

Natural Selections

Department of Defense Natural Resources Program



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DOD SIGNS GUIDELINES FOR STREAMLINED INRMP REVIEW



On July 20, 2015, the Department of Defense (DoD) signed the *Guidelines for Streamlined Integrated Natural Resource Management Plan (INRMP) Review*. These guidelines clarify the process for reviewing and concurring on updates to existing INRMPs, as described in the recent Sikes Tripartite Memorandum of Understanding (MOU) signed in July 2013 by DoD, the U.S. Fish and Wildlife Service (USFWS), and the Association of Fish and Wildlife Agencies (AFWA). The MOU and these guidelines clarify a new process to facilitate faster review and approval of INRMPs requiring updates, reduce the number of non-compliant INRMPs, and improve coordination and collaboration among installation personnel and USFWS regional reviewers.

USFWS UPDATES GUIDELINES FOR COORDINATION ON INRMPs



In June 2015, USFWS enacted new guidelines for coordination on INRMPs, replacing the June 8, 2001 memorandum, *Guidance for Coordination of DoD Sikes Act INRMPs*. The Sikes Act directs the Secretary of Defense, in cooperation with USFWS, and the appropriate state fish and wildlife agencies, to prepare and implement INRMPs for DoD lands with significant natural resources. The new guidelines will serve as a reference for USFWS personnel when implementing INRMPs to conserve, protect, and manage fish and wildlife resources.

SPOTLIGHT: UNDERSTANDING WHY AND HOW NON-NATIVE PLANTS PROMOTE DESERT FIRES

By Claus Holzapfel, Rutgers University Newark, and Kirk A. Moloney, Iowa State University

Biological invasion, or the spread of non-native organisms, is happening rapidly worldwide. In many desert areas, this is resulting in a dramatic increase in the arrival and spread of non-native invasive species (NIS). Among the effects are alterations in fire regimes and direct negative impacts on native plant species performance. Prior to invasion, native annual plants were mostly restricted to nutrient-rich areas under desert shrubs, primarily *Larrea tridentata* (creosote). With Strategic Environmental Restoration Research and Development Program (SERDP) funding ([RC-1721](#)), our team researched the idea that some of the now dominant and problematic NIS

are able to spread into areas between shrubs, increasing the overall amount of vegetation, and thereby reducing a natural firebreak between shrubs.



Burning creosote bush – experimental fires at Fort Irwin in the Mojave Desert, June 2011. Source: Claus Holzapfel

We conducted observational and experimental studies in two contrasting desert sites (Fort Irwin, CA, in the Mojave Desert, and Barry M. Goldwater Range, AZ, in the Sonoran Desert) to develop detailed, landscape-scale, spatially-explicit population models to describe and predict fire in desert landscapes. The multi-year experiments examined the combined effects of fire, disturbance, and precipitation amounts on the demographics of native and NIS annual plants.

Continued on page 3

NATURALLY SPEAKING

From the Desk of L. Peter Boice, Deputy Director, DoD Natural Resources Program; Director, Legacy Program



Peter at the red-footed booby colony at Marine Corps Base Hawaii (formerly Kaneohe Bay).

Naturally occurring and human induced wildland fires present a serious risk to people, infrastructure, and the natural and cultural environment. Each year wildfires burn millions of acres in the United States.

The size, frequency, and intensity of these fires are unprecedented in recent times, and are likely to continue. Furthermore, changing conditions (e.g., climate changes, new invasive species) exacerbate fire threats – with more frequent and more intense fires becoming the norm.

On military training ranges, fires are inevitable. Many munitions commonly used by DoD are ignition sources; consequently, the number of potential fires on military installations are far greater than on most public lands.

A key way to reduce fire risk is through proactive fuels management, to include prescribed burns for the purposes of controlling invasive species and enhancing habitat. The responsibility for implementing prescribed burns rests with DoD's natural resources offices. Installation integrated natural resources management plans (INRMPs) describe prescribed burning requirements, including optimal timing for such burns. By performing these controlled burns, our natural resources managers reduce the fuel source for wildfires and minimize the risk of damage on DoD-controlled land. Prescribed burns and vegetation management may also allow military missions to continue throughout periods of high fire danger.

This issue of *Natural Selections* looks at various aspects of fire, including how non-native plants stimulate desert fire; fire reduction measures to promote ecological restoration of dry forests; fire dependent ecosystems and their relationships to birds and herpetofauna; fire and munitions models; and the Air Force's recently established Wildland Fire Center. It also looks at prescribed burning from the eyes of an installation natural resources manager and from a research perspective. Our authors also touch briefly on other topics that merit detailed consideration. The range of issues associated with wildland fire management is challenging and complex!

Our natural resources managers must deal with a wide array of biological, legal, and budgetary issues. For many of the conservation and management actions they plan, budget for, and execute, they must coordinate with military trainers, testers, and operators. It's no different for fire, where coordination must center on such issues as determining which munitions and ranges pose the greatest ignition risks; deciding when to implement prescribed burns for greatest effectiveness and safety; and recommending potential training modifications that could reduce ignition and fire risk without compromising training needs.

Together, we face many challenges moving forward, not least of which is to ensure our installations have adequate resources to address the growing fire risk. Our office will work to promote awareness, improve coordination, and develop enhanced tools. We welcome your comments and ideas on what would most help you.



An Army National Guardsman walks toward volunteer fire trucks on station battling an out-of-control fire south of Helena, MT. Source: Staff Sgt. Jack Holt, NGB.



"Crown fires" are spread by wind moving quickly across the tops of trees. "Running crown fires" are even more dangerous because they burn extremely hot, travel rapidly, and can change direction quickly.

Methods included burning individual shrubs, installing rainout shelters, irrigating plots to mimic changing rainfall amounts, and experimentally disturbing soils. Using data from the experimental studies, we also characterized spatial patterns of fertility and soil moisture availability. Based on initial parameters obtained in the experimental studies, we developed basic landscape-scale, spatially explicit simulation models.



Mimicking drought – one of the 28 rainout shelters at Fort Irwin in the Mojave Desert, September 2011. Source: Claus Holzapfel

Our results suggest that different processes have the potential to promote fire in the two contrasting desert sites. In the Mojave, the spread of invasive plants has the potential to promote fire. Whereas in the Sonoran Desert, native species also occupy the areas between shrubs and potentially provide enough fuel to carry wildfires in the absence of NIS.

Responses of annual plants to our treatments show the following overall trends:

- Fire increased annual biomass and favored NIS only in the Sonoran Desert
- Disturbance had strong increasing effects on biomass in both deserts
- Disturbance and decreasing rainfall favored NIS in both deserts

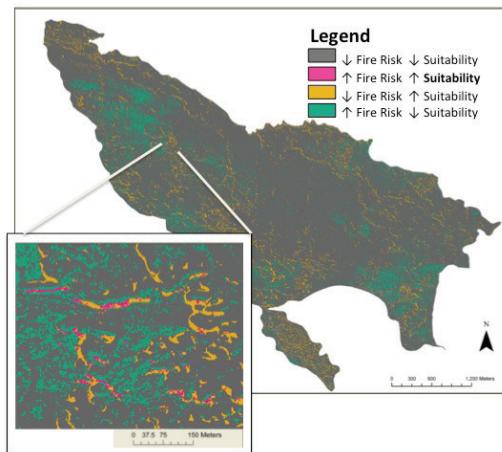
The simulation model, based on data from our experiments, demonstrates that even though increasing fuel loads lead to increasing potential of fire spread, there is still a lot of variability in the degree of spread that occurs from a localized fire source depending on the local distribution of fuels. This makes prediction of fire spread in any one location less precise when considering individual events. The results derived from this project's experimental and simulation-modeling approaches facilitate a better understanding of the association between annual plants and desert shrubs that may influence fire risk. They also provide insights into the different role some exotic species can play in fire spread when characterizing the Mojave and Sonoran Desert sites. This understanding is a solid first step in understanding the interaction of fire and soil disturbance in changing the likelihood of future fire occurrences through the direct influence on the creosote plant community.

INCREASING THE IMPACT AND SUCCESS OF ECOLOGICAL RESTORATION IN DRYLAND ECOSYSTEMS

By Susan Cordell, Research Ecologist, U.S. Forest Service

Tropical dry forest resources in Hawai'i and the Pacific are declining at alarming rates. This loss of habitat for threatened and endangered species is largely a result of fire, forcing land managers such as DoD to develop strategies to protect and restore these areas. We suggest that restoring woody canopy cover into this ecosystem is likely to reduce fire risk by altering fuel and microclimate conditions in ways that reduce the likelihood of fire ignition and spread. Since many fire-promoting alien grasses employ a C₄ photosynthetic pathway requiring high levels of light, canopy shade would decrease their productivity. (See [text box on page 4](#) for more information on C₄ photosynthesis.)

Examples of targeted restoration activities



Landscape analysis to target restoration

1. Restoration to reduce fuels: target areas with high fire risk and high suitability for plant growth (**pink**).
2. Restoration of endangered plant populations: target areas with low fire risk and high suitability for plant growth (**yellow**).
3. Physical fire barriers – target areas with high fire risk and low suitability for plant growth (**green**).

To assess restoration potential and aid planning for a dry forest landscape in Hawai'i, and with funding from the DoD Strategic Environmental Research and Development Program (RC-1645), we integrated field experiments and surveys with LIDAR, a remote sensing technology, and spectroscopic measurements from the Carnegie Airborne Observatory (CAO). Specifically, we analyzed the topography and canopy density from the CAO data combined with current microclimate measurements to identify areas with the greatest need for restoration and areas with high potential for restoration success. For example, areas in need of restoration had high invasive species cover, low native species cover, or conditions favorable to the spread of wildfire. Areas with high potential for restoration success had conditions favorable for plant growth, such as reduced wind speeds, greater water availability, and greater shade. We developed restoration planning tools for three dryland ecosystems that reflect different restoration targets, including biodiversity, endangered plant populations, ecosystem services, and fuel prevention.

We also designed effective fire reduction measures to protect remaining dry forest fragments and to stop the spread of large fires across grass-dominated landscapes. Our experimental design incorporated "green strips," areas planted with fire resistant and preferably native species. To test the idea in Hawai'i, we seeded experimental plots with a highly invasive grass under various combinations of outplanted native species. Preliminary data indicate that fire tolerant shrubs substantially reduce grass biomass, suggesting that this approach could aid in management and protection efforts.

Finally, to enhance the predictive capability of when fires will occur, we developed the use of high temporal frequency satellite imagery to monitor near real-time fire fuel conditions. Invasive grasses fuel fires in Hawai'i because they are perennials, and thus they maintain a large amount of aboveground biomass throughout the year. Because these fuels differ noticeably from their mainland counterparts, traditional fire danger rating systems have not been effective in Hawai'i. Our [fuel fire web tool](#) is available to DoD and other Hawaii based land managers. This comprehensive research program has provided basic scientific information and practical tools for managing and restoring tropical dry forest landscapes in the Pacific. Results benefit the military mission in the Pacific by increasing capacity and knowledge to restore native forests, thereby reducing wildfire and enhancing habitat for threatened and endangered species.

To learn more about invasive C_4 grasses, we suggest:

Cordell, S.; Sandquist, D.R.; Litton, C.; Cabin, R.J.; Thaxton, J.; Hadway, L.; Castillo, J.M.; Bishaw, D. 2004. An invasive grass has significant impacts on tropical dry forest ecosystems in Hawaii: The role of science in landscape level resource management and native forest restoration in West Hawaii. In: Proceedings of the Society for Ecological Restoration annual meeting, 2004 August 24-27; Victoria, Canada.

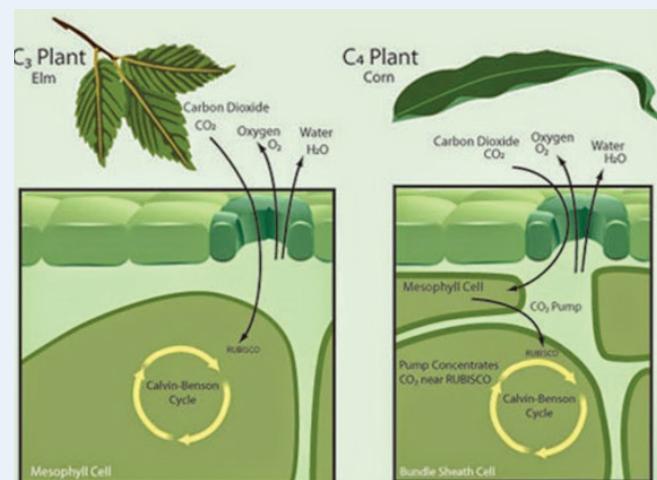
Knapp, A. K., and E. Medina. 1999. Success of C_4 photosynthesis in the field: Lessons from communities dominated by C_4 plants. Pages 251-282 in R. F. Sage and R. K. Monson, editors. C_4 plant biology. Academic Press, San Diego.

C_4 PHOTOSYNTHESIS

Photosynthesis is a process that plants use to convert energy from the sun into a form of energy they can use to fuel their activities. More specifically, this process occurs inside a plant's cells and converts carbon dioxide (CO_2) and water from the atmosphere into the oxygen we breathe. C_4 plants are often fire promoting grasses that require high levels of sunlight. They are less common and differ from C_3 plants because they fix CO_2 inside the cell twice during photosynthesis, whereas C_3 plants only fix CO_2 once. This process enhances CO_2 in C_4 plants, giving them a higher photosynthetic capacity which makes them highly flammable.

Source:

Knapp, A. K., and E. Medina. 1999. Success of C_4 photosynthesis in the field: Lessons from communities dominated by C_4 plants. Pages 251-282 in R. F. Sage and R. K. Monson, editors. C_4 plant biology. Academic Press, San Diego.



A Comparison of C_3 and C_4 Plants. Source: <http://www.majordifferences.com>

STATE OF FIRE BEHAVIOR MODELS AND THEIR APPLICATION TO ECOSYSTEM AND SMOKE MANAGEMENT ISSUES

By Susan J Prichard, Research Scientist, School of Environmental and Forest Sciences, University of Washington, Seattle, WA; Roger D Ottmar, Research Forester, Pacific Wildland Fire Sciences Laboratory, U.S. Forest Service Pacific Northwest Research Station; and John A. Hall, PhD, Resource Conservation & Climate Change Program Manager, OASD(EI&E), SERDP and ESTCP

With approximately 25 million acres of land throughout the United States, DoD manages a wide diversity of ecosystems and important habitat for many threatened and endangered species. Of the five million acres of DoD forestland, over half are southern pine forests that are maintained by frequent prescribed burns. In fire-adapted ecosystems such as southern pine and western pine forests, DoD uses fire as an ecological restoration and forest management tool and conducts prescribed burns on an average of 600,000 acres annually. Smoke is a by-product of



DoD PARC Group and Photo Site

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prescribed burning, and air quality is an important consideration in DoD prescribed burning programs.

Predicting smoke from wildland fires to reduce air quality impacts requires accurate estimates of the area burned, quantities of pre-burn fuel, and fuel consumption. Since the rate of spread and intensity of a fire are fundamental in determining fuel consumption and the resulting pollutant emissions, it is important to understand how a fire will behave. To assess the status of fire behavior modeling and priorities for model development related to smoke and ecosystem-based forest management, the DoD Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) organized a special session, *State of Fire Behavior Models and their Application to Ecosystem and Smoke Management Issues*, as part of the *International Smoke Symposium* on October 24, 2013, in College Park, MD.



Presenters provided a status update and summary of research needs in the following areas: fuel characterization, smoke dispersion modeling, smoke validation, next-generation fire behavior modeling, fire-atmosphere interactions, ecosystem management, and fire effects. The Symposium also featured presentations on research and funding directions for SERDP/ESTCP and the Joint Fire Sciences Program. A summary report on each presentation and synthesizing information on the status of fire behavior modeling, research applications, and recommendations for future research directions is available for download on the [SERDP/ESTCP Air Quality](#) page as a workshop report.



Large fires can create their own winds and weather, increasing their flow of oxygen

WHAT'S HOPPIN' IN DOD PARC: SNAKE PAMPHLETS MAKE AN IMPACT

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

Education and outreach are core strategies of the DoD Partners in Amphibian and Reptile Conservation (PARC) group. As such, our group members have recently launched an effort to create and share educational brochures, pamphlets, and signs depicting amphibians and reptiles found on military lands. These informational materials are created to inform and educate military personnel about the presence and ecological importance of herpetofauna species (some of which are venomous, non-native, or listed as endangered or threatened under the Endangered Species Act) living on the installations where soldiers work and train.

The first brochure, *Venomous Snakes of Southeastern Virginia*, targets Navy installations in the Tidewater area of Virginia. It features photos and information about the three venomous snakes (copperhead, cottonmouth, and timber rattlesnakes) that occur on seven Navy sites in Virginia. The brochure also has information on the general characteristics of venomous snakes, what to do when encountering a snake, and tips to stay safe while working in snake habitats.

Because of the first brochure's popularity, more herpetofauna on military sites pamphlets and posters soon followed. Julie Robbins, DoD PARC Representative and Natural and Cultural Resources Manager at Marine Corps Logistics Base Albany, developed a snake brochure for MCLB Albany and two educational signs—one for [alligators](#), and one for the [Eastern diamond-backed rattlesnake](#). The Kansas Training Range, Naval Air Station Key West, and the Florence Military Reservation also developed snake brochures. The DoD PARC group has created or assisted others in developing more than 10 products; some of which are posted on the [DoD PARC website](#). The product templates are available to group members, allowing them to save time and money.

Pictures of the various herpetofauna species used to create the products come primarily from the [DoD PARC Photo Site](#). This website contains more than 1,200 herpetofauna pictures, which are available at no cost for use in educational and outreach products. To join or contribute pictures, contact [Paul Block](#).

As demonstrated in the aforementioned examples, education and outreach is at the heart of the DoD PARC group. DoD PARC recognizes the importance and value of educating the military community on the ecological prominence of amphibians and reptiles found on military lands. By creating opportunities for individuals to learn about the identification, behavior, habitat use, and ecological significance of herpetofauna, installation biologists and military personnel can support environmental sustainability and the military mission. For assistance in developing a product for your installation, contact [Chris Petersen](#) or [Rob Lovich](#) or visit the [DoD PARC website](#).

THE AIR FORCE WILDLAND FIRE CENTER

The Air Force Wildland Fire Center (AFWFC), established in 2012 as part of the Air Force Civil Engineer Center Environmental Directorate, is a collaborative operation with the U.S. Fish and Wildlife Service and the U.S. Forest Service designed to manage increasing wildland fire threats to Air Force missions. The AFWFC uses the vision, national goals, and guiding principles of the National Cohesive Wildland Fire Management Strategy.

A Network of Wildland Fire Support:

In addition to Headquarters at Eglin Air Force Base (AFB), FL, AFWFC plans to establish two regional offices at Peterson AFB, CO, and Vandenberg AFB, CA, and one overseas office at Joint Base Elmendorf-Richardson, AK. AFWFC is also establishing twelve wildland support teams that will report to their respective regional offices. The organization plans to train and equip these teams to handle wildland fire response and management on a seasonal or full-time basis.

The National Wildfire Coordinating Group contains qualified firefighters located within installation fire and emergency services and natural resources organizations that lend additional support to AFWFC. In return, AFWFC provides training, support, certifications tracking, and other services to the National Wildfire Coordinating Group.

Wildland fire response is critical to conserving natural resources on DoD lands and ensuring the safety of military personnel. The center's five core functions, training and qualifications, planning and risk mitigation, fire operations support, fire reporting analysis, and wildland fire expertise help the Air Force suppress fires and continue military testing, training, and operations.

For more information on AFWFC, visit: <http://www.afcec.af.mil/environment/afwildlandfirecenter/index.asp>

One of the largest fires in recent history was in 1825 when a fire tore through Maine and New Brunswick, Canada, burning 3 million acres of forest.



STEPPINGSTONES CORNER: VIEW FROM THE EYRIE

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



I started my wildlife profession at Auburn University where I first learned about the benefits of prescribed fire. The notion of fire-dependent ecosystems, like longleaf pine communities, and the benefits to Northern bobwhite and other bird species, became a prominent theme. Among my wildlife friends, the name Herbert Stoddard was probably more recognizable than Bo Jackson or Charles Barkley. One of the many class field trips, mostly to quail plantations, was a trip to

Florida to visit the Tall Timbers field station. This is where much of Stoddard's (and his successors) research showed the many benefits of fire to the complex longleaf ecosystem.



From Auburn, I continued my education in Idaho where I conducted a four-year investigation on the effects of fire on migratory sage-grouse population ecology. That is where I learned that fire was not always a good thing. In fact, it could be downright detrimental. The invasion of cheatgrass that increased fuel loads, along with some sagebrush species that did not resprout after fire, seemed like a recipe for disaster for sage-grouse and other shrub-steppe species. The Bureau of Land Management conducted a large-scale prescribed fire on my study area just before my arrival, which I determined, had some dramatic negative impacts on sage-grouse ecology. I spent countless mornings on the 1.7 million acre Big Desert in southern Idaho at leks often exceeding 100 strutting males. It was not too many years after I left Idaho that a major wildfire burned through the Big Desert, destroying a significant amount of the breeding habitat for that population.



Prescribed burn at Beale Air Force Base, CA. Source: Chuck Carroll, Beale AFB

Depending on geographic location, military natural resources professionals view fire differently. Some of the best wildlife habitat in the country resides within military impact areas that are ignited by live munitions. Some installations, such as Fort Bragg and Fort Riley, use fire as a management tool to mimic natural fire return intervals. These prescribed fires not only significantly

improve habitat for wildlife, but also enhance training lands and opportunities. At Beale Air Force Base, CA, personnel use fire to reduce fuel loads, improve rangeland, control invasive weeds, and manage vernal pools. In contrast, wildfires in southern California can have profound negative impacts. At Marine Corps Base Camp Pendleton, CA, wildfires burned through Santa Margarita River riparian habitat, which negatively affected habitat for the riparian bird community, particularly for the federally listed Least bell's vireo.



Wildfire at Marine Corps Base Camp Pendleton, CA. Source: Diane Walsh

As a proactive means of fire planning, many installations are now developing Wildland Fire Management Plans (WFMP) that specify protocols for responding to wildfire, as well as recommendations for using fire as a management tool where appropriate. Navy installations in Virginia and North Carolina are working with the U.S. Fish and Wildlife Service on such plans to address a variety of mission areas, including reducing ground cover, removing deer bedding areas adjacent to airfield runways, and managing vegetation height and composition relative to obstruction concerns for communication systems. Fort Belvoir, VA, is also developing a WFMP to respond to wildfire to protect important training and conservation areas surrounded by an urban and suburban environment.

The fire season is here and wildfires are already widespread in Alaska; the forecast for the western United States suggests a particularly bad year for wildfires. Installation natural resources managers should consider the benefits of developing WFMPs to respond proactively to wildfire and avoid negative impacts to training lands, as well as to specify how to use fire as a positive management tool to promote sound conservation, and more importantly, how to enhance the military training and testing missions.

PREScribed FIRE – A NATURAL RESOURCE MANAGER'S MULTI-USE TOOL

By Ronald June, Natural Resource Manager, Shaw AFB

Prescribed fire is one of the most effective and efficient tools available to natural resource managers. The goal of the prescribed fire program at Shaw Air Force Base (AFB), SC, is to protect and enhance native ecosystems and the species they support to sustain military missions. Shaw AFB's prescribed fire program results in a reduction in forest fuels, fewer high-intensity wildfires, and thus fewer interruptions to flight training on Poinsett Electronic Combat Range (Poinsett Range). Prescribed fires also remove undesirable vegetation and promote fire tolerant native species such as longleaf pine. The abundant biodiversity on Poinsett Range is due in part to the robust

prescribed fire program promoting an herbaceous layer of vegetation that is beneficial to all wildlife, especially the federally endangered red-cockaded woodpecker (RCW).



Longleaf seedlings protected from fire by abundant needles; while small hardwoods are left exposed. Source: Cossaboom, Shaw AFB 20 FW/PA 2014

Natural resource managers at Shaw AFB actively manage 6,000 acres of upland pine forests for the RCW at Poinsett Range. Through close coordination with several partners (Range Operations, Shaw Fire Department, and the U.S. Fish and Wildlife Service (USFWS) to name a few), the RCW population at Poinsett Range reached a record high of 28 active clusters in 2015, which is a 560% increase since 2001! This documented success should afford Shaw AFB greater flexibility and consideration from USFWS should the U.S. Air Force (AF) mission dictate changes that might affect the RCW population. Prescribed fire has been, and will continue to be, a key component in the success of the RCW management program at Poinsett Range.

The year 2015 was a landmark year for the prescribed fire program at Poinsett Range. The AF Wildland Fire Center helped Shaw AFB establish a regional fire team at Poinsett Range to help achieve resource management goals. With help from the Carolinas Wildland Fire Support Team, Shaw AFB natural resource staff burned 2,344 acres, which exceeded the amount burned in any previous year! This regional approach infuses the team with qualified fire personnel to help implement the prescribed fire program at Poinsett Range, Joint Base Charleston, North Auxiliary Airfield, and other AF installations in the southeast. Through these partnerships, Shaw AFB has developed a more effective prescribed fire program and increased fire protection while ensuring increased support for current and future mission requirements.



Abundant biodiversity on Poinsett Electronic Combat Range promoted by prescribed fire. Source: Hovis, Shaw AFB 20 CES/CEIEA 2014

SPOTLIGHT ON THE NATIONAL INTERAGENCY FIRE CENTER (NIFC)

By Charlotte Taylor, Booz Allen Hamilton

Headquartered in Boise, ID, and established in 1965, the National Interagency Fire Center (NIFC), serves as the nation's support center for wildland firefighting by mobilizing ground and air resources to manage wildland fires across the country. NIFC's partner agencies (Bureau of Land Management, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, National Park Service, U.S. Forest Service, National Oceanic and Atmospheric Administration, National Business Center, U.S. Fire Administration, and National Association of State Foresters) work together to coordinate national fire planning operations in a cost-effective manner.

In 1975, DoD signed an interagency agreement with the U.S. Department of Agriculture and the Department of the Interior to provide aerial and ground firefighting support to wildland fire management agencies when needed. Since then, DoD has assisted NIFC during 11 critical fire seasons (seasons with low humidity, no rain, and an abundance of dry vegetation). DoD provides support through the Modular Airborne Firefighting System, a program that provides Air National Guard and Air Force Reserve units in military C-130 aircraft equipped as air tankers to support wildland fire suppression activities. All military personnel who carry out these firefighting procedures are trained and course-certified by NIFC. The partnership between DoD and NIFC is an important part of wildland fire management operations.



A U.S. Forest Service aircraft breaks away, top, as a Modular Airborne Fire Fighting System-equipped C-130 aircraft begins dropping flame retardant on a section of the Waldo Canyon fire near Colorado Springs, CO, June 26, 2012. Source: U.S. Air Force photo by Tech. Sgt. Thomas J. Doscher

For more information on NIFC, visit www.nifc.gov and for more information on DoD's partnership with NIFC, please visit: www.nifc.gov/fireInfo/fireInfo_military.html.



Lightning strikes the earth over 100,000 times a day. 10 to 20% of these lightning strikes can cause fire.

PENNSYLVANIA GUARD PRESCRIPTIONS YIELD FIRE-DEPENDENT HERPS

By David McNaughton and Joseph Hovis, Pennsylvania Department of Military & Veterans Affairs

Despite the state's size, only very small, and isolated parcels of Pennsylvania have had a continuous and active fire history through the "Smokey Bear" suppression era. Fort Indiantown Gap National Guard Training Center (the Gap) is one of the largest of these parcels. Fire histories performed by Steve Signell, then of Pennsylvania State University, show a record of stand replacement fires crossing the installation every decade through the earliest tree and soil records available (approximately 1890). These fires have transitioned from farm and timber clearing to military pyrotechnics and now to prescribed fire, evolving the effects, safety, and timeframe of the fires on the landscape.

At the Gap, the Pennsylvania Department of Military and Veterans Affairs (DMVA) conducts approximately 80 percent of the state's prescribed burns annually. The Natural Resources Office has helped to train and certify many of the state's burn crews for several agencies through regular collaboration on up to 5,000 acres of prescribed burns per year.

The result of the prescribed burns has been a boon for the installation's herpetofauna (herp) populations, supplying food sources for turtles, snakes, lizards, salamanders, frogs, and toads. The DMVA Wildlife team has monitored population sizes through turtle mark-recapture programs on box, wood, and spotted turtles for over a decade and continue to find signs of active breeding success and longevity. In 2014, a box turtle originally captured in 2004 resurfaced on the perimeter of an annual burning and high activity machine gun range, and personnel recaptured a wood turtle, originally captured 11 years ago, near a recent grassland burn unit.



A neonate Eastern hognose snake (*Heterodon platirhinos*) forages through a recently burned area at Fort Indiantown Gap National Guard Training Center. Source: Pennsylvania DMVA Cristie Shull.

The fire-dependent habitat hosts a wide diversity of common species to state species of concern, such as timber rattlesnakes, eastern hognose snakes, ribbon snakes, Fowler's toads, and five-lined skinks. These species feed on the grassland and barrens-ecology rodents and insects that increase after a dormant-season fire. Burns stimulate raspberries, blueberries, nut trees, and nutritious grasses to regenerate and produce fruit, providing food directly and indirectly to the herp community. Dormant season burning avoids aestivating (summer sleeping) herps from being active in the dry locations that carry fire. Early amphibians heading for vernal pools need to stay moist, also protecting

them from intense heat due to the cooler and patchier nature of eastern fire.

As DMVA and the Pennsylvania Army National Guard lead the way for state public lands, other critical species in Pennsylvania such as the Eastern massasauga rattlesnake and the bog turtle will benefit from the return of fire management to their habitats, a step desperately needed to save these species on the edge of extinction.

THE TRACER IGNITION MINIMIZATION TOOL

By Andrew Beavers and Christopher Herron, The Center for Environmental Management of Military Lands, Colorado State University, and Patrick McArdle, Department of Mechanical Engineering, Colorado State University



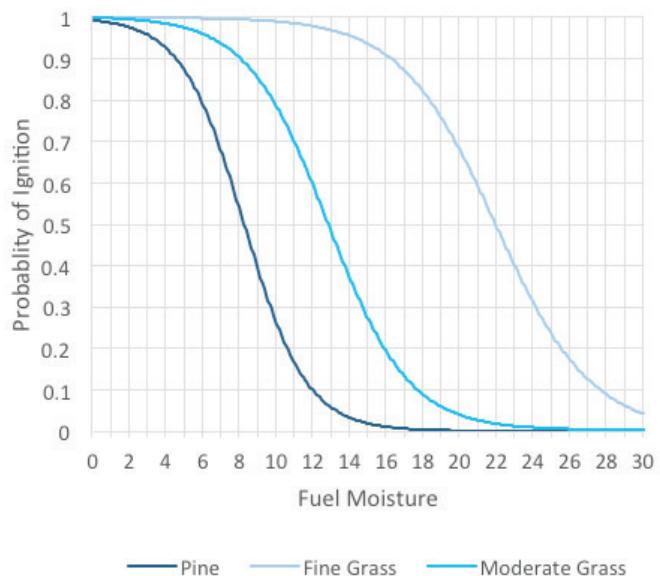
Tracers are the most common ignition source on most military live-fire ranges. Source: Sgt Mike MacLeod.

Wildfires are a concern for military land managers due to short and long-term impacts to training, infrastructure, and natural and cultural resources, as well as the threat of fires burning off-installation onto neighboring properties. Tracer rounds are known to be a primary ignition source on many military ranges. In Legacy Project 12-374, we used a climate-controlled wind tunnel to determine the ignition probability of tracer rounds in three different vegetative fuel types across the range of environmental conditions commonly found in the field. During this study, we found surprisingly robust differences in ignition probability between the different fuels. We also found that tracers produce ignitions more easily than traditional wildfire ignition sources such as burning debris, cigarettes, and catalytic converters, all of which burn at a lower temperature but for a longer period than tracer rounds. These differences lead to noticeably higher ignition probability than predicted by the National Fire Danger Rating System, which forecasts fire danger on a daily basis.

We have continued our research effort in Legacy Project 13-628 by leveraging the data from our earlier work to create a thermodynamically correct model that predicts ignition probability from tracer rounds in the three vegetative fuels studied. By using thermodynamics principles, it is possible to apply parameters to the model with the properties of any vegetation, not just the three with which we experimented, and produce ignition probabilities (as shown in figure below). Thermodynamic properties for individual vegetation types are relatively inexpensive to determine and can be analyzed by many commercial labs.



Forest fires move faster uphill than downhill! The steeper the slope, the faster the fire travels.



Probability of ignition response curves for three fuels at 85° F and 1 mph surface wind speed.

The models resulting from these studies, packaged into an easy to use computer program known as the Tracer Ignition Minimization Tool (TIM Tool), are available for long-term as well as daily fire management planning. Range and fire managers can use the TIM Tool with long-term weather data to develop a fire ignition probability profile for any period desired (e.g., from days to years). Range and fire managers can also use this information to help determine long-term fire risk exposure, which is particularly useful at installations where fires are relatively uncommon. Short-term uses include helping to determine appropriate staffing levels or, conversely, limiting the use of tracers when staffing is insufficient to handle the expected fire load produced from training using tracers. In addition, the TIM Tool allows fire managers to pre-position resources on or near ranges with predicted high ignition probabilities. Pre-positioning fire-fighting resources minimizes response time and allows firefighters to quell any fires caused by tracers while those fires are small.

For more information, please contact [Andrew Beavers](#).

NEXT GENERATION FIRE MODELING FOR ADVANCED WILDLAND FIRE TRAINING

By James Furman, U.S. Forest Service

The Air Force Wildland Fire Center and Los Alamos National Lab (LANL) have initiated a project, funded by DoD's Environmental Security Technology Certification Program, to demonstrate and validate the capabilities of a fluid dynamics wildland fire spread model, FIRETEC, to simulate fire behavior from prescribed fires in southeastern fuels. The project proposes to:

- Compare FIRETEC model simulations to measured values of fire-induced wind velocities and heat release from experimental prescribed fires.
- Demonstrate the ability of FIRETEC to predict realistic fire phenomenological response to heterogeneous forest structure, wind speed, and firing pattern scenarios.
- Disseminate modeling results and lessons learned to fire managers and practitioners.

Current fire spread models are inadequate for predicting the complex influences of atmosphere, forest structure, and self-generating fire processes on wildland fire behavior. FIRETEC is a physics-based, three-dimensional computer code, developed by LANL, designed to capture what is a constantly changing, and interactive relationship between wildland fire and its environment. To represent interactive fire processes, FIRETEC combines physics models that represent combustion, heat transfer, aerodynamic drag, and turbulence with a computational fluid-dynamics model that represents airflow and adjustments to terrain, vegetation, and the fire itself.

The Prescribed Fire Combustion and Atmospheric Dynamics Research Experiment (RxCADRE) took place at Eglin AFB in 2008, 2011, and 2012 and will provide invaluable validation datasets for FIRETEC model runs. FIRETEC will produce short video clips of fire behavior for modeled simulations for use in developing video and training materials for fire managers.

The project will explore the following questions:

- What is the effect of distance between ignition points on fire intensity and plume lofting?
- How does spot ignition moderate fire intensity as compared to "dash" or "line" ignition patterns?
- How does forest structure affect wind fields and resulting fire behavior with various ignition patterns?
- How do the effects of the above ignition patterns change under varying wind conditions?

SERDP/ESTCP'S FIRE SCIENCE STRATEGY

By John A. Hall, PhD, Resource Conservation & Climate Change Program Manager, OASD(EI&E), SERDP and ESTCP

Fire is a fact on military installations. Substantial training time is lost due to wildfires, yet training and testing activities are a major ignition source. Fire plays a vital role in the ecology of fire-adapted ecosystems and, due mostly to the introduction of non-native invasive species (NIS), in non-fire-adapted ecosystems. Fire also contributes to air quality and carbon management concerns. Currently, prescribed fire is the primary tool DoD installations use to mitigate wildfire risk, manage fire-adapted ecosystems and their associated listed and at-risk species, and provide safe and realistic training environments. DoD annually conducts more prescribed burning (about 600,000 acres per year) than any federal agency other than the U.S. Forest Service.



The Colorado National Guard supports efforts to fight the Black Forest fire, June 12, 2013. Black Hawk helicopters from the Army Aviation Support Facility on Buckley Air Force Base in Aurora, CO, perform water drops using buckets that can carry up to 500 gallons of water and make more than 20 drops before refueling. Source: U.S. Air Force photo by Capt. Darin Overstreet.

To help guide future investments in research and demonstration, and to better coordinate fire-science research across agencies, the Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) the [Resource Conservation and Climate Change \(RC\) Program Area](#) has developed a [Fire Science Strategy \(the Strategy\)](#). The Strategy provides a framework for advancing solutions to current and future fire-associated natural resource management challenges faced by DoD land managers. To address key research gaps, the Strategy provides a conceptual model for identifying future priority research and demonstration investments relevant to DoD ecosystem, air quality, and carbon management needs, with an emphasis on the role of fire behavior. The conceptual model also captures SERDP and ESTCP's vision for future work as embodied by four core areas of fire science: (1) ecological effects of fire, (2) carbon accounting, (3) emissions characterization, and (4) fire plume dispersion. These four areas are tightly coupled to fire behavior and represent points of potential management or regulatory concern to DoD.

Traditional DoD fire management focused on listed species habitat management or recovery and maintenance of dominant canopy species. NIS are creating new ecosystem management challenges related to the role of fire in invaded ecosystems, whether previously fire-adapted or not. Additional factors are also driving the need for understanding the effects of fire including the emerging general interest in biodiversity, ecosystem-based management including applying the principles of ecological forestry, ecosystem services, the effects of a non-stationary climate, and novel ecosystems. The interest in these areas suggests a shift in research focus from understanding fire as a driving force of directional change to a dynamic process that can create a variety of results over a range of locations and time. Better understanding the physics underlying fire behavior is a key part of improving the use of fire to achieve desired results. This will require linking fire behavior models with ecological effects process models. SERDP can play a role in developing and testing the types of models needed (with potentially subsequent validation through ESTCP) to meet DoD's ecosystem management, stewardship, and sustainability needs.

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.

An Analysis of Forest Riparian Buffer Zones on Military Installations in the Chesapeake (Legacy 07-305) – Report, Fact Sheet, and Appendix

This study tested the effectiveness of restored forest riparian buffers along streams on military installations in the Chesapeake Bay watershed by examining stream macrobenthic invertebrate community structure, and water and habitat quality. Research results provide installation land managers with recommendations for management actions to improve restored riparian buffer areas and address issues concerning the DoD Total Maximum Daily Load program.

UPCOMING EVENTS CONFERENCES, WORKSHOPS, AND TRAINING

2015 Association of Fish & Wildlife Agencies Annual Meeting September 12-17, Tucson, AZ

The 105th annual meeting of the Association of Fish and Wildlife Agencies is a forum for conservation leadership that brings together more than 700 leaders from fish and wildlife agencies and conservation groups nationwide to discuss conservation policy and management issues and accomplishments. Attendees include key decision makers in the field of fish and wildlife, including directors, assistant directors, program managers, and others involved in fisheries, wildlife habitat, law enforcement, legal affairs, industry, and public affairs (information and education).

National Association of State Foresters Annual Meeting September 14-17, Olympic Valley, CA

The National Association of State Foresters collaborated with the California Department of Forestry and Fire Protection to schedule this meeting. This event brings forestry and wildfire leaders from all over the nation together for business, networking, and learning opportunities.

National Public Lands Day

September 26, Nationwide

National Public Lands Day is the nation's largest, single-day volunteer effort for public lands. In 2014, during the 21st annual National Public Lands Day, more than 175,000 volunteers and park visitors celebrated at more than 2,100 public land sites nationwide.

National Wildlife Refuge Week

October 12-18, Wildlife Refuges Nationwide

Many refuges will host public celebrations during National Wildlife Refuge Week, which falls on the second full week in October. The nation's 561 national wildlife refuges protect wildlife habitat while cleaning our air, filtering our water and pollinating our crops. They also provide excellent hunting, fishing, and hiking. Visit the [special events calendar](#) for Refuge Week events.

Wildlife Society 22nd Annual Conference

October 17-22, Winnipeg, Manitoba, Canada

The Wildlife Society's [Annual Conference](#) is one of the largest gatherings of wildlife professionals, students, and supporters in North America. More than 1,500 attendees gathered at our 2014 Annual Conference in Pittsburgh, PA. The conference features more than 400 learning opportunities on wildlife management, research, and techniques through a wide variety of symposia, contributed papers, panel discussions, workshops, contributed posters, and field trips.

Annual Meeting of the Raptor Research Foundation

November 4-8, Sacramento, CA

This November marks the 50th anniversary of the groundbreaking 1965 Peregrine Falcon meeting in Madison, WI. Hosting the conference is the Golden Gate Raptor Observatory, celebrating 30 years of raptor migration monitoring in the Marin Headlands. The 2015 conference will feature a symposium on golden eagle conservation and other anticipated symposia may include *Strix* owl conservation, rodenticide effects, raptor health and diseases, and mitigating energy impacts on birds of prey.

Develop and Utilize a Landscape Scale GIS Model That Identifies the Location of Potential Subterranean Bat Habitat on the Marine Corps Air Station Yuma, Luke AFB and YPG: Identification and Status of Sensitive Bat Habitat Resources (Legacy 12-143) – Map, Fact Sheet, and Technical Report

The objective of this project is to identify, map, and describe potential bat roost structures (e.g., caves and mines) throughout the Barry M. Goldwater Range and Yuma Proving Ground. Researchers documented bat species present within identified bat roosts and proposed management and population sampling recommendations to monitor sensitive bat species while maintaining military mission activities. The research will assist DoD natural resources managers in identifying where conflicts may exist between important roosting habitat and routine military training.

Release and Establishment of Phorid Flies (*Pseudacteon* spp.) Against Red Imported Fire Ants (*Solenopsis invicta*) on Department of Defense Installations (Legacy 12-620) – Fact Sheet, Protocol, and Management Plan

This project aimed to achieve long-term sustainable suppression of fire ant populations through integrated pest management. In this study, researchers released ant-decapitating flies, which are natural enemies of imported fire

ants, and documented its efficacy for pest management. This method allows natural resources managers to reduce their reliance on insecticides, improve native ant diversity, and improve outdoor training and recreational experiences.

Species at Risk on Department of Defense Lands: 2014 Updated Analysis, Report, and Maps (Legacy 14-772) – Report and Appendix

NatureServe scientists compiled a report, analysis, and maps to identify species at risk on DoD lands to protect, manage, and monitor these species. They provided an analysis of species at risk that occur only or mostly on DoD lands or that are otherwise highly dependent on DoD management for their survival, and an overall summary analysis of installations with high numbers or densities of species at risk. These analyses help DoD to direct resources towards both high priority species at risk and high priority installations. Read the spotlight article in the spring issue of [Natural Selections](#) for more information.



More than four out of every five wildfires are caused by people.

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.

View the Summer 2015 Edition of the REPI Program's Newsletter to read the Veterans + REPI Buffer Partnerships article, which focuses on wildland fires.



Did you know SERPPAS (Southeast Regional Partnership for Planning and Sustainability) has a prescribed fire working group? [Click here](#) for more information!



DOD NATURAL RESOURCES PROGRAM

Enabling the Mission, Defending the Resources

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