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Moving Pennsylvania Wildlife Conservation Forward*

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Abstracts

Paper Presentations

(Listed alphabetically by last name of presenter--italicized)

Gubernatorial intervention in white-tailed deer management: A comparison of Pennsylvania and Wisconsin episodes

Gary L. Alt, Normandeau Associates, PO Box 370, Lagunitas, CA 94938

Gary L. Alt, (415) 488-4186, galt@normandeau.com; professional presentation

Governors intervened with statewide white-tailed deer (*Odocoileus virginianus*) management programs in both Pennsylvania and Wisconsin when deer management was identified as an important issue during their election campaigns. In Pennsylvania, during Governor Tom Ridge's 1998 re-election campaign, political pressures were exerted to take actions to reduce an overabundant deer herd that caused negative impacts to agriculture, the forest products industry, and the sustainability of forest ecosystems due to overbrowsing. In an effort to reduce the deer herd, actions were taken from 1999 through 2004 with unprecedented gubernatorial political support which led to the most sweeping changes in the history of deer management in Pennsylvania. In a contrasting situation, during Scott Walker's 2010 gubernatorial campaign in Wisconsin, the public vented their dissatisfaction with the Wisconsin deer management program, most notably because they believed there were not enough deer. In response, after his election, Scott Walker appointed a Deer Trustee Committee to review the Wisconsin Department of Natural Resources' (WDNR) deer management program. The review took place in 2012 providing over 60 recommendations to improve deer management, and the relationship between the public and the WDNR regarding deer management. This presentation will provide specific details concerning each of these episodes and the overriding political and ecological challenges, involved in managing white-tailed deer herds throughout the country in the 21st century.

Local effects of Marcellus Shale natural gas drilling on north-central Pennsylvania forest birds

Ethan P. Barton and Margaret C. Brittingham, Pennsylvania State University, 414 Forest Resources Building, College of Agricultural Sciences, Department of Ecosystem Science and Management, The Pennsylvania State University, University Park, PA 16802

Ethan P. Barton, (570)506-4087, epb5026@psu.edu; student presentation

Because of the newness of shale gas development, wildlife biologists and ecologists have had little time to research the effects of drilling on forest habitat and the flora and fauna that constitute Pennsylvania's forest ecosystems. Forest bird species are frequently used as indicators of forest health. To assess local-scale effects of gas development on forest communities, I conducted bird point counts at various distances surrounding a total of 30 Marcellus Shale natural gas pads located in forested areas across north-central Pennsylvania in a seven-county region. I placed

survey points at the following distances: 0m from pad edge, 50m from any edge, 150m from any edge, and 250m from any edge to assess distance effects on birds. Because the 0m and 50m points overlap, points on the same transect were not included in the analysis to avoid double-counting. At least 150 meters separated transects in order to minimize double counting. I used mean number of encounters per point count per site by species as the primary abundance metric. Edge-loving generalist species such as the American Robin (*Turdus migratorius*) were observed primarily near well pad edges and were almost never found in the forest interior. Forest interior species such as the Black-Throated Green Warbler (*Setophaga virens*) generally avoided pad edges and became more abundant with increasing distance from edge. Early successional species such as the Eastern Towhee (*Pipilo erythrophthalmus*) exhibited little to no response to pad installation with a near-uniform distribution over distance, giving no indication that newly-created Marcellus pad edges provide quality early successional habitat. These results will serve as baseline data for future research and further survey.

Resilient Sites for Terrestrial Conservation in Pennsylvania, the Central Appalachians and China

Scott L. Bearer, Mark Anderson and Wang Longzhu, The Nature Conservancy; 220 West Fourth Street, 3rd Floor Community Arts Center, Williamsport PA 17701

Scott L. Bearer, (570) 321-9092, sbearer@tnc.org; professional presentation

Species distributions are expected to change as species move to adjust to changing climatic conditions. Conservation scientists urgently require a way to prioritize research and strategic land conservation which will conserve the maximum amount of biological diversity despite shifting distribution patterns (IPCC 2007). Current conservation approaches based on species locations or on predicted species' responses to climate are necessary, but are hampered by uncertainty. The Nature Conservancy has recently completed a new, publicly-available, GIS dataset that allows the scientific community to focus conservation efforts to areas that contain a wide range of habitat complexity and connectivity. This dataset is based on the resiliency of habitats, or the habitat's capacity for renewal in a dynamic environment (conserveonline.org/workspaces/ecs). We will discuss how the data were developed, how they are currently being used at both a regional (Central Appalachian) and national (People's Republic of China) level, and how new applications are being integrated into landscape level planning and management. We also hope novel ideas from conservation scientists will expand the application of these data for emerging species', mitigation and conservation models.

Influence of Plant Species and Prey Availability on Golden-Winged Warbler Foraging Ecology

Emily Bellush, Jeffery L. Larkin, and Joseph Duchamp, Department of Biology, Indiana University of Pennsylvania, 975 Oakland Ave., Indiana, PA 15705

Emily C. Bellush, 724-463-8547 ext. 100, Emily.Bellush@pa.usda.gov, qtgr@iup.edu; student presentation

The Golden-winged Warbler (*Vermivora chrysoptera*) is an insectivorous migratory songbird that breeds in young deciduous forest and shrubland habitats of eastern North America. The species has experienced significant population declines over that past 50 years and is currently a focal species for young forest management in the eastern United States. To date, most Golden-winged Warbler breeding grounds research has examined the influence of habitat structure on the species' breeding ecology and reproductive success. While bird fitness has been linked to the quality and quantity of insect food supplies, research on Golden-winged Warbler foraging ecology has been limited. As such, habitat recommendations that consider quality foraging habitat remain absent from Golden-winged Warbler habitat management guidelines. We evaluated shrub and tree species selection by foraging Golden-winged Warblers in northcentral Pennsylvania during the 2011 breeding season. We also compared cruciform larvae (i.e. caterpillar) abundance among 13 woody plant species present within Golden-winged Warbler breeding territories. Golden-winged Warblers selectively foraged on white oak (*Quercus alba*), black locust (*Robinia pseudoacacia*), pin cherry (*Prunus pensylvanica*), and *Rubus* spp. The latter three species also supported the highest number of caterpillars. Additionally, *Rubus* spp., black locust, pin cherry, and black cherry (*Prunus serotina*) were indicators of Golden-winged Warbler breeding territories compared to adjacent, unoccupied areas of similarly aged habitat. Results from our study warrant the need for managers to consider both structure and species composition when creating Golden-winged Warbler breeding habitat.

Current Status and Concerns of Pennsylvania Streams and Lakes

Fred J. Brenner, Biology Department, Grove City College, Grove City, PA 16127

Fred J. Brenner, (724)458-2113, fjbrenner@gcc.edu; professional presentation

According to a recent Department of Environmental Protection Report to U.S. Environmental Protection Agency, nearly 20% or 16,599 miles of the 84,571 miles of streams in the Commonwealth do not meet the Federal Water Quality Standards. This is an increase of 972 miles impaired streams over the last five. Of the 16,599 miles of impaired streams, agriculture runoff accounts for 5,705 miles with 5,596 and 3,482 miles being adversely impacted by abandoned mine drainage (AMD), respectively. The remaining 3,482 miles are impaired by unknown sources. Of the 80,525 acres of assessed lakes in the commonwealth, 37,331 acres are impaired in term of supporting a diversity of aquatic life. In addition, currently 1,318 miles of streams and 40,405 acres of lakes are under fish consumption advisories. These assessments do not include of potential adverse impacts of invasive species of the natural biodiversity of waters of the commonwealth. To resolve these issues will require the cooperation of our management agencies and professional biologists across the commonwealth.

Spatial analysis of black bear (*Ursus americanus*) to assess harvest vulnerability in relation to anthropogenic activity in Pennsylvania

Charles S. Crawford, Pennsylvania Cooperative Fish and Wildlife Research Unit, 436 Forest Resources Building, The Pennsylvania State University, University Park, PA 16802; and W. David Walter, US Geological Survey, Pennsylvania Cooperative Fish and Wildlife Research Unit, 403 Forest Resources Building, The Pennsylvania State University, University Park, PA 16802

Charles S. Crawford, (814) 865-4183, csc199@psu.edu; student presentation

Successful management of large mammals is dependent upon presence of populations in areas open to hunting in defined management units or season structures. Therefore, harvest success is dependent on landowner distribution and land use patterns within management units that species occupy. Populations that largely inhabit private lands pose a challenge to management agencies due to varying landowner characteristics, land use patterns, ordinances and the seasonal habitat use of wildlife. A current study of 3 populations of radiocollared black bear (*Ursus americanus*) in Centre, Cambria, and Lackawanna counties by the Pennsylvania Game Commission can assist in understanding use of urban/suburban environments by black bear. We will explore harvest vulnerability and possible refugia created on private lands in three populations of black bear in relation to parcel specific land ownership data through spatial analysis of location data of GPS-collared black bear and landowner mail surveys. This study is designed to determine the proportion of GPS-collared black bear that were available and vulnerable to harvest during regulated hunting seasons in Pennsylvania.

Impacts of historic deer browse on present insectivorous forest songbird communities in the Allegheny National Forest

Ethan Cullen, Indiana University of Pennsylvania, 1011 South Drive, Indiana, PA 15705; Tim Nuttle, Indiana University of Pennsylvania, 1011 South Drive, Indiana, PA 15705, Civil & Environmental Consultants, Inc., 333 Baldwin Road, Pittsburgh, PA 15205-1751; and Scott Stoleson, USDA Forest Service Northern Research Station, PO Box 267, Irvine, PA 16329

Ethan Cullen, (508) 826-2466, wbf@iup.edu; student presentation

It is well documented that deer browse, particularly at higher densities, can strongly influence forest regeneration and subsequent tree species composition. Although many studies have looked at the effects of current prevailing deer densities on songbird habitat structure and subsequent communities, few have considered the long-term implications historic deer-induced changes have for insectivorous forest songbirds via effects on canopy tree recruitment. We used forest composition data obtained from the Allegheny National Forest to select and locate 89 forest stands of varying diversity, age class, and community composition matched to known deer effects on tree communities from 30-year old experimental deer enclosures. Specifically, we selected both young and mature stands with different diversity and dominance values for six focal tree species: black cherry (*Prunus serotina*), pin cherry (*P. pennsylvanica*), red maple (*Acer rubrum*), sugar maple (*A. saccharum*), birch (*Betula spp.*), and American beech (*Fagus grandifolia*). We quantified bird abundance in each stand plus 16 original deer enclosures using 5-minute, 50-m fixed radius point-counts during May – July 2012 (n = 315 censuses). We identified 18 primarily insectivorous, foliage-gleaning songbird species and calculated bird species richness, total abundance, and diversity values for each stand. Preliminary results suggest tree species dominance has more influence over insectivorous songbird species richness and abundance than did tree species diversity. Although we have yet to clarify mechanisms by which tree species composition affects insectivorous songbird community assemblages, we suspect it is through food availability and bird foraging preferences.

Population Monitoring of Three Turtle Species of Concern at Fort Indiantown Gap

Jarrold M. Derr, Pennsylvania State University, Fort Indiantown Gap NGTC, Wildlife Office
Bldg. 11-19 Utility Rd. Annville, PA 17003

Jarrold M. Derr, (717) 269-6774, c-jaderr@pa.gov; professional presentation

Since 2003, mark-recapture (MR) methods have been used to calculate population estimates for five turtle species at Fort Indiantown Gap National Guard Training Center (FIG; Dauphin and Lebanon Counties). Each year, individuals were captured, marked, measured, and returned to the population as they were encountered opportunistically or during turtle surveys. Three WAP-Priority Species in Pennsylvania: Eastern Box Turtle (*Terrapene carolina*; Maintenance Responsibility), Wood Turtle (*Glyptemys insculpta*; Species of Greatest Conservation Need), and Spotted Turtle (*Clemmys guttata*; Species of Greatest Conservation Need) were the focus of this study. Eastern Box and Wood Turtles (due to their association with wetland and upland habitats) were the most common and abundant over the study period. Spotted Turtles were least abundant as expected due to their dependence on wetter habitats and only found in three locations. Additionally, estimates from both open and closed MR models were calculated and compared for differences. Over the last nine years, populations of these three species at FIG appear to be stable despite wide-spread habitat and landscape changes across the 17,000 acre installation since the initial year of study.

Development of a chronic wasting disease surveillance plan and modeling of the potential spread in Pennsylvania

Tyler S. Evans, Pennsylvania Cooperative Fish and Wildlife Research Unit, 436 Forest Resources Building, The Pennsylvania State University, University Park, PA 16802; and W. David Walter, US Geological Survey, Pennsylvania Cooperative Fish and Wildlife Research Unit, 403 Forest Resources Building, The Pennsylvania State University, University Park, PA 16802

Tyler S. Evans, (814) 865-4183, tse119@psu.edu; student presentation

Chronic wasting disease (CWD) is a prion disease that faces both free-ranging and captive cervid populations. In the past 45 years, CWD has spread from a single region in Colorado to all bordering states, as well as Canada, the Midwest and the northeastern United States. On October 11, 2012, the Pennsylvania Department of Agriculture (PDA) confirmed the state's first case of CWD in a captive white-tailed deer (*Odocoileus virginianus*) from a farm in eastern Adams County. In order to develop a CWD surveillance plan for the state, we will determine the best scale for analysis and then extract demographic and environmental covariate information within these spatial grids for each harvested deer that tested positive and negative for CWD in Maryland, Virginia and West Virginia. This information will be extrapolated to Pennsylvania using Bayesian Disease mapping with WinBUGS. Specifically, we will attempt to determine the number of harvested deer needed to find a positive at 1% prevalence with a confidence of 80%. Instead of providing these estimates at the WMU scale, we plan to be able to provide estimates that are at the county or township level. The objectives of my research are (1) to summarize the history of CWD in the northeastern U.S. (2) to develop a CWD surveillance plan for the state of Pennsylvania given surveillance data of free-ranging deer in adjacent states and (3) to model the

potential spread of CWD given multiple demographic and environmental covariate factors in Pennsylvania.

Space and Habitat Use by Breeding Golden-winged Warblers in the Central Appalachian Mountains

Mack W. Frantz, Joseph Duchamp, Thomas Simmons, Timothy Nuttle, and Jeffery Larkin, Indiana University of Pennsylvania, Indiana, PA 15701; Andrew Vitz, Powder Mill Nature Preserve, Rector, PA 15677; Kyle Aldinger, Petra Wood, West Virginia Cooperative Wildlife and Research Unit, West Virginia University, Morgantown, WV 26505

Mack W. Frantz, (724)-825-6809, birdmack@lycos.com; student presentation

We compared differences in space and habitat use of individual male Golden-winged Warblers (*Vermivora chrysoptera*) that were monitored using both spot mapping and radio telemetry in Pennsylvania and West Virginia. We recorded 639 telemetry observations among 22 male Golden-winged Warblers in Pennsylvania and 496 telemetry observations among 8 males in West Virginia. Telemetry delineated use areas (100 and 50% MCPs) were on average 3 times larger than spot-mapped territories. Telemetry use areas revealed considerable overlap among *Vermivora* spp. which was not detected through spot-mapping alone. More than a third (39%) of all telemetry locations were located outside their respective male's spot-mapped territory. More telemetry locations were in mature forest compared to spot-mapped locations, and were also closer to forested edges in WV. On several occasions, we observed radio-tagged individuals greater than 200m (maximum of 1.48km) from their spot-mapped territories. Although the exact motive for a Golden-winged Warbler to leave its spot-mapped territory is unknown, observations suggest foraging, extra-pair copulation, and reconnaissance for post-breeding movement as possible motives. Sapling abundance was greater in telemetry use areas (mean 22.49 ± 2.14) than in spot-mapped territories (11.80 ± 1.86) in Pennsylvania. In managed grazing lands of WV, tree abundance was greater in telemetry use areas (31.40 ± 7.06) than in spot-mapped territories (5.77 ± 3.60). Ultimately, spot mapping alone does not accurately reflect Golden-winged Warbler space and habitat use even in areas with relatively low territory densities.

Effect of Marcellus shale gas development on forest bird species in north-central Pennsylvania

Nathan R. Fronk and Margaret C. Brittingham, Pennsylvania State University, Department of Ecosystem Science and Management, 414 Forest Resources Building, University Park, PA 16802

Nathan R. Fronk, (570) 916-1406, nrf5017@psu.edu; student presentation

North-central Pennsylvania contains some of the largest tracts of contiguous forest in Pennsylvania and supports a diversity of Neotropical migrant bird species. These forests are also one of the more concentrated areas for Marcellus shale development in Pennsylvania. The exploration and development of the Marcellus shale has the potential to fragment core forest habitat and create new edges. We examined how different levels of Marcellus shale gas extraction

impact the relative abundance of individual bird species as well as habitat guilds. To quantify the level of fragmentation, we calculated a fragmentation index for individual breeding bird atlas blocks, before and after gas development. Included in the index were all sources of fragmentation as well as development associated with Marcellus shale development such as roads, well pads, and pipelines. We investigated the relationship between individual and guild bird abundance and fragmentation levels. Our analysis has found that core forest is reduced with increasing well pads. As well pads increase, the forest becomes more fragmented. The relative abundance of seven species increased as fragmentation increased while five species saw a decrease in abundance as fragmentation increased. As fragmentation increased, the forest interior species guild abundance decreased and the edge-human associated species guild abundance increased.

Breeding ecology of Veeries nesting in Nescopeck State Park, northeastern Pennsylvania

Christopher B. Goguen, Science Program, Penn State – Hazleton, 76 University Dr., Hazleton, PA 18202

Christopher B. Goguen, (570) 450-3088, cbg10@psu.edu; professional presentation

The veery (*Catharus fuscescens*) is a migratory songbird that breeds within moist, forested habitats of eastern North America, particularly those with a well-developed shrub layer. Although vulnerable to activities that reduce shrub cover (e.g., deer herbivory), veeries appear to have benefitted in some locations from invasions by exotic shrub species. From May-July 2012, I used nest monitoring and habitat sampling to study Veery nesting ecology in forest habitats that have been invaded by exotic shrubs, particularly multiflora rose (*Rosa multiflora*) and Japanese barberry (*Berberis thunbergii*), within Nescopeck State Park, Luzerne County, Pennsylvania. Based on 42 nests monitored, veeries initiated nests from mid-May through early July. All nests were placed low, but above ground (mean = 58.6 cm), with 60% of nests built in exotic shrubs. Overall Mayfield method calculated nesting success was low (23.1%), although success was lower in early nests (initiated before 6 June; 15.5%) than in late nests (36.3%). Predators were responsible for all nest failures. This temporal pattern in nesting success likely resulted, in part, from a low overall nesting success for veeries in exotic shrubs (20.3%) relative to native plants (31.8%), and a greater use of exotic shrubs as nesting substrates early in the season. Although apparently of poor quality for nesting sites, exotic shrubs may be preferred as nesting substrates early in the spring because they leaf-out earlier than native species.

Stopover habitat use of migrating Sharp-shinned (*Accipiter striatus*) and Cooper's hawks (*A. cooperii*) in the central Appalachians

Laurie J. Goodrich, Acopian Center for Conservation Learning, Hawk Mountain Sanctuary Association, 410 Summer Valley Road, Orwigsburg, Pennsylvania 17961; Margaret C. Brittingham, School of Forest Resources, Pennsylvania State University, University Park, Pennsylvania 16802; Susan Guers, Chris Farmer, and David Barber, Acopian Center for Conservation Learning, Hawk Mountain Sanctuary Association, 410 Summer Valley Road, Orwigsburg, Pennsylvania 17961; and, Duane Diefenbach, School of Forest Resources, Pennsylvania State University, University Park, Pennsylvania 16802

Laurie J. Goodrich, 570-943-3411 x106, goodrich@hawkmtn.org; professional presentation

The quality and abundance of stopover habitat can influence the survival of migrating birds. To understand the stopover ecology of migrating raptors, we radio-tracked 44 Sharp-shinned (*Accipiter striatus*) and Cooper's hawks (*A. cooperii*) along the Kittatinny Ridge in eastern Pennsylvania during autumn 2003 and 2004. We examined stopover habitat use at three scales, a (1) regional scale, the area encompassing 95% of the migration tracks, (2) landscape scale, an area within 10 km of stopover sites, and (3) near-scale, habitat within 0.5 km of sites. We used logistic regression to evaluate selection with covariates including the cover of deciduous, evergreen or mixed forest, row crop or fields, suburban or urban, wetlands or water, and the size class of the forest patch. Habitat selected varied by scale, species, and age. At a regional scale, both species selected sites with greater cover of mixed forest and pasture. At the landscape and near scale, forest patch size was the most important factor in site selection, with both species using larger forest patches than were expected. Sharp-shinned Hawks also avoided suburban cover. At near-scale, hatch-year birds used smaller forest patches more often than adults. Habitat use by migrants was more conservative than wintering or breeding habitat use studies might suggest. Conservation of natural habitats within key raptor migration corridors may be critical to migrant survival. Land use with a focus on rural landscapes should be prioritized within migration corridors.

To catch a poacher: different strategies and approaches to mitigate poaching of white-tailed deer

Aaron M. Haines, Millersville University, Department of Biology, P.O. Box 1002, Millersville, PA 17551-0302

Aaron M. Haines, (717) 872-3355, aaron.haines@millersville.edu; professional presentation

Most Americans support legal hunting for food or as a population management tool, but there are strong concerns about illegal hunting activities such as poaching. Poaching may negatively impact animal populations by causing local extinctions, reducing genetic variability, reducing trophy size and hunting opportunities, and altering sex ratios and age structures. Throughout North American multiple studies have found that illegal harvest is a consistent form of mortality for white-tailed deer (*Odocoileus virginianus*). During this presentation I will discuss different strategies and approaches to help in the identification and mitigation of poaching activity on white-tailed deer. Some of the approaches I will discuss include the analysis of temporal, spatial, and environmental patterns associated with poaching activity on white-tailed deer. By identifying geographic hotspots and environmental conditions preferred by poachers, conservation officers can improve surveillance efforts to mitigate poaching activity. I will also discuss soil testing and potential white-tailed deer fecal testing efforts that can be used to identify chemicals such as chloride, phosphorous and calcium which may indicate an area that has been or is being illegally baited for white-tailed deer. The goals of these efforts are to help in the prosecution and reduction of individuals who illegally harvest white-tailed deer.

Experiential learning in ecological restoration at Delaware Valley College

Reginald A. Hoyt, Delaware Valley College, 700 E. Butler Avenue, Doylestown, PA 18901

Reginald A. Hoyt, (215) 489-2943, reginald.hoyt@delval.edu; professional presentation

Delaware Valley College, founded in 1896, has always focused on undergraduate experiential learning. A “Current Topics” course has been offered the past three years to provide Conservation and Wildlife Management majors with an introduction to the discipline of ecological restoration. Utilizing funding from the Harleysville National Bank and Trust Company “Great Professorship Award,” students and faculty have been supported in the development of a draft restoration plan, implemented group projects, and suggested priorities for coming years. In addition to the students registered for this course, students from other majors and in various courses have been involved in aspects of the monitoring and restoration efforts, as they have been incorporated into syllabi by other faculty. What had started out as a short-term project has evolved into an experiential learning opportunity that benefits students in Conservation and Wildlife Management, Biology, Environmental Science, and Plant Science. Activities represent a realistic cross-section of the expertise required by the ecological challenges of a rapidly changing mosaic of forest fragments, agriculture, and suburban development. Next steps include making this experiential learning course a permanent part of the curriculum, formalizing long-term monitoring protocols with faculty from various departments, expanding restoration activities to engage other faculty and student groups (i.e. DVC Student Chapter of TWS), and incorporating the concerns related to restoring this forest fragment into agricultural practices on adjoining land farmed by Delaware Valley College. Our goal is to provide opportunities to explore numerous disciplines that are representative of those needed in wildlife and habitat management.

Effects of Marcellus Shale gas development on forest fragmentation in Pennsylvania: a case study of the Tiadaghton State Forest

Lillie A. Langlois and Margaret C. Brittingham, Pennsylvania State University, School of Forest Resources, University Park, PA 16802

Lillie A. Langlois, (585) 487-8283, lal276@psu.edu; student presentation

The rapid expansion of Marcellus Shale gas development and its impact upon the natural resources of Pennsylvania is largely unknown. Recent development in the north-central region of Pennsylvania is of interest because it encompasses the state’s largest block of contiguous forest and is one of the most important areas for wildlife. Natural gas development will result in direct loss of habitat at well sites, pipelines, and service roads, however the resulting habitat fragmentation surrounding these areas may be of greater importance. We selected the Tiadaghton State Forest for a case study to project changes in forest fragmentation and core forest (forest greater than 100 m from edges) across the north-central region of Pennsylvania. Since 2008, Shale gas development resulted in the clearing of 130 ha (321 acres) for well pads (209 well permits located on 55 pads), 47 ha (115 acres) for related infrastructure (water impoundments, compressor stations, etc.), and 89 km (55 miles) of pipeline within the Tiadaghton, thereby decreasing core forest by 2050 ha (5065 acres) or 4.1 percent. The non-leased portion of the state forest lost 0.3 percent core forest, while the leased portion lost 8.2 percent core forest. Within leased tracts, loss of core forest ranged from 0-16 percent, indicating a range in gas development completion. Our results suggest major changes in landscape composition have already occurred within five years as a result of Shale gas development and highlight the importance of maintaining the remaining areas of core forest habitat.

Cerulean Warbler Response to Forest Management in the Central Appalachian Mountains

Jeffery L. Larkin, Andrea Evans, and Matthew White, Indiana University of Pennsylvania, 975 Oakland Ave., Indiana, Pennsylvania 15705; Petra B. Wood, James Sheehan, Molly E. McDermott, Greg A. George, Karen A. Perkins, US Geological Survey West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown, West Virginia 26506; Than J. Boves, Tiffany A. Beachy, David A. Buehler, and Patrick D. Keyser, Department of Forestry, Wildlife, and Fisheries, University of Tennessee, Knoxville, Tennessee 37996; Amanda D. Rodewald, Felicity L. Newell, and Marja H. Bakermans, School of Natural Resources, Ohio State University, Columbus, Ohio 43210; and Bentley Wigley, National Council of Air and Stream Improvement, Inc., Clemson University, Clemson, South Carolina.

Jeffery L. Larkin, (724) 357-7808, Larkin@iup.edu; professional presentation

Cerulean Warblers (*Setophaga cerulea*), one of the fastest declining avian species in North America, are associated with heterogeneous canopies in mature hardwood forests. However, the age of most second and third-growth forests in eastern North America is not sufficient for natural tree mortality to maintain structurally diverse canopies. Previous research suggests that forest management through timber harvest also may create conditions suitable as Cerulean Warbler breeding habitat. We conducted a multi-state study that examined Cerulean Warbler response to varying degrees of canopy disturbance created by operational timber harvest. Specifically, 3 harvest treatments and an un-harvested reference plot were replicated on 7 study areas in 4 Appalachian states in 2005-2010. We compared pre-harvest and four years post-harvest demographic response of Cerulean Warblers. Over all study areas, Cerulean Warbler territory density remained stable in un-harvested reference plots and increased significantly the first year post-harvest on intermediate harvest plots. By year 3 post-harvest, territory density remained significantly greater for intermediate harvest than reference plots, and marginally greater for light and heavy harvests than reference plots. However, un-harvested reference plots had greater nest survival than most harvest treatments. The one exception was nest survival between reference plots and the intermediate harvest on the northern study areas did not differ. Our results indicate that intermediate harvests likely benefit Cerulean Warblers in some portions of the species' breeding range. However, additional research is needed to better examine fitness consequences of timber harvests and to estimate population-level implications. In particular, does the greater number of nesting individuals, particularly in intermediate harvests, compensate for lower nesting success? Until researchers provide such insight, we recommend management decisions be based on local conditions, particularly in forests where Cerulean Warbler populations are high.

A comparison of Lepidoptera communities inhabiting restored and degraded pitch pine (*Pinus rigida*)-scrub oak (*Quercus berberidifolia*) barrens in Pennsylvania

Wendy Leuenberger, Indiana University of Pennsylvania, 975 Oakland Ave, Indiana, PA 15705; Scott Bearer, The Nature Conservancy, 220 West Fourth Street, 3rd Floor, Williamsport, PA 17701; Pat McElhenny, The Nature Conservancy, Hauser Nature Center, P.O. Box 55, Long Pond Road, Long Pond, PA 18334; and Jeffery Larkin, Indiana University of Pennsylvania, 975 Oakland Ave, Indiana, PA 15705

Wendy Leuenberger, 402-910-8330, W.M.Leuenberger@iup.edu; student presentation

Scrub oak barrens were once distributed throughout portions of the northeastern United States. This fire-dependent community covered approximately two million acres in Pennsylvania during the mid-1900s, but was reduced to about 17,600 acres by the late-1900s. Decline of scrub oak barrens is attributed to human development, fire suppression, and colonization by fire-intolerant trees. In recent years, the Pennsylvania Game Commission and The Nature Conservancy have partnered to restore large amounts of degraded scrub oak barrens through prescribed fire. Scrub oak barrens are a state imperiled ecosystem, and support high species richness including several endemic species. For example, scrub oak barrens are known for supporting high Lepidoptera (butterfly and moth) diversity. Our study examined Lepidoptera communities in recently burned scrub oak barrens in northeastern Pennsylvania. We used black light traps and bait stations to compare Lepidoptera diversity and abundance across six burned sites and three degraded unburned sites. Sites were sampled two nights per month in June, July, and August 2012. A total of 13,386 individuals were identified, representing 397 species. Seven species are rare or state listed with three species exclusive to treatment sites. No differences in Lepidoptera species richness, diversity or evenness were found between burned and unburned scrub oak barrens. Several species (n=207) were found in both burned and unburned sites. However, several species were unique to burned (n=54) and unburned sites (n=136). Our data suggest scrub oak barrens should be managed to create a mosaic of burned and unburned patches if Lepidoptera diversity is a conservation goal.

Abundance, distribution, and conservation of the northern flying squirrels (*Glaucomys sabrinus*) in Pennsylvania: a decade worth of monitoring and research

Carolyn Mahan, Biology and Environmental Studies Programs, Penn State Altoona, Altoona, PA 16602; Micheal Steele, Department of Biology, Wilkes University, Wilkes Barre, PA 18702; and Gregory Turner, Pennsylvania Game Commission, Harrisburg, PA 17112

Carolyn Mahan, (814)-949-5530, cgm2@psu.edu; professional presentation

The northern flying squirrel (*Glaucomys sabrinus*) is a species that is dependent on mature forest stands with a coniferous component and is in decline throughout the periphery of its range in the Appalachians. In Pennsylvania, the severe decline of this species is most likely the result of loss of critical mature coniferous habitat and due to competition with the southern flying squirrel (*G. volans*). Since 2001, we have conducted and established a live-trapping and nest box monitoring program for northern flying squirrels in Pennsylvania. During this time we have had declining capture success of both northern and southern flying squirrels—with no captures of northern flying squirrels in the past year. In an attempt to improve conifer cover, we initiated a red spruce restoration program in core northern flying squirrel habitat in northeastern Pennsylvania. In 2012 we acquired, planted, and monitored > 2,000 red spruce seedlings in these locations. Our talk will provide further summaries of habitat use, parasite occurrence, and distribution of this state endangered sciurid.

Paired resource selection models predict risk to migratory golden eagles (*Aquila chrysaetos*) from industrial wind energy development

Tricia A. Miller, Riparia, 302 Walker Building, The Pennsylvania State University, University Park, PA 16802, USA and Division of Forestry and Natural Resources, PO Box 6125, West Virginia University, Morgantown, WV, 26506, USA; Robert P. Brooks, Adam Duerr, and Todd E. Katzner, Division of Forestry and Natural Resources, PO Box 6125, West Virginia University, Morgantown, WV, 26506, USA; Michael J. Lanzone, Cellular Tracking Technologies, Suite B, 2405 North Center Avenue, Somerset, PA 15501 USA; Jeff Cooper, Virginia Department of Game and Inland Fisheries, 1320 Belman Rd., Fredericksburg, VA 22401, USA; Kieran O'Malley, West Virginia Division of Natural Resources, 1 Depot Street, Romney, WV 26757, USA; Charles Maisonneuve, Ministère des Ressources naturelles et de la Faune, 92, 2e Rue Ouest, Rimouski, Québec, G5L 8B3, Canada; Junior Tremblay, Ministère des Ressources naturelles et de la Faune, 880 chemin Sainte-Foy, Quebec City, Quebec, G1S 4X4, Canada; David Brandes, Department of Civil and Environmental Engineering, Acopian Engineering Center, Lafayette College, Easton, PA, 18042, USA

Tricia A. Miller, (814) 865-6831, tricia.a.miller@gmail.com; professional presentation

Conservation of populations in the face of economic development can cause complex management problems. We took a unique, balanced approach to this help solve this problem by recognizing that both industry and wildlife select resources to increase economic return and biological fitness, respectively. Our framework involves overlay of paired spatially explicit resource selection models to identify areas of overlapping resource selection and thus, priority sites for conservation management. Where high quality habitats for wildlife and economic development intersect, there is the greatest risk of negative interactions - where populations may suffer mortality, habitat loss, decreased fitness, etc. and industry may suffer from increased costs and lower return on investment (ROI). We illustrate our approach to provide solutions to minimize and mitigate negative wind turbine-wildlife interactions. We created spatially explicit models of resource selection of wind turbines and low-flying golden eagles (*Aquila chrysaetos*) in the central Appalachian Mountains in Pennsylvania, USA and overlaid those models to describe risk of negative interactions. We found regional variation in risk, i.e., overlap of high quality habitat, which can be used to guide regional development of the wind industry. Furthermore, we applied our models across scales to understand project-level and turbine-level risk, allowing for recommendations of site- and turbine-level adjustment. Our results greatly improve our understanding of risk of wind energy to eagles and illustrate the effectiveness of this approach. While we applied our framework to wind-wildlife interactions, it is effective valuable tool that can be applied to describe and understand risk across species and industries.

Population genetic structure of little brown bats (*Myotis lucifugus*) in Pennsylvania predicts the pattern of spread of white-nose syndrome

Cassandra M. Miller-Butterworth, Penn State Beaver, 100 University Drive, Monaca, PA 15061; Maarten J. Vonhof, Dept. of Biological Sciences and Environmental Studies Program, Western Michigan University, 1903 W. Michigan Avenue, Kalamazoo, MI 49008; Joel Rosenstern, Penn State Beaver, 100 University Drive, Monaca, PA 15061; Greg G. Turner, Pennsylvania Game Commission, 2001 Elmerton Avenue, Harrisburg, PA 17110; and Amy L. Russell, Department of Biology, Grand Valley State University, 1 Campus Dr., Allendale, MI 49401

Cassandra Miller-Butterworth, (724) 773-3527, cmm48@psu.edu; professional presentation

Until recently, the little brown bat (*Myotis lucifugus*) was one of the most common bat species in North America. The high density of caves in the Appalachian mountains provides an abundance of suitable hibernacula that historically have supported very large populations. However, this species faces a significant and immediate threat from white-nose syndrome (WNS). The aim of this study was to examine the population genetic structure of *M. lucifugus* in PA, and thereby infer the impact that WNS is likely to have on *M. lucifugus* populations, both locally and on a landscape scale. Samples were collected from ~200 individuals from hibernacula throughout PA, as well as from West Virginia and Vermont. Both mitochondrial (cytochrome oxidase I) and nuclear (8 microsatellites) loci were examined. Although no substructure was evident from nuclear DNA, female-mediated gene flow was restricted between hibernacula in western PA and the remaining colonies. This mitochondrial genetic structure mirrors topographical variation across the region: three hibernating colonies located on the Allegheny high plateau were significantly differentiated from colonies located in the central mountainous and eastern lowland regions, suggesting reduced gene flow between these clusters of colonies. Consistent with the hypothesis that WNS is spread primarily through bat-to-bat contact, these same three hibernating colonies in westernmost PA remained WNS-free for 1-2 years after the disease had swept through the rest of the state, suggesting that female migration patterns may influence the spread of WNS across the landscape.

Lepidoptera Communities Occupying Invasive vs. Native Shrubs

Stephanie L. Moon, Emily C. Bellush, and Jeffery L. Larkin, Department of Biology, 95 Oakland Avenue, Indiana University of Pennsylvania, Indiana, PA 15705; and Art Gover, 456 Agricultural Sciences and Industries Building, The Pennsylvania State University, University Park, PA 16802

Stephanie Moon, (814) 462-4343, trjs@iup.edu; student presentation

Shrubland communities provide important habitat for many wildlife species including several imperiled songbirds. However, many of North America's native shrubland communities are becoming dominated by non-native invasive shrubs species. While non-native and native shrubland communities both meet the structural habitat needs of breeding songbirds, it is unclear if non-native species support adequate caterpillar abundances - a major prey item for breeding songbirds and their young. Native and non-native plant species composition is known to be determinants of insect populations, which can affect higher trophic levels, especially songbirds and their young. As such, understanding plant-insect interactions on native and non-native shrubs is crucial in establishing habitat management guidelines for declining songbirds and their insect

prey. We compared caterpillar density among four native (arrowwood viburnum, *Viburnum dentatum*; hawthorn, *Crataegus* spp.; silky dogwood, *Cornus amomum*; and gray dogwood, *Cornus racemosa*) and 2 non-native (autumn-olive, *Elaeagnus umbellata* and honeysuckle, *Lonicera* spp.) shrub species in central and western Pennsylvania. Our data revealed that some native shrub species support higher caterpillar densities than the non-native species we studied. - Hawthorn (2.08 caterpillars/10g Dry Leaf Weight) and arrowwood viburnum (0.96 caterpillars/10g DLW), supported the highest lepidoptera densities, whereas autumn olive (0.14 caterpillars/10g DLW) and honeysuckle (0.24 caterpillars/10g DLW) supported the lowest densities. Land managers should consider native and non-native plant species composition when modifying shrubland habitats for wildlife. Gaining a better understanding of caterpillar species diversity in native vs. non-native communities should be the focus of future research.

Bat response to oak regeneration silviculture

Amber Nolder, Joseph Duchamp and Laura D'Acunto, Department of Biology, Indiana University of Pennsylvania, 1101 South Drive Indiana, PA 15705; Joy O'Keefe, Jeremy Sheets, Megan Caylor, and John J. Whitaker, Jr., Department of Biology, Indiana State University, 200 North Seventh Street, Terre Haute, IN 47809; and Timothy Carter, Department of Biology, Cooper Life Science Building, Ball State University, Muncie, IN 47306

Amber Nolder, (814) 603-9160, a.d.nolder@iup.edu; student presentation

Silvicultural practices potentially affect the availability of bat roosting and foraging resources. Thus, concern over declining bat populations has generated increased interest regarding the role of forest management in bat habitat conservation. Bat activity is generally higher in harvests than in unharvested forest stands. However, activity patterns of individual bat species often differ from overall bat community trends. Our study examined the influences of harvest practices on bat activity in two state forests in south-central Indiana as part of the Hardwood Ecosystem Experiment, a long term investigation of the effects of oak regeneration management on forest communities. We recorded echolocation calls in first-stage shelterwood, clearcut, and patch cut harvests and in unharvested (reference) stands. Acoustic surveys were conducted each summer for 2 years pre-harvest and 4 years post-harvest. We measured vegetation characteristics at all acoustic sites to examine relationships between stand structure and bat activity. Total bat activity increased following harvest and was higher in clearcuts and shelterwoods compared to unharvested sites. *Myotis* species were more active in shelterwoods, where overstory stem density was 30% lower than in unharvested sites. The most commonly detected species *pre-harvest* were northern long-eared bat (*Myotis septentrionalis*) and Indiana bat (*Myotis sodalis*), and activity of these species did not differ between pre- and post-harvest. However, tricolored bats (*Perimyotis subflavus*) and eastern red bats (*Lasiurus borealis*) were the most commonly detected species post-harvest. Management that creates a mix of structurally diverse forest stands can maintain habitat for a more diverse bat community.

Evaluation of automated camera methods for white-tailed deer (*Odocoileus virginianus*) population monitoring

Patrick T. Oelschlager and Corey A. Houck, Juniata College, 1700 Moore St., Huntingdon, PA 16652.

Patrick T. Oelschlager, (267) 733-8715, oelscpt10@juniata.edu; student presentation.

A 27-day survey of white-tailed deer (*Odocoileus virginianus*) populations in Huntingdon County, PA, used automated game cameras to compare differences in population estimates based on data from automated cameras with 1-minute and 10-minute trigger delay settings. We hypothesized that 1-minute delay settings would yield more complete records of deer activity. Additionally, different photo analysis techniques, defined by the authors as the “largest yield” and “herd visit” techniques, were compared with the hypothesis that a difference in duration of feeder visits would be observed between adult bucks and doe/fawn groups. The average estimated deer population between the four data analysis technique/camera setting combinations was 35 deer and the average adult doe:buck ratio was 4.8:1. Analysis failed to show statistically significant differences at the $\alpha = 0.05$ level between number of unique bucks observed with 1 and 10-minute delay settings, but one additional unique buck was observed using a 1-minute delay. A difference in average number of trigger events between bucks (1.77) and doe/fawn groups (2.43) was observed, supporting our hypothesis. Site-specific differences in data seemed to lessen the significance of these trends. The population estimate technique used in this study relies on the identification of unique bucks and assumes the ratio of photos taken to number of individual deer is consistent between bucks and doe/fawn groups when using the largest yield technique; we believe the herd visit technique with 1-minute camera delay settings captures images of more unique bucks and eliminates the potentially incorrect assumption of a consistent ratio.

Monitoring Changes in the Aquatic Biological Community Following Passive Treatment of Abandoned Mine Drainage

Shawn M. Rummel, Ph.D., Trout Unlimited, Lock Haven, PA 17745

Shawn M. Rummel, (570) 748-4901, srummel@tu.org; professional presentation

Middle Branch is a tributary to Twomile Run, which drains into Kettle Creek in northcentral Pennsylvania. Middle Branch, along with Twomile Run, is listed as impaired by abandoned mine drainage (AMD) by the Department of Environmental Protection. In 2000, a passive treatment system was constructed on Middle Branch to treat the two main sources of AMD impacting the stream. However, this system was not adequately treating water quality issues. The system was rehabilitated in 2006 and is now effectively treating the AMD pollution in Middle Branch. Since 2006, Trout Unlimited has been monitoring both the chemical and biological recovery of the stream. Results to date show dramatic improvements in water quality. In addition, the aquatic biota (benthic macroinvertebrates and brook trout [*Salvelinus fontinalis*]) have been improving over time. This presentation will focus on how the composition of the biological community in Middle Branch has responded to positive changes in water quality over time.

Pennsylvania Game Commission Wind Energy Voluntary Cooperative Agreement: Moving Forward

John W. Taucher and Tracey M. Librandi Mumma, Pennsylvania Game Commission, 2001 Elmerton Avenue, Harrisburg, PA 17110

John W. Taucher, (717) 787-4250 ext 3632, jotaucher@pa.gov; professional presentation

The Pennsylvania legislature ratified the Alternative Energy Portfolio Standards Act in 2004 requiring 18% of the electricity sold to retail customers in Pennsylvania to come from renewable and advanced energy sources within 15 years. To further understand, avoid, and minimize potential impacts to wildlife and its habitat from wind energy development in the state, the Pennsylvania Game Commission (PGC) worked collaboratively with the wind industry to develop a Wind Energy Voluntary Cooperative Agreement in 2007. The Cooperative Agreement allowed Pennsylvania to become one of the national leaders in determining and addressing wildlife impacts from wind energy development. Between 2007 and 2012, over 250 surveys were conducted, including breeding bird surveys, raptor migration surveys, bat mist-net surveys, bat acoustic surveys, bat hibernacula investigations, and mortality monitoring. Through these surveys, we have gained a better understanding of what the actual impacts of wind energy development in Pennsylvania are. Several new observations of state-listed threatened and endangered species have been documented in Pennsylvania through pre-construction surveys. Post-construction surveys have provided estimates of bird and bat mortality as well as documented the mortality of a federally endangered Indiana bat (*Myotis sodalis*) and several state-listed endangered Blackpoll Warblers (*Setophaga striata*) and Yellow-bellied Flycatchers (*Empidonax flaviventris*). The PGC is in the process of working with Cooperators to update the Cooperative Agreement and implement minimization efforts to reduce overall bat mortality from the operation of wind turbines.

Tracking invasive species with iMap Invasives

Mary Walsh and Kierstin Carlson, PA Natural Heritage Program, Western Pennsylvania Conservancy, 800 Waterfront Dr., Pittsburgh, PA 15222

Mary Walsh, (814) 689-1823, mwalsh@paconserve.org; professional presentation

Invasive species can be a threat to developed and natural systems, cause human diseases, reduce water quality, degrade recreational experiences, and cause loss of biodiversity. Having a tool to track the introduction and spread of invasive species is one critical step to curbing their damage. *iMap Invasives*, a database for Pennsylvania invasive species, stores spatially-referenced information on invasive plants and animals in an on-line system for the public and for natural resource managers. Tracking invasive species locations in this way can assist managers with decision making and prioritizing resources for management. Several types of information, such as general observations, targeted-survey efforts, and treatments, may be entered through the on-line system. Queries and interactive mapping tools enable users to retrieve data and map species distributions. The presentation will walk participants through the use of *iMap Invasives* database and applications.

The importance of public lands for forest interior birds in Pennsylvania

Andrew M. Wilson and Daniel C. Williams, Department of Environmental Studies, Gettysburg College, 300 N Washington St, Gettysburg, PA 17325; and Daniel W. Brauning, Pennsylvania Game Commission, 2001 Elmerton Avenue, Harrisburg, PA 17110

Andrew M. Wilson, (717) 337-6972, awilson@gettysburg.edu; professional presentation

Forest interior birds are known to be disproportionately negatively affected by forest fragmentation. Pennsylvania's forests support significant numbers of many forest interior birds, but forest fragmentation due especially to expanding energy infrastructure could have negative impacts on populations of these species. We use point count data from the Second Atlas of Breeding Birds in Pennsylvania (2004-09) to first identify those bird species that would most likely be affected by fragmentation, and second, to compare bird abundances and species richness in forests on public versus private lands. Species that were strongly associated with interior forest (KS Test; $p < 0.05$), including winter wren (*Troglodytes hiemalis*), hermit thrush (*Catharus guttatus*), black-throated blue warbler (*Setophaga caerulescens*), and Blackburnian warbler (*Setophaga fusca*) were also found in higher abundances in public rather than private forests, while private forests supported higher abundances of species typically associated with highly disturbed landscapes, e.g. mourning dove (*Zenaida macroura*) and song sparrow (*Melospiza melodia*). In contrast, there was no overall difference in bird species richness between public and private forests, suggesting that species richness is a poor indicator of forest bird community integrity in Pennsylvania. The drivers of these patterns, including landscape and historical factors, are discussed. We conclude that public forest lands in Pennsylvania are of crucial importance to the state's forest bird community.

Abstracts

Posters

(listed alphabetically by last name of presenter--italicized)

Prevalence of two emerging infectious diseases among Eastern Hellbender (*Cryptobranchus a. alleganiensis*) populations in western Pennsylvania

Jared D. Bilak, Timothy B. Hummel, Samantha N. Sullivan, and Kurt J. Regester, Department of Biology, Clarion University, Clarion, PA 16214; Megan J. Walker, Matthew T. Martin, and Chad S. Brooks, Department of Biology, Austin Peay State University, Clarksville, TN, 37044; and Eric J. Chapman, Watershed Conservation Program, Western Pennsylvania Conservancy, Indiana, PA, 15701.

Jared D. Bilak, (304) 545-6975, J.Bilak@eagle.clarion.edu; student poster

Emerging infectious diseases have been linked to declines in amphibian abundance and diversity around the world. Ranavirus and the fungus *Batrachochytrium dendrobatidis* (*Bd*) have been implicated in many amphibian declines but relatively few species in Pennsylvania have been assessed for these pathogens. Between June-August 2012, we collected skin swab and tail tissue

samples from 171 Eastern Hellbenders (*Cryptobranchus a. alleganiensis*) inhabiting four Pennsylvania watersheds: French Creek (Crawford county), Tionesta Creek (Forest county), Little Mahoning Creek (Indiana county) and Tubmill-Hendricks Creek (Westmoreland county). We stored samples in 70% ethanol and assayed them for pathogen DNA using polymerase chain reaction analysis. Among hellbender populations, *Bd* prevalence ranged from 0-16% for French Creek, 11-37% for Little Mahoning Creek, 7-48% for Tubmill-Hendricks Creek, and 8-24% for Tionesta Creek. Ranavirus prevalence ranged from 0-16% for French Creek, 5-28% for Little Mahoning Creek, 0-16% for Tubmill-Hendricks Creek, and 0-12% for Tionesta Creek. Only two hellbenders were infected by both pathogens. Our study is the first to document the occurrence of ranavirus for any amphibian species in Pennsylvania and provides baseline data for monitoring changes in both ranavirus and the *Bd* prevalence for hellbender populations. Assessing the disease status of other amphibians across a wide taxonomic and geographic range is important for identifying other species at risk in Pennsylvania.

Geography, Fire, and Bullets: Regaining Lost Depression-Era Grasslands

Joseph Hovis, Nick Hoffman, David McNaughton, Wildlife Section, Building 11-19, Utility Road, PA Department of Military & Veterans Affairs, Fort Indiantown Gap National Guard Training Center, Annville, PA 17003-5002; Mark Swartz and Jarrod Derr, The Pennsylvania State University, University Park, PA 16802

Joseph Hovis, (717) 861-2806, jhovis@pa.gov; professional poster

Created by Governor Gifford Pinchot in 1931, Fort Indiantown Gap (FIG) is a 17,100 acre military training facility in south-central PA. The combination of 80 years of military training (soil disturbance and fire regime), absence of industrial agriculture, intersection of major landforms, and adjacent public lands has created a landscape of quality habitats. FIG has 3,000 acres of grassland, scrubland, or savanna, 2,000 acres of mowed fields (native and exotic grasses), and 11,000 acres of forest. This landholding provides habitat for over 111 species of concern (WAP-Priority + PNDI), including the largest Eastern population of the regal fritillary butterfly (*Speyeria idalia*); a responsibility species of immediate conservation concern. In 2008, 900 acres of native-dominated grassland habitat of varying quality were on site but 1938 aerial photographs suggest that there may have been 5,000 acres. Tree scar analyses revealed that some of the high-biodiversity grassland areas burned every three years since 1941. Prescribed fire is now used to control fuel load and restore grassland and savanna habitat, which also benefits tactical military training exercises and early-successional wildlife species. A SWG project was implemented 2010-2011 to regain some the 5,000 acres of Depression-era “old-fields” that are currently low-quality grasslands, pine thickets, or low quality habitats using a combination of land management techniques and to monitor early-successional specialists (41 SGCN documented on site) and habitat response. Additional objectives were PA-ecotype seed collection and propagation and development of Eastern native grassland restoration techniques for other projects in “Penn’s Woods” and the Mid-Atlantic Region.

Assessment of infection by the fungal pathogen *Batrachochytrium dendrobatidis* among plethodontid salamanders in Cook Forest State Park, Pennsylvania

Timothy B. Hummel, Samantha N. Sullivan, and Kurt J. Regester, Department of Biology, Clarion University, Clarion, PA 16214; Megan J. Walker, Matthew T. Martin, and Chad S. Brooks, Department of Biology, Austin Peay State University, Clarksville, TN 37044

Timothy B. Hummel, (814) 673-5170, T.B.Hummel@eagle.clarion.edu; student poster

Emerging infectious pathogens, such as the fungus *Batrachochytrium dendrobatidis* (*Bd*), have been implicated in amphibian declines on a global scale. Biologists must understand the distribution and occurrence of this pathogen because the loss of amphibian abundance and diversity has broader negative effects on ecosystem structure and function. Relatively few amphibian species in Pennsylvania have been assessed for *Bd*. Between September and October 2012, we collected skin swab samples from 30 Redback salamanders (*Plethodon cinereus*) and 30 Mountain Dusky salamanders (*Desmognathus ochrophaeus*) at three study sites in Cook Forest State Park, Pennsylvania. In addition, we opportunistically collected skin swab samples from three Slimy salamanders (*Plethodon glutinosus*), two Two-lined salamanders (*Eurycea bislineata*), two Four-toed salamanders (*Hemidactylium scutatum*), and one Longtail salamander (*Eurycea longicauda*). Swab samples were preserved in 70% laboratory grade ethanol and later tested for *Bd* DNA using polymerase chain reaction assays. All salamanders tested negative and thus we did not detect the occurrence of *Bd* among the six species we examined. We cannot conclude that *Bd* is absent among amphibians inhabiting Cook Forest State Park because relatively low levels of *Bd* prevalence (<10%) may not be detected with modest samples sizes. Our study represents the first to assess *Bd* among multiple plethodontid species in Pennsylvania. Future studies should focus on increasing sampling effort for individual species and expanding the taxonomic and geographic range of amphibians examined.

Effects of wind on spatial distribution of white-tailed deer

Michael Rodgers, Fredrik Bryntesson, Sherri Cooper, and Eugene Potapov, Bryn Athyn College, Bryn Athyn, PA 19009

Michael Rodgers, (848) 482-1727, michaelbrodgers1120@gmail.com; student poster

A total of 28 white-tailed deer (*Odocoileus virginianus*) were monitored using high density radio-tracking (5 min between the fixes) in a suburban land area north of Philadelphia. In part, the study area is covered by the Pennypack Ecological Restoration Trust (PERT) preserve. Deer GPS location fixes were merged with weather parameters from a nearby weather station. The slope, aspect, elevation and habitat type of the deer GPS location fixes were analyzed within GIS framework with respect to wind speed and wind direction. Wind directions at the time when fixes were taken were compared between fixes located north and south of the median latitude of fixes for each individual, and similarly to east and west from median longitude. All tracked individuals were highly selective for slope at the various wind speed gradations. The deer appeared to show no selectivity for either aspect or elevation for all observed wind gradations; however, the animals were more randomly distributed along aspect gradients at higher wind speeds. Regression analysis of wind direction versus aspect of patch selected by deer revealed that the deer routinely select

patches with aspects directly opposite from the direction of the wind. Effects of the wind direction on the usage of different directional portions of home ranges are discussed.

A Collaborative Program for the Conservation and Restoration of Habitat for the Eastern Massasauga Rattlesnake

Howard K. Reinert, Department of Biology, The College of New Jersey, PO Box 7718, Ewing, NJ 08628-0718; Laretta M. Bushar, Department of Biology, Arcadia University, 450 South Easton Road, Glenside, PA 19038; B. Scott Fiegel, Ecological Associates, LLC, PO Box 181, Oley, PA 19547; Brandon M. Ruhe, Mid-Atlantic Center for Herpetology and Conservation, PO Box 620, Oley, PA 19547; and Christopher A. Urban, Natural Diversity Section, Pennsylvania Fish and Boat Commission, 450 Robinson Lane, Bellefonte, PA 16823-9616

Brandon M. Ruhe, (610) 462-8530, bruhe@machac.org; professional poster

During the past century the Eastern Massasauga (*Sistrurus c. catenatus*) has suffered serious population declines throughout its entire geographic range. In Pennsylvania the number of extant populations has plummeted to a critical level making this species one of the Commonwealth's most endangered animals. The major factor in this decline has been the loss of emergent wetland, meadow, and old-field habitat. We are embarking on a concerted effort to: 1) protect critical areas with extant Massasauga populations from further degradation, 2) assess methods for the restoration of degraded habitats, and 3) develop management plans to improve, expand, and connect existing habitat. This effort involves an unprecedented collaboration among non-profit conservation organizations, state and federal agencies, university researchers, and local landowners. Conservation easements are currently being acquired by the US Department of Agriculture through a special initiative by the Natural Resources Conservation Service designed specifically for the protection of the Massasauga. The Pennsylvania Fish and Boat Commission is providing funding through a US Fish and Wildlife Service State Wildlife Grant for an active program of habitat restoration and the evaluation of the efficacy of restoration methods on a 100 acre study site. Progress on the recently initiated restoration project includes the removal of over 20 acres of mature forest for conversion to open meadow and old-field habitat, the removal of trees and shrubs from wooded wetlands to create the open, emergent wetland habitat preferred by the Massasauga, pre-logging surveys of prey density, and telemetric monitoring of Massasaugas.

The Status of a PA Endangered Bird – the Upland Sandpiper

Paul Di Salvo, Kalley Hansel, Jessica Zupancic, and Andrew M. Wilson, Department of Environmental Studies, Gettysburg College, 300 N Washington St, Gettysburg, PA 17325

Andrew M. Wilson, (717) 337-6972, awilson@gettysburg.edu; student poster

The upland sandpiper (*Bartramia Longuardia*) has experienced a steep population decline in the northeastern U.S. since the mid-20th Century. In Pennsylvania it was found in less than 0.5% of atlas blocks during the *Second Atlas of Breeding Birds in Pennsylvania* project (2ndPBBA; 2004-09) and breeding was confirmed at only two locations. Due to continued declines and a small population size, the upland sandpiper was listed as PA endangered in 2012. During May 2012 the areas around 15 2ndPBBA upland sandpiper sightings were resurveyed by Gettysburg College

students and volunteer birdwatchers. The aim was to establish whether the atlas records related to persisting populations. We used five-minute audio playback at up to 10 locations within 4km of the atlas sightings. A maximum of 19 pairs/calling male upland sandpipers were found across the state in 2012, most of them on or close to reclaimed surface mines. However, locating such a scarce species can be problematic, and it is still not known to what extent the species is under-reported. To help direct future surveys we analyzed data from the 2nd PBBA and the 2012 survey to produce a habitat suitability model for the upland sandpiper in Pennsylvania. We used a GIS framework to determine areas of suitable habitat and then stratified these by proximity to recent (2004-2012) upland sandpiper sightings. We recommend that our suitability model be used to establish a sampling protocol for more thorough statewide upland sandpiper survey every five years, in order that the species' precarious status can be closely monitored.

The need to incorporate uncertainty into recovery goals for endangered species

Katie Brittingham, College of Natural Resources, Department of Ecology and Conservation Biology, Room 103A, Moscow, ID 83844-1141; Aaron M. Haines, Millersville University, Department of Biology, Millersville PA, 17551; J. Michael Scott, United States Geological Survey, Idaho Cooperative Fish & Wildlife Research Unit, University of Idaho, CNR Room 103, Moscow, ID 83844-1141; Dale D. Goble, University of Idaho, College of Law, Law 201, Moscow, ID 83844-2321; Janet L. Rachlow, Fish and Wildlife Resources, University of Idaho, Moscow, ID 83844-1136; and Matthew Zak, Millersville University, Department of Biology, Millersville PA, 17551, USA

Matthew Zak, (908)-256-9785, mmzak@millersville.edu; student poster

The purpose of the Endangered Species Act (ESA) of 1973 is to preserve both endangered and threatened species and their ecosystems. Since its enactment, over 1,350 species have been listed under the ESA. Over a thousand of these species have recovery plans specifically written to help in delisting or downlisting the species, over 200 of those have a population size stipulated as a benchmark for recovery. We discuss whether uncertainty associated with population estimates is commonly reported in these recovery documents as a measure of precision. Tentatively, we found that prior to 2006, < 6% of all recovery plans reported uncertainty for population estimates. This number is subject to change with the drafting of both new and revised plans, which we are currently evaluating. The failure to evaluate and quantify uncertainty associated with population estimates could lead to species being downlisted or delisted before benchmarks are achieved. In order to avoid premature changes in species status we recommend more rigorous approaches when specifying recovery criteria for endangered species.