

FY 2013 Secretary of Defense
ENVIRONMENTAL AWARDS

NATURAL RESOURCES CONSERVATION – SMALL INSTALLATION:
WARREN GROVE GUNNERY RANGE DETACHMENT OF THE 177TH FIGHTER WING NEW JERSEY AIR NATIONAL GUARD

INTRODUCTION

The mission of Warren Grove Gunnery Range (WGR) is “To Provide a Quality Combat Training Environment for All U.S. and Allied Air and Ground Forces.” WGR is currently a detachment of the 177th Fighter Wing (FW) of the New Jersey Air National Guard (NJANG) and is one of only 14 Air National Guard (ANG) Ranges. WGR provides a diverse training environment to nine full-time flying units and four part-time flying units. These units consist of multi-role fighter aircraft that employ precision guided weapons; attack aircraft that provide close air support to troops on the ground; airlift aircraft responsible for a resupply mission; and helicopters that perform personnel rescue. In concert with the flying units, WGR also provides a training resource for multiple ground units to include Army engineers, Transportation Companies, Security Forces specialists, and 22 Joint Terminal Air Control (JTAC) units from across the entire U.S. and Europe. From 2009 to 2013, WGR has facilitated the training of over 5,100 airborne missions and 6,122 ground personnel. WGR has only nine full-time military personnel and zero civilian personnel.

WGR is located in the heart of the New Jersey (NJ) Pinelands, the largest body of open space along the mid-Atlantic coast between Richmond and Boston. The NJ Pinelands comprises 1.1 million acres and is home to one of the largest fire-maintained dwarf pine plains forests in the world. WGR encompasses approximately 9,416 acres. Approximately 550 of those acres, located in the east and central portion of the Range, are designated for tactical and conventional air-to-ground gunnery training (target zone). The target zone is surrounded by 8,864 acres of undeveloped land that is managed and protected as a safety buffer.



WGR prescribed burned 5,100 acres last year in one of its largest and most intense burns to date to lower hazardous fuel loads. Following burning, the flowering populations of the federally-threatened Knieskern’s beaked rush increased 1900 percent and those of the Pinelands-protected pine barrens gentian increased by 136 percent. Visitors to WGR learn about the important role these fires play in maintaining the natural Pinelands ecosystem.

WGR supports a mosaic landscape of upland and lowland Pinelands habitats. Uplands are dominated by dwarf pine plains which are an imperiled community type both globally and at the state level. The United States Fish and Wildlife Service (USFWS) has designated wetlands on WGR associated with the Oswego River as priority wetlands for biodiversity conservation. Out of the 33 rare plant species on WGR, 28 are associated with wetland habitats, including the federally-listed Knieskern’s beaked-rush (*Rhynchospora knieskernii*). WGR supports the largest known population of Knieskern’s beaked-rush in the world.

BACKGROUND

WGR’s Integrated Natural Resources Management Plan (INRMP) was developed in 2001 and then updated in 2006 and 2011. An ecosystem approach is used to manage natural resources and enhance the ecological integrity of biological communities. This approach is less reactive to definitions of new endangered species and more effectively promotes the mission at WGR. The following plans have been integrated into the INRMP: the Comprehensive Range Plan, Wildland Fire Management Plan, Bird Aircraft Strike Hazard (BASH) plan, Integrated Cultural Resources Management Plan (ICRMP) and the Integrated Pest Management Plan (IPMP). To enhance development of the INRMP, WGR completed the Natural Resources Infrastructure Inventory and Assessment (NIIA) for WGR and established an INRMP team which includes the USFWS, NJ Department of Environment Protection (NJDEP), United States Department of Agriculture (USDA), NJ Forest Fire Service (NJFFS), and the NJ Conservation Foundation (NJCF).

Natural resource management at the range is a program and a philosophy that guides the WGR’s approach to land use. A significant portion of INRMP implementation is done through internal coordination in regard to training site operations and land use decision making, which cannot be measured by project implementation or funding levels. It is evidenced by such things as the ability to continually train, sustainable land use, ongoing regulatory compliance, retention of species diversity, retention of surface water quality, and the acknowledgement of sustainable natural resource management by partnering conservation agencies and other interested organizations and individuals. Beneficial partnerships are maintained with the NJFFS, the NJDEP, and the NJ Pinelands Commission. In addition, the relationship with the Laboratory of Pinelands Research at Drexel University (LPRDU) has provided expertise and manpower that have proven invaluable for managing the natural resources at WGR.

SUMMARY OF ACCOMPLISHMENTS

Natural Resource Management for Mission Support

The 177 FW Environmental Manager oversees natural resource management activities on WGR; there is no designated Natural Resources Manager at WGR. The Environmental Manager coordinates with range personnel, the National Guard Bureau (NGB), USFWS, NJDEP, and the LPRDU. WGR has a cooperative agreement with Drexel University which facilitates research and saves WGR \$200,000/year. This partnership is highlighted in Chapter 10 of *Conserving Biodiversity on Military Lands* (http://www.dodbiodiversity.org/ch10/index_3.html), which cites it as “a match made in heaven.” Dr. Walter Bien is the principal investigator who supervises the research of graduate students, interns, co-ops, and volunteers. Five Ph.D. students are currently doing research at WGR that directly relates to completing task orders outlined in INRMP objectives. Additionally, over 25 volunteers have participated in INRMP-related projects over the last two years and over 200 within the last 10 years. The partnership with Drexel University serves as a model relationship for WGR, resulting in the completion of 77 discrete management actions in the last 12 years and 30 finalized or in progress since the last update in 2011. The LPR at Drexel University received \$843,165 during the first INRMP (2001-2006), \$558,097 during the second INRMP (2007-2012), and \$371,912 since the last INRMP (2011-2016) for research and task order projects. The combined efforts of Drexel personnel have contributed over 21,000 hours in the last three years and over 6,000 hours per year since 2001 to help complete 40 specific task orders (with 13 in progress), frequently giving additional value at no additional project cost.



WGR has restored 27 impacted sites over the last 20 years. In a prime example of adaptive management, a study was undertaken to review restoration sites and test new recovery methods, resulting in a restored site that is ecologically more similar to undisturbed sites. Left, the original site in 2002; right, the site today.

The studies completed by Drexel researchers include: comprehensive floristic, herpetological, avifauna, and Lepidoptera surveys; fire management and forest restoration

assessment; home range movements and hibernacula locations of rare snakes; avian study in conjunction with the BASH program; identification of migrating bald eagles at WGR; small mammal study; identification and control of invasive plant species; mapping of biological populations: wetlands inventory database; fish and wildlife plan; northern pine snake spatial ecology study; timber rattlesnake radio-telemetry study; bog turtle survey; and a fire risk study.

To promote its natural resource management, WGR worked in close partnership with the LPRDU to develop and launch a website hosted at Drexel University. The website includes sections on the history and mission of WGR, Pine Barrens ecology, fire safety, research projects, environmental stewardship, community relations, and a special section relating range resources to fun activities for children. The website can be viewed at <http://www.pages.drexel.edu/~bio/warrengrove/v2/index.html> and will serve as an effective communication with surrounding communities and stakeholders to provide information on natural resource projects, community affairs and community council meetings, environmental stewardship, and local issues and concerns.

WGR was the first Air Force Installation to be evaluated under the Air Force Inspector General's (IG) new integrated Environmental, Safety, and Occupational Health (ESOH) requirements inspection process. WGR uses a systematic approach to manage the environment through our Environmental Management System (EMS) which was identified as being 'in conformance' after the 2012 Combined Unit Inspection (CUI). Our EMS commitment statement professes that we will build environmental considerations into all policies, programs, and missions; that we will achieve continuous improvements in environmental performance over and above regulatory and legislative requirements; and that we will work in partnership with all stakeholders. Our partnership with Drexel University supports our leadership's vision and commitment, and provides a key link within our system. Successfully supporting the WGR mission by managing over 9,000 acres with only nine full-time military members and no on-site natural resources manager, maintaining an EMS determined to be 'in conformance' by the Air Force IG, and saving tax-payers hundreds of thousands of dollars validates that EMS and the adaptive ecosystem approach to managing natural resources at WGR is working and serves as a model program for other Air Force Installations.

Threatened and Endangered Species Management

WGR maintains a geographic information system (GIS) database of all threatened, endangered, and at-risk species (TERS) that is utilized to identify, prevent, and minimize impacts from daily operations, prescribed burning, maintenance, and mowing regimes. A total of two federally-listed (once since delisted) and 45 state listed species have been

censused on WGR. The Comprehensive Floral Survey (CFS) identified 28 rare species out of 343 plants; five rare species have been added over the last seven years. WGR funded \$122,000 in 2012 to study fire effects and resource allocation in Knieskern's beaked sedge (*Rhynchospora knieskernii*). This disturbance-dependent species benefits from the management regime at WGR, which maintains ideal early successional habitat. Of the 14 landowners determined by the USFWS to have healthy populations, only WGR has a long-term protection agreement in place to conserve the species. After a recent prescribed burn in an area experiencing population declines, the population quadrupled, while the fruiting population increased 1,900 percent. Data collected from 2011-2014 will be used by the USFWS (which provided a permit for the study) and NJDEP in making species management decisions.

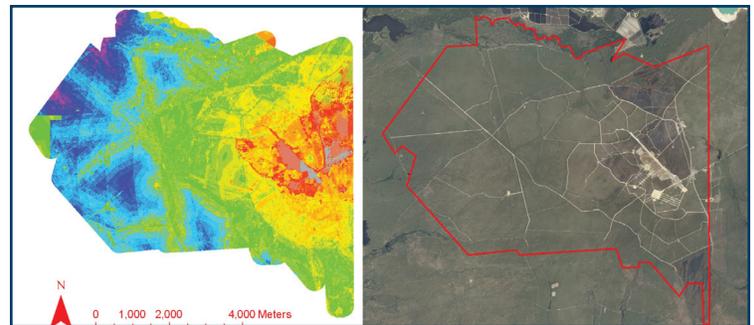
WGR supports one of the largest viable populations of northern pine snake, a state-threatened species, in the NJ Pinelands. Over the 10 years LPRDU has conducted snake ecology studies for WGR, they have captured approximately 300 pine snakes and passive integrated transponder (PIT) tagged more than 150 unique individuals. Previous studies have demonstrated that military activities within the target zone and buffer zone have had no negative effect on rare snakes (timber rattlesnake and pine snake) spatial ecology. From 2010 to present LPRDU has identified 24 pine snake hibernacula (over-wintering dens), radio-tracking 30 adult snakes in both 2010 and 2011, and 18 in 2012. WGR has participated in several projects designed to reduce snake mortality, both on WGR and in surrounding communities. WGR coordinates rare species management with grounds maintenance needs by consulting the LPRDU to ensure snakes have begun overwintering before beginning mowing and road maintenance operations. WGR also partnered with the NJDEP and the New Jersey Department of Transportation (NJDOT) in 2011-12 to conduct a pilot study that focused on the use of under road culverts to reduce vehicular injury and road mortality. High-quality motion-sensitive cameras were used to capture footage of animals using the large predator exclusion culverts, which were installed for the purpose of species management. In over 100 hours of footage, culverts were used 51 times (14%) by small mammals and snakes out of 364 visits by various animals while excluding large predators such as coyotes, raccoons, and skunks. Consistent with Department of Defense Instruction (DoDI) 4715.03, *Natural Resource Conservation Program*, requirements WGR incorporated climate change considerations into our INRMP, and data collected during research on the northern pine snake has been used in a preliminary study of the impact of climate change on seasonal snake behavior and movement patterns.

Researchers who have partnered with WGR have presented more than 25 scientific talks describing the conservation efforts of pine snakes at WGR. Both the NJDEP and the NJCF have provided letters of support for the conservation work being conducted at WGR for herpetofauna. Additionally, the LPRDU has collaborated with researchers from Temple University to use non-invasive ground penetrating radar (GPR)

to examine the structure of northern pine snake nests and hibernacula. This innovative approach is believed to be the first time this non-destructive technology has been employed in snake ecology studies. This approach has been proven to minimize impacts to this state-listed species on WGR.

Wildland Fire Management

Encroachment by surrounding communities is one of most serious concerns for mission sustainability and urban-interface wildfire management at WGR. As one of the first participants in the DoD's Sustainable Range Initiative, WGR was the first ANG base to utilize Readiness and Environmental Preparedness Initiative (REPI) funds to purchase and conserve undeveloped lands adjacent to WGR. Our 2009 REPI purchase was highlighted in the 2013 REPI 7th Annual Report to Congress. We partnered with the NJCF in a cost-effective purchase of 179 acres along the perimeter of our property reducing encroachment, improving fire control space, and increasing habitat preservation.



WGR uses modern LiDAR technology to generate maps that identify locations that have high fuel loads (left, green and blue areas). WGR (image on right) utilizes controlled burning to reduce fuel loads, improve visibility for pilots, and maintain the 13 out of 35 rare plants that are disturbance-dependent. Many rare animals also benefit from this ecosystem fire management program.

WGR is the most actively fire-managed property in the Pinelands. In conjunction with the NJANG, the United States Forest Service (USFS) Northern Research Station, and the LPRDU WGR developed an Ecosystem Fire Control Model with several components that have helped guide fire management policies since 2009. Data utilized for the analysis of fire-control space (roads and firebreaks) were obtained via the 2008 LiDAR (Light Detection and Ranging) and ortho-photo collection. LiDAR data found a strong relationship between the number of fires in an area and reduction of both ground and canopy fuel loads, which has helped guide the fire rotation schedule. The fire break/plow line inventory plan includes 91 miles. WGR and the NJFFS have developed a GIS system with locations of all roads, houses, properties and fire histories for WGR, comparable for other large military owned lands. These technologies are valuable tools for fire protection on the range.

WGR has a fire ecology team consisting of military personnel, members of the NJFFS, and wildlife biologists who are all consulted prior to controlled burns. A fire ecologist reviews the annual prescribed burn management plan in order to protect sensitive habitat and TER species. While many species benefit from fire, some species are fire sensitive. Our fire regime is managed to promote habitat for early successional and fire-dependent species, including the northern barrens tiger beetle, a potential species for Federal listing. WGR also conducts prescribed burning and mowing at the end of the growing season to protect federal- and state-listed species. The WGR fire management program was featured as a case study in *Conserving Biodiversity on Military Lands* (http://www.dodbiodiversity.org/case_studies/ch_8_3.html) written by Dr. Bien. WGR developed and updates a fire log database annually to record date, number of acres, and location (using GIS) of prescribed burns. This database allows us to determine whether prescribed burns are mimicking the natural fire return intervals for their respective habitats. Over the last two years WGR have prescribed burned 5,100 acres (54% of range property). Prescribed burning on WGR is vital to its mission. Decreasing fuel loads and stopping wild fires from spreading off range property to neighboring communities is one of WGR's priorities.

Fish and Wildlife Management

During the INRMP update process, WGR coordinated with the New Jersey Wildlife Action Plan (NJWAP) to ensure INRMP goals, objectives, and strategies are consistent with New Jersey's overall statewide and site specific plans. The black-banded sunfish and mud sunfish, two species of conservation concern for the Mullica River watershed, were censused in a baseline fish survey (2002) and censused in 2012-13 during an ecology class stream survey. These data suggest that water quality on WGR continues to support both rare and common Pinelands species. Another objective of the NJWAP that is consistent with the DoD policy to keep "common things common" is the effort to conserve the pirate perch (found on WGR), which is a native fish that is the only species in its genus in North America; it may represent a living fossil with historic associations within the Pinelands ecosystem.

Combined with water quality data taken by the ecology classes and compared to original baseline data, this suggests that military operations at WGR have had no observable negative impact on aquatic species over the last decade. By using data collected by environmental science students being trained at the university level in field techniques, these students are able to survey natural resources more frequently at no cost ('no cost' because additional work is performed outside the scope of work (SOW)) while also making its natural resources available to a larger community.



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Mowing operations on the range are timed to avoid breeding season in grassland and other ground-nesting birds, many of which are experiencing rapid population declines that were identified through a comprehensive avifauna survey. The survey identified 82 avian species (2,818 individuals), including four state-listed species (American kestrel, red-shouldered hawk, horned lark, barred owl) and eight species of special concern. The survey has also identified 17 potential BASH species. Range personnel utilize a raptor identification booklet created by the LPRDU to help differentiate BASH species from other raptors. WGR uses an updatable database that includes maps and GIS data for all listed species and species of concern found in numerous studies conducted on WGR over the past decade to plan management activities. Sensitive areas are marked on range maps and are consulted prior to activities such as prescribed burning, road maintenance, and new building. Survey data indicate the range has a variety of herpetofauna, including one lizard, two salamanders, five turtles, seven frogs

and toads (including the state-threatened Pine Barrens tree frog and two species of special concern, the Fowler's toad and carpenter frog), and 12 snakes (nine species are TER). There are nine small mammal species, including the southern bog lemming and meadow jumping mouse, two species for which there is limited data in the Northeast. A recent analysis of Lepidoptera survey results did not find evidence of the state-endangered arogos skipper, but provided baseline data on native pollinator species and censused 72 species of butterflies, including three species of concern in New Jersey. Several local groups, including members of the North American Butterfly Association, participated in intensive searches for the arogos skipper and other TER insect species.

Water Resources Management

Wetlands on WGR host a significant biodiversity of flora and fauna, including numerous TERS. Research indicates that one of the most important factors for rare plants such as the federally-endangered swamp pink (found adjacent to WGR) and the state-listed bog asphodel is the maintenance of natural hydrology and water quality. In 2012, bog asphodel was delisted by the USFWS as a federal-candidate species. Although currently found only in NJ, the USFWS utilized data from a monitoring study on WGR to make a "not warranted for listing" determination. The 2011 INRMP has several task orders related to periodic surveys and continued monitoring of water resources and in 2013 the LPRDU developed a SOW to update the wetlands and water quality data. WGR used wetland delineation data over the last several years to install 11 critical habitat wetland crossings to prohibit erosion/sedimentation and preserve hydrology at no cost ("no cost" because additional work is performed outside the SOW) to the government.



WGR was the first ANG base to successfully utilize REPI funds to purchase land bordering the Range. This purchase was included in the 2013 7th Annual Report to Congress. WGR not only reduced encroachment but ensured that beautiful wetlands like the one above will continue to be preserved.

Program Management

We have developed a number of programs to protect the environment while increasing efficiency and minimizing costs. This increase in efficiency and reduction of overall costs allows the nine WGR staff members to focus more of their attention and resources on the management of natural resources at the range. WGR received \$245,000 in energy conservation funds in 2010 and began implementing renewable energy projects. WGR finished a solar target lighting system in 2011, eliminating propane and battery waste streams, resulting in a 100 percent energy reduction for the system. WGR completely updated the heating, ventilation and air conditioning (HVAC) and environmental control system which helps WGR meet its EMS significant aspect goal of reducing energy and meeting the Air Force standard. We have recycled over 50 tons of steel and aluminum targets during the past two years; over 750 tons have been recycled since 1996. WGR used over 600 gallon of donated latex paint for targets annually and have recycled 88 tons of creosote poles. With the assistance of ANG leadership WGR has also developed an approved mechanical training munitions collection system. This system cut range Unexploded Ordnance (UXO) clearance time by 50 percent, resulting in a 50 percent reduction in the manpower required and \$20,000 annual savings. Studies have shown there are no munition related wastes migrating on or off range property. Together the 177th and WGR have received 16 environmental awards since 1996, including several ANG Natural Resources Conservation Awards, an honorable mention by the NJDEP's Environmental Excellence Award in the Healthy Ecosystems category, and two (2002 and 2013) General Thomas D. White awards.

Public Outreach

WGR has participated in numerous public outreach activities. In 2013 the range launched a website promoting public awareness of environmental research conducted in support of the INRMP. WGR manages a Community Council, which is an open forum between local government officials, nature groups, and the public. In 2012 WGR presented at the Federal Aviation Administration Earth Day celebration, and demonstrated northern pine snake radio-tracking techniques. WGR was featured in a 2012 panel discussion, "When Fire Gives Life: A Look at the Heroism of Fire in Nature", sponsored by the New Jersey Symphony Orchestra. WGR developed an observation area in 2011 and additional public facilities over the past year for viewing aerial demonstrations, open houses, and group visits.

WGR has been the subject of numerous news reports promoting its natural resource management. In 2013 a Drexel University story on pine snake research at WGR was mentioned on over 40 websites and blogs; in 2012 pine snake research was the subject of stories and videos in the Burlington County Times

and in the Drexel research magazine. Patrick Regan of New Jersey News produced seven Science and Technology Reports about WGR and our environmental work was the subject of his farewell segment. From 2012-2013 researchers delivered 23 oral and poster presentations at meetings all over the country; two of the poster presentations won awards.

Conservation Education



Conservation education is very important at WGR, giving student and community groups the opportunity to learn about maintaining the military mission while conserving natural resources. From 2011-2013 over 300 people visited WGR while many others visited the recently launched website. The efforts of WGR to enhance the compatibility of these two important goals were featured in *Conserving Biodiversity on Military Lands*.

WGR with its extensive hands on experience and resources is an excellent place for teaching and studying. Over 70 scientists, consultants, and government officials have worked collaboratively or presented at WGR over the last 13 years. This includes scientists from Rutgers, Temple, Montclair, Columbia, William Patterson, Richard Stockton College, and the Smithsonian Institution. Additionally, a wide range of other non-governmental organizations and educational organizations have utilized our natural resources or worked with WGR on regional management, including the NJ Conservation Foundation, Pinelands Preservation Alliance, Academy of Natural Sciences, South Jersey Butterfly Club, NJ Butterfly Association, NJ Forestry Resource Center, Marine Academy of Environmental and Technical Sciences, and Nature Conservancy. WGR collaborates with numerous local, state, and federal offices, including the NJDEP, NJ Office of Natural Lands Management, NJFFS, Pinelands Commission, USFWS, NJ DOT, NJ Endangered and Nongame species program, USDA, and local country governments. Over 100 students have worked or volunteered on research projects conducted at WGR in support of INRMP task orders, with many going on to receiving B.S., M.S., and Ph.D. degrees in environmental science. WGR has an open door policy and has been visited by a wide range of community groups, including

the Boy Scouts, the Civil Air Patrol, numerous botanical organizations, and students participating in Earth Week. WGR serves as an educational resource, teaching biodiversity conservation and environmental ethics. Drexel, Rutgers, and Montgomery County Community College students have all participated in class field trips to WGR.

Vegetation Management

CFS identified over 300 species of plants, including two federally-listed species (one candidate species has since been delisted), 27 state-threatened and endangered species and five globally rare habitats (out of 25 habitat types). WGR partnered with the LPRDU to develop a novel adaptive management protocol for vegetation regrowth on highly disturbed military lands and a simple model to quickly determine factors promoting invasive species in order to prevent their spread on WGR. Over the past 20 years WGR has restored 27 sites, consisting of 19 unique reclamation projects, including re-vegetation of old Range sight lines. WGR coordinated with the LPRDU to create a herbarium with over 120 plant species and sent voucher specimens to the Academy of Natural Sciences in Pennsylvania.



WGR has successfully managed the 37 TER plant species found on the Range. A rare plant study conducted on WGR which provided preliminary data on bog asphodel (above) pollination ecology was part of the documentation used by the USFWS in making its determination that this federal-candidate species was not warranted for listing.

Invasive Species and Integrated Pest Management

The LPRDU developed an innovative Disturbance Assessment Model currently in use to provide an efficient method of identifying and prioritizing sites for non-native species management. The non-native species study found little encroachment, thus enabling WGR to minimize spending on non-native species control. Due to the unique soils and ecology of the Pinelands, the relatively intact condition of WGR

habitat, and the lack of non-native plants identified as noxious weeds, managing for invasive species focuses on preventing soil amendments in disturbed areas and new sources for non-native seed, rather than on particular species. Additionally, protecting natural resources such as the state-threatened northern pine snake helps reduce the rodent population, deters BASH species, and further realizes cost savings.

Soil Conservation and Sediment Management

Researchers have recently analyzed the impact of fire on soils on WGR. At no cost to WGR the LPRDU has collaborated with William Paterson and Montclair Universities to examine the impact of fire on clay soil formation using X-ray diffraction technology following controlled burns at WGR. This technology was able to discern subtle differences in soil composition and showed that disturbance from frequent fires influences only small changes to soil composition compared to soils subjected to longer fire intervals. Although preliminary, the current Knieskern's beaked-rush study suggests that native plant populations benefit from periodic fire that increases soil nutrient, productivity, and recruitment.