant communities, identified areas of change, and evaluated the impact of disturbances on vegetation communities. The results clarify how human and natural disturbances altered the vegetation on this installation. This information will allow natural resource managers to have a better understanding how vegetation changes over periods and to identify future management techniques that would best support training activities.



The American pika lives at high elevations in cool, moist conditions. Pika populations are disappearing from areas that span from the Sierra Nevadas to the Rocky Mountains and are

migrating to higher elevations to avoid reduced snowpack and increasing temperatures. Unfortunately, pikas rely on limited, rocky-talus (piles of rocks that accumulate at the base of a slope) habitat, which gives them few options as temperatures continue to increase.

## LINKS OF INTEREST

### AFPMB

The Armed Forces Pest Management Board (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 DoD operations.

### CESU Network

The Cooperative Ecosystem Studies Unit (CESU) Network is a national consortium of federal agencies, tribes, academic institutions, state and local governments, and nongovernmental conservation organizations working together to support research, technical assistance, education, and capacity building. There are 17 CESUs which link DoD and other federal agencies, a host university, and partner institutions. One of the benefits of joining a CESU is a reduced, Network-wide Finance and Administration (i.e., overhead) rate of 17.5% for federal agencies.

### DENIX

The DENIX Natural Resources home page is an electronic environmental network and information exchange that provides access to natural resources information, such as Executive Orders, policies, guidance, INRMPs, fact sheets, and reports.

### DoD Biodiversity Handbook

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.

### DoD Invasive Species Outreach Toolkit

This site provides education and outreach materials 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 also is included.

### DoD Legacy Resource Management Program Tracker

The DoD Natural Resources (NR) Program funds high priority natural and cultural resources projects that have regional, national, and/or multi-Service benefits through the DoD Legacy Program. The Legacy Tracker lets users download fact sheets and reports for completed Legacy-funded projects.

### DoD Natural Resources Program

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. The website offers information on DoD's natural resources initiatives, programs, presentations, and links to other DoD conservation and natural resources sites.

### DoD PARC

DoD Partners in Amphibian and Reptile Conservation (PARC) is an inclusive 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.

### DoD PARC Group and Photo Site, DoD PIF Photo Library, DoD Natural Resource Photo Library

The three sites are designed to share pictures, news, information, and ideas with the DoD Natural Resources, DoD PARC, and DoD PIF communities. Members may use the websites to download photographs for reports, Power Point Presentations, and educational materials such as brochures and posters. There is also a forum for posting questions to group members, a calendar listing upcoming events, and a library where reports and documents are stored.

### DoD Partners in Flight

The DoD Partners in Flight Program supports and enhances the military mission while it works to develop cooperative relationships to ensure a focused and coordinated approach for the conservation of resident and migratory birds and their habitats.

### DoD Pollinator Initiatives

This website provides an overview of pollinators and the reasons they are important to DoD. It contains fact sheets and technical reports, how-to guides, resource lists, and more describing some of the simple ways that people can help pollinators and their habitats.

### REPI

Under Readiness and Environmental Protection Integration (REPI), DoD partners with conservation organizations and state and local governments to preserve buffer land and habitat around military installations and ranges as a key tool for combating encroachment. By promoting innovative land conservation solutions, REPI supports the military's ability to train and test at its lands now and into the future.

### SERDP and ESTCP

Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) harness the latest science and technology to improve environmental performance, reduce costs, and enhance and sustain mission capabilities. They are independent DoD programs managed from a joint office to coordinate the full spectrum of efforts, from basic and applied research to field demonstration. SERDP and ESTCP, in conjunction with the Legacy Program, support readiness, quality of life, adherence to legal mandates, and responsible environmental stewardship of natural and cultural resources.





# DOD NATURAL RESOURCES PROGRAM

**Enabling the Mission, Defending the Resources**

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