WELCOME!

Welcome to the Spring 2018 West Virginia Chapter of the Wildlife Society Conference. This conference promises to be an extremely informative and interesting get together for students, professionals and others all involved with the management and conservation of our wildlife resources all throughout the state.

Our expert speakers come from all over the state and represent various agencies, institutions, consulting companies and more. The officers of the WV Chapter of The Wildlife Society would like to thank each and every presenter. Without them, none of this would be possible. We would also like to personally thank all of the members of the audience for attending this conference.

Any feedback (both positive and negative) is appreciated to make any future conferences better. Please email any of the officers listed below to voice your concerns.

Thanks again for attending!!

West Virginia Chapter of the Wildlife Society Officers

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AGENDA

9:30 – 3:00 Registration

10:00 Welcome and Introductions *Jerry Westfall*
Morning Moderator *Jim Crum*

10:20 In a sea of scat: Using non-invasive sampling to study gray wolves *Lucas Price*

10:40 Spatio-temporal analysis of genetic diversity associated with extended pre-clinical symptoms of Chronic Wasting Disease *Darren M. Wood*

11:00 Projected current and future habitat for the Cow Knob salamander *Carl D. Jacobsen*

11:20 Wintering American Black Duck Occupancy in Central Appalachia *Sally Yannuzzi*

11:40 Region-wide Assessment of Marcellus-Utica Shale Gas Development on Birds *Laura S. Farwell*

12:00 **LUNCH**

1:00 **POSTER VIEWING**

Afternoon Moderator *Mike Peters*

2:00 Modeling Bobcat Occupancy in West Virginia at the Landscape Scale Thomas F. Rounsville Jr

AGENDA

2:20 Monitoring Eastern Diamondback Rattlesnakes Using a Novel External Radio-transmitter Attachment Method
Michael Jungen

2:40 The Central Appalachian Spruce Restoration Initiative: Restoring and Conserving Wildlife Habitat
Cathy Johnson

3:00 **BREAK**

3:20 Snowy Owls in West Virginia: A case report and discussion of snowy owl natural history *Jesse A. Fallon*

3:40 Identifying drivers of eastern hellbender extirpation in West Virginia using environmental DNA (eDNA)
Sean M. Wineland

4:00 Wintering Sparrow Occupancy on Private Agricultural Conservation Easement Program Wetlands and Public Wetlands in West Virginia *Katharine Lewis*

4:20 Preliminary assessment of bird community response to young forest management *Eric L. Margenau*

5:00 **Conference wrap up, paper & poster awards and door prizes followed by a WVTWS meeting.**

POSTERS

Benjamin Walton Examining Population Genetics of Reintroduced Rocky Mountain Elk in Southern West Virginia

Saahirah Cua Ecological and Urban Factors Impacting Wood Duck Nest Success

Sara M. Crayton Effects of Imidacloprid Treatment of Hemlocks on Aquatic Ecosystems

Carl D. Jacobsen Predation and mutualism: conflicting selection pressures maintain spotted salamander egg mass dimorphism

Berlynna Heres Population monitoring at two extant spotted turtle populations in West Virginia

Rachel Arrick Cutaneous Microbiome of Eastern Hellbenders in the Monongahela National Forest

Zachary Ross Developing Outreach Programs to Reduce Rattlesnake Vilification

Katelyn Amspacher Comparing Foraging Behaviors of Southern Fox Squirrels and Eastern Gray Squirrels

Haley Hutchins CASRI's efforts to restore red spruce benefit associated wildlife populations

Lauren Stollings Utilization of Special Youth Hunt Days by Young Hunters in West Virginia

Brett P. Skelly Does Oil and Gas Development Effect Female Mule Deer Rearing Resource Selection?

Kendyl Hassler Historical decline and current monitoring of eastern spotted skunks in their northeastern range

Hannah L. Warner Riparian Wildlife on the WVU Reedsville Farm

Eric Tidmore Using maximum entropy modeling to predict suitable habitat locations for the Cutshin Crayfish (*Cambarus taylori*)

Tanya Khan Reassessment of the Crayfishes of the Upper Ohio River Basin in Pennsylvania

Nicole Sadecky Status Survey Results and Distribution of the Guyandotte River Crayfish across the Upper Guyandotte River Basin of West Virginia

ABSTRACTS

Abstracts are listed as they are presented in the agenda.

In a sea of scat: Using non-invasive sampling to study gray wolves

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Fecal sampling is a non-invasive sampling method that can inform management of elusive species and those of conservation concern, such as the gray wolf (*Canis lupus*). Wolf scat samples were collected in Wisconsin and Michigan using road surveys. DNA was extracted from scats, and 12 microsatellite markers were amplified to examine population genetics. Program Structure identified 2 unique populations in the region, and low levels of genetic differentiation (F_{st}=0.03; $p<0.05$) were found between the North (Northern Wisconsin and Michigan) and Central Forest sites. We additionally studied road selection as travel corridors using wolf sign. Roads surveyed 3 times were extracted in ArcMap, and forest cover, developed land cover, and Euclidean distance to roads were summarized for a 175-m buffer, and road surface type was also included. If sign was found within 3 surveys, the road was considered used. We evaluated the dataset using logistic regression, as the assumptions of occupancy modeling were violated. Four competing models ($\Delta AIC<2$) were identified, forest cover occurred in 3 of 4 competing models, and the weight of all models including the forest cover variable summed to 0.7. Based on this, we identified the forest cover model as the top model. Using wolf scat samples, we were able to identify 2 unique populations and identify forest cover as the most important landscape variable for road usage. Scat is a valuable, non-invasive sample which can be used to evaluate dynamics of a system without impacting wildlife.

Spatio-temporal analysis of genetic diversity associated with extended pre-clinical symptoms of Chronic Wasting Disease

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Chronic wasting disease (CWD) is a transmissible spongiform encephalopathy (TSE) that affects cervids throughout North America and was detected in a free-ranging, white-tailed deer *Odocoileus virginianus* within West Virginia in 2004. Previous studies have indicated that nucleotide polymorphisms in the 285th and 286th position of the prion precursor gene (*PRNP)* have been associated with delayed pre-clinical disease symptoms. To determine the association with CWD positive individuals in a CWD-affected population in West Virginia and determine temporal differences in polymorphism frequency before and after detection, 513 CWD negative female white-tailed deer were sampled in Hampshire County, WV. In addition, 146 CWD positive male and female white-tailed deer were sampled from 2006-2014. Female white-tailed deer (CWD positive and negative) were also selected to determine any changes associated with *PRNP* polymorphisms and disease status as well as temporal changes before disease detection within a high density area of CWD detections (>1/km^2). While polymorphisms at *PRNP* 285 (Adenine to Cytosine) were not statistically associated with disease detection at either sampling, polymorphisms at *PRNP* 286 (Guanine to Adenine) were statistically associated with the prevalence of disease detection at both samplings (P=0.000, P=0.050). Comparisons between observed allele frequencies at *PRNP* 286 following CWD detection and expected allele frequencies if the locus was under selection found a significant decrease in frequency of the beneficial allele in both the high density sampling as well as the Hampshire County sampling, which is counter to the expected increase in frequency if selection was occurring.

Projected current and future habitat for the Cow Knob salamander

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The Cow Knob Salamander (*Plethodon punctatus*) has a narrow distribution at the high elevations of Shenandoah and Great North Mountain. Given their small distribution and specialized habitat requirements, *P. punctatus* is considered a species of special concern in both Virginia and West Virginia. Previous studies have predicted that the climatic niche for this species will be eliminated by 2050 due to climate change. We sought to expand on these studies by using a species-specific approach and a robust occurrence data set to identify habitat variables that are the strongest predictors of the environmental niche for *P. punctatus*. Additionally, we created a habitat suitability model that can be used to facilitate the discovery of new populations. We used a maximum likelihood approach (package maxlike) to model the structural and climatic niche for this species. We explored the effects of climate change using an ensemble of 37 global climate models produced for the IPCC 5th assessment report and statistically downscaled using SimClim. Our results indicate that elevation, aspect, and hill shade are the best predictors for structural niche, while mean annual temperature and mean precipitation in the warmest quarter are the best predictors of climatic niche. Further, our climatic niche model predicts a drastic reduction in suitable habitat for this species by 2050 due to warmer annual temperatures.

Wintering American Black Duck Occupancy in Central Appalachia

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American Black Ducks (*Anas rubripes*) have been in decline for over half a century due to habitat loss, and hybridization with Mallards (*Anas platyrhyncos*) and other factors. While the overall population of Black Ducks has stabilized and even increased in portions of its range, important wintering areas in western Pennsylvania and West Virginia have continued to see a decrease. Our objective is to determine Black Duck use of created and natural wetlands and riverine systems to create models to help guide future management practices that will contribute to meeting the North American Waterfowl Management Plan's population goal of 640,000 breeding Black Ducks. We performed biweekly waterbird surveys between November and March of 2015–16 and 2016–17. Using UNMARKED occupancy modeling, we chose a top model with the lowest AIC score. Black Ducks made the most use of natural, passively managed wetlands. In addition, they were the most widespread in the southern portion of the study area and concentrated in the northern wetlands closer to Lake Erie, with occupancy overall being higher in the first year than in the second. Our results will help guide management decisions for Black Ducks wintering in the region.

Region-wide Assessment of Marcellus-Utica Shale Gas Development on Birds

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In a region-wide assessment of impacts of Marcellus-Utica shale gas development on forests and breeding songbirds in the central Appalachian region, we aimed to: (1) quantify the footprint of shale gas infrastructure in forested landscapes; (2) assess whether bird communities respond differently to shale gas development relative to other types of anthropogenic forest disturbance; and (3) evaluate patterns of bird response to specific types of shale gas development. We evaluated land cover and bird count data from 2,576 points at 190 forested sites across the Marcellus-Utica region: 120 sites affected by shale gas development and 70 sites affected only by human development unrelated to shale gas. We found that linear shale gas infrastructure was a larger driver of forest loss and fragmentation than well pad development, across the region. A broad comparison of bird communities at sites with and without shale gas development showed little difference, suggesting bird communities generally respond similarly to shale gas development and other types of anthropogenic forest disturbance in the region. However, finer-resolution analyses of bird counts across gradients of forest cover and human development revealed distinct effects of shale gas development. We observed lower species richness and abundance among forest interior birds relative to shale gas development, while early successional and synanthropic birds showed higher richness and abundance relative to shale gas development. Our results suggest efforts to reduce forest fragmentation due to shale gas development may reduce negative impacts on native biological communities in the region, particularly for area-sensitive and forest dependent species.

Modeling Bobcat Occupancy in West Virginia at the Landscape Scale

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Bobcats (*Lynx rufus*) were traditionally found throughout North America. However, unsustainable hunting and trapping resulted in nationwide population declines. Since the 1980s bobcat populations have increased nationwide, but many states lack abundance and occupancy information on this game species. The goals of this study were to construct a statewide occupancy model to evaluate bobcat distribution and to identify the habitat variables associated with bobcat occupancy in West Virginia. An even sampling approach was used to collect hair samples non-invasively from wild bobcats throughout West Virginia from March to August, 2015. A total of 30 square grids comprised of 25, 10km^2 cells (5x5, 250km^2 total area per grid) were selected for intensive study. Each grid was sampled for a total of 4, 1-week periods with a single bobcat hair snare cubby being placed in each of the 750 grid cells of the study. A newly developed qPCR test was used to determine which hair samples originated from bobcats or domestic cats (*Felis catus*). Bobcat detection data were paired with habitat covariates collected from the 2011 West Virginia Land Use Raster in Fragstats v4.2. The program PRESENCE v12.6 was used to construct a single-season occupancy model for the entirety of West Virginia. Of the total 2,171 hair samples that were collected, 383 (17.6%) were from domestic cats and 274 (12.6%) were from bobcats, for a statewide average of 1.30 bobcat detections per 100 trap nights. The constructed occupancy model will then be used to assist in bobcat management decisions in West Virginia.

Monitoring Eastern Diamondback Rattlesnakes Using a Novel External Radio-transmitter Attachment Method

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Internal implantation of radio-transmitters is the preferred attachment technique for snakes, but the high costs and invasive nature of the surgery make a functional alternative desirable. External radio-transmitters are cost-effective alternatives to surgical implantation. External transmitter attachment site and methodology depend on the unique morphology of a given study species, making external adherence impractical for most snake species. Rattlesnake rattles are unique morphological features that can serve as an attachment site for external radio-transmitters. Since 2011, we attached transmitters to the rattles of eastern diamondback rattlesnakes (*Crotalus adamanteus;* EDB) using thread and epoxy. We calculated average monitoring duration using radio telemetry data collected from 49 adult EDBs telemetered from 2014 to 2017 in coastal South Carolina. On average, we monitored EDBs for 189 ±78 days with 14 EDBs monitored > 240 days and 3 EDBs monitored >300 days. External transmitter attachment is a viable alternative to surgical implantation, providing a non-invasive approach to monitoring rattlesnakes.

The Central Appalachian Spruce Restoration Initiative: Restoring and Conserving Wildlife Habitat

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The Central Appalachian Spruce Restoration Initiative (CASRI) is a partnership of federal, state, and private organizations and individuals with a common goal of restoring red spruce (*Picea rubens*) habitat across the central Appalachian Mountains. CASRI's partnership initially grew out of a concern for providing continued conservation and enhancement of the West Virginia northern flying squirrel's (*Glaucomys sabrinus fuscus*) habitat following its de-listing from the federal endangered species list. The northern flying squirrel has a unique association with spruce-northern hardwood forests. One of its primary food resources, hypogeous fungi, is associated with the roots of mature spruce and facilitates the tree's ability to absorb water and nutrients. By disseminating the spores of the fungi across the forest floor via fecal pellets, the northern flying squirrel facilitates spread of the fungi and helps to maintain the health of the forest upon which it depends. Additional federally-listed and West Virginia State priority species, such as the Cheat Mountain salamander (*Plethodon nettingi*), northern goshawk (*Accipiter gentilis*), northern water shrew (*Sorex palustris punctulatus*), and a host of other species also benefit from the terrestrial and aquatic habitat restoration efforts undertaken by CASRI. In addition to implementation of spruce-northern hardwood restoration on the ground, through plantings and forest management techniques allowing the release of suppressed understory spruce, CASRI supports environmental education and research efforts focused on the spruce-northern hardwood ecosystem as well as the individual plants and animals that depend on this unique habitat.

Snowy Owls in West Virginia: A case report and discussion of snowy owl natural history

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In December of 2017, the Avian Conservation Center of Appalachia (Morgantown, WV) admitted an injured snowy owl (*Bubo scandiacus*) from Vienna, WV. This bird was emaciated and had suffered a shoulder injury after being hit by a car. This presentation discusses the rehabilitation of this bird from capture to release, highlighting some of the challenges associated with this species in captivity. Additionally, this presentation will discuss the natural history of snowy owls, which are the largest, most recognizable species of owl in North America. Population size was historically thought to be 200,000 individuals, but has more recently been estimated to be 28,000 birds, prompting the International Union for Conservation of Nature to list the species as vulnerable. Although snowy owl migration is not well understood, irruption events occur about every 4 or 5 years. During winter irruptions, such as the winter of 2017-2018, snowy owls are identified in greater abundance further south than during typical years.

Identifying drivers of eastern hellbender extirpation in West Virginia using environmental DNA (eDNA)

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Population declines and range constrictions among freshwater fauna, particularly amphibians, as a result of land-use alteration are widespread but poorly studied. Identifying drivers of change in species distributions is essential to conservation planning. However, conventional detection methods for rare and elusive amphibians are inefficient. Integrating new surveying and modeling techniques may allow for more comprehensive assessment of population declines. We used environmental DNA (eDNA) sampling methods and detailed historical records to identify drivers of extirpation in an imperiled, long-lived giant salamander, the eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*) in West Virginia, USA. We used a site occupancy and detection modeling framework (SODM) to test the effects of current and historic land use, hydrogeomorphic, and water quality variables on model-based predictions of occupancy and detection. Hellbenders were extirpated from 48% of the 52 historical sampling sites. Our top-ranked model indicated watershed-scale road density was the strongest predictor of hellbender occupancy, and water turbidity and electrical conductivity were the best predictors of detection. All covariates had a strong negative effect on hellbender occupancy and detection. Roads can contribute to sedimentation and increase the salinity and conductivity of freshwater environments, which may limit hellbender reproductive success. Integrating eDNA data within a SODM framework allowed us to rapidly and accurately assess causal changes in hellbender distribution throughout their historical range in West Virginia, which will aid conservation planning. This study emphasizes the impacts of anthropogenic land alterations on freshwater ecosystems and the sensitivity of long-lived amphibian species to rapid environmental change.

Wintering Sparrow Occupancy on Private Agricultural Conservation Easement Program Wetlands and Public Wetlands in West Virginia

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Wetlands established or restored on private land through the Agricultural Conservation Easement Program can act as important wintering habitat for avian species. Often, avian use of a site is an indication of the functional ability of its ecosystem services. In West Virginia, there are 24 wetland conservation easements established through the Agricultural Conservation Easement Program. By studying the avian occupancy, richness and abundance at these sites and a set of reference sites located on public land, we evaluated the wetland sites functional ability as wintering habitat for new world sparrows (Passerellidae species) and determined the effectiveness of current conservation practices. Our objectives were to compare the occupancy and richness between wetland types while controlling for vegetation variables during the winters of 2016-2017 and 2017-2018. Ten Passerellidae species were detected across the wetland sites, and were associated with wetland size and the vegetative structure of the sites. Some species such as dark-eyed junco (*Junco hyemalis*) and swamp sparrow (*Melospiza georgiana*) were more likely to be found on Agricultural Conservation Easement Program wetlands over reference wetlands which indicates that the heterogeneous landscape matrix these wetlands occur in provides favorable wintering habitat for avian species.

Preliminary assessment of bird community response to young forest management

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Active management for young or early-successional forest continues to be a topic of interest among forest ecologists. Young forest, characterized by dense understory vegetation with minimal overstory, is important for many wildlife species. Unfortunately, its distribution and total area have continued to decline in the eastern United States. We conducted point counts to assess songbird community response to young forest management. We created small tree-cuttings (cut-back borders of 1.1–3.8 acres) of varying widths and harvest intensity along energy corridors throughout West Virginia on WVDNR wildlife management areas to test how certain groups of songbirds (habitat guilds: edge, interior-edge, and forest interior) respond to these small man-made disturbances. We present our two-year findings (pre- and post-tree harvest data) and evaluate their immediate effects on the avian community. Richness of the total community ($F_{1,108} = 14.11$, $p<0.001$), interior-edge guild ($F_{1,110} = 4.86$, $p = 0.029$) and forest interior guild ($F_{1,110} = 10.96$, $p = 0.001$) decreased, while edge guild richness did not change ($F_{1,110} = 0.03$, $p = 0.86$). Community richness was not significantly different across treatment types in 2016 ($F_{6,49} = 0.40$, $p = 0.87$) or 2017 ($F_{6,49} = 1.86$, $p = 0.11$). Within years, only the interior-edge guild in 2017 ($F_{6,49} = 2.32$, $p = 0.048$) had significant differences among treatments. Our results suggest that forest-associated songbirds (interior-edge and forest interior guilds) are initially affected negatively by cut-back borders while songbirds associated with open and shrubby habitat (edge guild) are not.

POSTERS

Abstracts are listed alphabetically by the last name of the presentor.

Comparing Foraging Behaviors of Southern Fox Squirrels and Eastern Gray Squirrels

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The southern fox squirrel (*Sciurus niger niger*; SFS) is a declining habitat specialist strongly associated with the fire-maintained longleaf pine ecosystem (LLPE) of the southeastern United States. Eastern gray squirrels (*S. carolinensis*; EGS) are habitat generalists associated with deciduous forests throughout the eastern United States. Historically, these species limited interactions through habitat partitioning. However, fire exclusion and human activity have reduced the LLPE to 3% of its original range, allowing mixed forests to establish in areas once dominated by fire-maintained savanna-woodlands. We used feed depots and time lapse videography to record squirrel foraging activity across a range of canopy closures. We hypothesized that the strength of sub-lethal predator effects would reflect historical habitat associations, and that SFS and EGS would respond differently to the increased risk of avian predation in open canopy habitats. On average, SFS spent 8 minutes foraging, but 60% of that time was spent in a vigilant posture. Gray squirrels spent 2 minutes foraging and only 26% of that time was spent in a vigilant posture. Habitat features such as canopy closure, illumination, and substrate influence risk perception. Thus, species adapted to open canopy habitats (SFS) may perceive higher risk than their sympatric generalist counterparts (EGS) and respond by being more vigilant while spending more time foraging in areas with higher risks. Implications of these behavioral differences could arise as suitable open canopy habitat is lost, and the species become syntopic.

Cutaneous Microbiome of Eastern Hellbenders in the Monongahela National Forest

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Microbes inhabit virtually all surfaces of multicellular animal hosts, with microbial cells outnumbering the hosts' own cells 10:1. Symbiont microbes, collectively referred to as the microbiome, can have profound impacts on the metabolism, development, behavior, and disease resistance of their multicellular hosts. Pathogens are currently a global threat for amphibian populations, so the characterization of amphibian microbiomes is becoming an increasingly important tool for future disease management because the community composition of cutaneous microbial communities can influence disease resistance in amphibians. Eastern hellbenders are ideal candidates for a microbiome study because they have seen substantial declines throughout their range and learning more about the environmental and physiological drivers of the hellbender microbiome could help inform management decisions. Previous studies have explored the cutaneous microbial communities of hellbenders, but none have compared the microbiome of various age classes to look for an ontogenetic shift or captive hellbenders to those of wild populations where captive hellbenders may be released. We captured hellbenders within 5 rivers across the Monongahela National Forest, West Virginia from April to September 2017. Hellbender skin was swabbed for microbial community structure analysis. Swabs were also obtained from a captive, juvenile population. DNA was extracted from the samples, and the V3-V4 region of the 16S rRNA gene was amplified and sequenced via Illumina Mi-Seq paired end high-throughput sequencing. Sequences were grouped into OTU's and bacterial species richness and diversity were compared between age classes and capture locations. Preliminary data suggest an ontogenetic shift in hellbender microbiomes as well as a difference between captive and wild individuals.

Effects of Imidacloprid Treatment of Hemlocks on Aquatic Ecosystems

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The insecticide imidacloprid is widely used to prevent infestations of the invasive Hemlock Woolly Adelgid (HWA) but scientific evidence is beginning to suggest that imidacloprid has a negative impact on stream resources. Studies have demonstrated that imidacloprid negatively impacts macroinvertebrate assemblages and some amphibian species, although no studies have yet assessed the effects of imidacloprid on stream salamanders. We used high-performance liquid chromatography (HPLC) to measure the concentrations of imidacloprid in stream water samples. We assessed salamander and benthic macroinvertebrate abundance and diversity at 12 streams treated with imidacloprid and 12 control streams in the New River Gorge area of West Virginia. Benthic invertebrates were sampled with D-nets and identified to genus or species. Salamanders were captured within pools and riffles by flipping cover objects and searching through leaf litter. One hundred salamanders of the genus *Desmognathus* were sacrificed to chemically test whether imidacloprid is bioaccumulating in their tissues. Benthic macroinvertebrates from treated streams will also be sacrificed to test whether imidacloprid is bioaccumulating in their tissues. Statistical analyses will be performed that quantify the explanatory power of treatment intensity on salamander and macroinvertebrate abundance and diversity, and salamander body condition. Environmental factors will be included in an alyses as covariates.

Ecological and Urban Factors Impacting Wood Duck Nest Success

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Wood Duck (*Aix sponsa*) populations in the 1900's experienced dramatic population declines due to overhunting and habitat loss. Development of wood duck nest-boxes in conjunction with other management strategies, resulted in an increase in population size. However, habitat loss is still an issue for these cavity nesting birds, thus nest boxes continue to be a tool used by managers. Our goal was to use field-collected data to determine how nest box placement affects wood duck nest box use and success. We hypothesized that nest box use and success would be lower in boxes that are closer to urban cover and in shallow water. From March - July, 2017, we checked 57 nest boxes located in Pennsylvania and West Virginia, every two weeks with a GoPro Hero 3. We used logistic regression in RStudio to estimate the probability of use and success as it relates to our independent variables of interest. Probability of nest box use was positively related to distance to trees and water depth and negatively related to number of housing units in the area. Nest box use increased by ~ 200% if it was beyond 25 meters from a tree. Probability of nest success was positively related to water depth and distance to trees. Nests were most successful when they were at least 25 meters away from a tree. These results can be used as guidance for future nest box placement. Managers should avoid areas with housing units, areas near trees and target water deeper than 0.4 meters.

Historical decline and current monitoring of eastern spotted skunks in their northeastern range

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Once thought to be common throughout the eastern United States, eastern spotted skunk (*Spilogale putorius*) populations began declining in the early 1940's. Reason for their decline is uncertain and knowledge of the species is limited. Historically, western Maryland, southcentral Pennsylvania, and West Virginia represented the northeastern extent of the eastern spotted skunk's range. We review historical and recent occurrences of eastern spotted skunks in Maryland, Pennsylvania, and West Virginia, with emphasis on depicting the known distribution of extant populations in West Virginia. In the last 50 years, there have been 0 detections in Maryland and 1 detection via camera trap in Pennsylvania. In West Virginia, eastern spotted skunk populations are thought to have declined, but there are extant populations. Since 2015, the West Virginia Division of Natural Resources has radio-collared 9 eastern spotted skunks in the Monongahela National Forest, in Pendleton County. This year, we are expanding monitoring efforts to Allegheny and Nathaniel Mountain Wildlife Management Areas in Mineral and Hampshire Counties, respectively. By expanding monitoring efforts in West Virginia, we hope to develop better management strategies for eastern spotted skunks in this region.

Population monitoring at two extant spotted turtle populations in West Virginia

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Spotted turtles (*Clemmys guttata*) are thought to be declining range wide and have quickly become a conservation priority. The International Union for Conservation of Nature (IUCN) lists the spotted turtle as an "endangered" species, and the species is currently under review for listing under the federal Endangered Species Act. In West Virginia, the spotted turtle is listed as a priority 1 Species of Greatest Conservation Need in the 2015 West Virginia State Wildlife Action Plan. Spotted turtles once occupied several wetlands in the eastern panhandle counties of West Virginia, however habitat degradation and fragmentation has led to rapid declines of the species in the State. To date, spotted turtles are only known to occupy two wetlands in West Virginia. Currently, little is known about the two remaining spotted turtle populations in West Virginia, including population demographics and genetic make-up, and data is necessary to allow West Virginia Division of Natural Resource Biologists to develop effective conservation and management strategies. Starting in March 2017, population monitoring, using capture-mark-recapture methods, began at both occupied sites and preliminary data will be presented. Population monitoring will continue through 2022, and we plan to conduct live trapping surveys at wetlands containing suitable habitat for spotted turtles during the Summer of 2018.

CASRI's efforts to restore red spruce benefit associated wildlife populations

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CASRI is the Central Appalachian Spruce Restoration Initiative, a group of federal, state, and private organizations and individuals with a goal of restoring red spruce (Picea rubens) habitat across high elevation areas in the central Appalachian Mountains. Since 2012 , 329,945 spruce seedlings and 176,230 native plants have been planted, alongside 2,553 acres of non-native invasive species treated in high elevation red spruce ecosystems. In total 7,245 acres of red spruce ecosystem have be restored and 663,687 red spruce community plants have been planted. In addition to planting seedlings, spruce release has been implemented as a more immediate and effective method for the long term restoration of spruce habitat . In addition, CASRI provides red spruce education, NNIS control in spruce habitats, and more in efforts to assist in the restoration efforts. Restoration of the historic red spruce ecosystem is also expected to benefit or potentially expand existing habitat for the Cheat Mountain Salamander (Plethodon nettingi), West Virginia Northern Flying Squirrel (Glaucomys sabrinus fuscus), and other spruce associated species. The recently delisted West Virginia Northern Flying Squirrel has a close association with these habitats, particularly mature red spruce trees and the associated hypogeal fungi that comprises an important part of its diet. CASRI intends to continue with efforts to restore red spruce habitat across the central Appalachians with long lasting benefits to the high elevation ecosystems.

Predation and mutualism: conflicting selection pressures maintain spotted salamander egg mass dimorphism

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Spotted Salamanders (*Ambystoma maculatum*) have dimorphic egg masses that appear clear or opaque based on the presence or absence of a glycoprotein. We sought to test whether a mutualistic association between *A. maculatum* eggs and an endosymbiotic algae (*Oophila amblystomatis*) was driving selection for clear egg masses, while predation of Wood Frog (*Lithobates sylvaticus*) drives selection for opaque masses. *Oophila* is thought to contribute oxygen for developing embryos and is associated with elevated hatching success and growth rates. We conducted an enclosure experiment in a wetland where both *A. maculatum* and *L. sylvaticus* breed in Watauga Co., NC. In each of our enclosures we placed one clear and one opaque *A. maculatum* egg mass with 250 *L. sylvaticus* tadpoles. We quantified tadpole preference by counting the number of tadpoles feeding on each egg mass and determined algal densities by counting cells present in the inner capsular membrane of the egg. The last day of the experiment we observed 143% more *L. sylvaticus* tadpoles feeding on clear egg masses than on opaque egg masses in predation treatment enclosures (t_7=2.36, p=0.05). Additionally, in all enclosures, the clear egg mass was completely consumed by tadpoles before the opaque mass. Analysis of algal densities revealed that clear egg masses had significantly more algal cells than opaque masses (t_9=3.46, p=0.007). This suggests clear masses have greater algal content, potentially increasing embryonic developmental rates and hatching success. We propose that higher *Oophila* densities drives selection towards clear egg masses, while tadpole predation selects for opaque masses.

Reassessment of the Crayfishes of the Upper Ohio River Basin in Pennsylvania

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Crayfishes are keystone species and ecosystem engineers in freshwater systems and are considered the third most imperiled taxa on the planet. In 1906, Arnold Ortmann published one of the most complete historic crayfish surveys ever conducted, which has allowed Pennsylvania to assess changes to crayfish fauna over the past century. More recently, waterways have been impacted by anthropogenic stressors such as urbanization and extractive industry. Our primary goal is to determine changes in species distributions and relative abundances of crayfishes in western Pennsylvania by visiting historical and new sites. Surveys in 2015-16 focused on collecting primary burrowers by trapping and burrow excavation. In 2017, efforts shifted to epigean species in the Upper Ohio River drainage, using standardized sampling of 10 seine hauls/site to assess 265 sites. Populations of primary burrowing crayfishes were found at 20% of 61 historical sites and 72% of 57 new collection sites. Of epigean crayfishes, 79% were found at 102 historical sites and 97% of 163 new sites. These collections represent approximately 60% of the survey, with remaining collections to occur in 2018. Important findings were three nonnative species: Rusty Crayfish (*Faxonius rusticus*), Red Swamp Crayfish (*Procambarus clarkii*), and White River Crayfish (*Procambarus acutus*). Preliminary data suggests that crayfish fauna in western Pennsylvania has remained moderately stable over the last century, though the presence of nonnative crayfishes indicates the need for continued monitoring. Efforts in Pennsylvania must focus on prevention and management of the spread of nonnative species to preserve the native crayfish populations that remain.

Developing Outreach Programs to Reduce Rattlesnake Vilification

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The eastern diamondback rattlesnake (Crotalus adamanteus; EDB) is a large-bodied, venomous reptile that suffers from inflated risk perception and is often characterized as aggressive and antagonistic. Misconceptions about EDB's hinder public support of the species' conservation and encourage wanton killing, a leading factor in EDB decline. Long-term EDB monitoring at the Marine Corps Recruit Depot Parris Island, SC (MCRDPI), has provided human-snake encounter data over a 9 year period. Preliminary analyses indicate that research presence on the installation affects how the military, civilians, and visitors report encounters. Here, we discuss the utility of outreach presentations for both military personnel and civilians with three primary objectives in mind: (1) to increase understanding and awareness about the EDB and other snake species present on the installation, (2) to change public perception of these species, and (3) to increase and improve reports concerning human-snake interactions on the island. Understanding and perception of local herpetofauna will be assessed via a longitudinal questionnaire consisting of 15 close-ended Likert questions and 5 open-ended questions taken before and after attendance of an outreach presentations. Assessment of the third goal will be assessed by analyzing trends in the report rates of the Parris Island EDB data base following the introduction of outreach presentations. Public education and outreach programs that focus on snake conservation are important for achieving realistic risk assessments and ensuring public support for conservation efforts.

Status Survey Results and Distribution of the Guyandotte River Crayfish across the Upper Guyandotte River Basin of West Virginia

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The Guyandotte River Crayfish is endemic to West Virginia's Upper Guyandotte Basin (UGB) and was listed as federally endangered by the U.S. Fish and Wildlife Service in 2016. Basin wide surveys completed in 2009 only found the species in Pinnacle Creek, indicating The Guyandotte River Crayfish had experienced extensive population decline. During May and June 2015, surveys were performed across the UGB to determine the current distribution of the species. Seventy one sites were sampled, including all historic streams, as well as semi-randomly selected streams, with at least one and as many as nine 125m reaches sampled per wadeable stream. Surveys determined that Pinnacle Creek populations persist along a minimum of 4.8 stream kilometers. The Guyandotte River Crayfish was absent at both the confluence with the Guyandotte, and headwaters of Pinnacle Creek. Animals also were procured for the first time from the Clear Fork/Laurel Fork watershed, with The Guyandotte River Crayfish limited to a minimum of 21.7 there in. The Guyandotte River Crayfish were not encountered in any other historic locations including Still Run and Huff, Barker, Briar, Indian, Little Indian, or Turkey Creek. Thirty four sites sampled outside of Clear Fork, Pinnacle Creek, and the known historic sites failed to produce additional populations. At present, The Guyandotte River Crayfish is known to occur within a minimum of 26.5 stream kilometers in two subwatersheds in the UGB, and given this limited distribution and apparent population decline is deserving of federal protection.

Does Oil and Gas Development Effect Female Mule Deer Rearing Resource Selection?

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Rearing site selection of ungulates is critical for neonatal survival and ultimately recruitment into the population. Changes in sensitive demographic rates, such as recruitment, have the ability to influence abundance. Furthermore, the dam is also under a lot of nutritional stress from energy needs associated with rearing young. Therefore, the dam will need to select rearing sites that have access to high-quality forage while also mitigating predation risk to her and her neonate(s). There has been a decrease in mule deer (*Odocoileus hemionus*) abundance across much of the western United States. In North Dakota, much of the recent oil and gas development has occurred on critical mule deer habitat. Mule deer declines throughout the region are not well understood but have been attributed to low fawn survival, habitat loss and conversion, and predation. For this study, we evaluated the potential impacts of oil and gas development on rearing resource selection of mule deer in western North Dakota and eastern Montana. We assessed mule deer rearing resource selection by evaluating location data from 129 global positioning system (GPS) radio-collars that were deployed from 2012 to 2016. We evaluated rearing resource selection using discrete choice models. We found evidence to suggest that oil and gas development influences rearing resource selection. Mule deer selected areas located further from well pads and further from roads. Determining the potential effects that oil and gas development have on mule deer rearing resource selection can help inform managers on ways to mitigate potential adverse effects.

Utilization of Special Youth Hunt Days by Young Hunters in West Virginia

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In 2015, the West Virginia Division of Natural Resources implemented an Electronic Licensing System to manage license purchasing and harvest data for all game species. The system also stores demographic information of license holders. Our study employed the Electronic Licensing System to assess the use of Special Youth Hunt days in cooperation with the R3 Initiative, a project designed to increase hunter recruitment, retention, and reactivation. Using an ANOVA, it was determined that there is a significant difference between harvest by individuals aged 17 and younger on Special Youth Hunt days and the first three days of white-tailed deer rifle season when the state is assessed as a whole unit. It was also found that there are significant differences in harvest within four of the six districts in the state. In order to develop management goals, demographic data was also examined. The results show that, during the youth season, female hunters generated more of the harvest than males. Conversely, male hunters made up the majority of the harvest during rifle season. During both seasons, most harvests were taken on private land and most sampled youth participants were under the age of 15, meaning they were not required to purchase a license of any type. This information can be used to identify key groups that are using Special Youth Hunts but are not being recruited into the hunting population for the regular season and allow the agency to focus on these groups to increase young hunter recruitment.

Using maximum entropy modeling to predict suitable habitat locations for the Cutshin Crayfish (*Cambarus taylori*)

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The Cutshin Crayfish (*Cambarus taylori*) is a recently described species which is endemic to the Middle Fork of the Kentucky River basin. The Middle Fork of the Kentucky River lies within the anthracite coal fields of Eastern Kentucky, and thus a conservation assessment of *C. taylori* is warranted. The goal of this study was to predict suitable habitat locations for *C. taylori* through use of maximum entropy modeling (MaxEnt). The Middle Fork of the Kentucky River's crayfish fauna was surveyed during the summer of 2014. The occurrence data from this study coupled with landscape scale environmental variables—such as stream order and land use data—was used to create the model. The mean area under the receiver operating characteristic curve (AUC) value was 0.898, showing the model had high predictive accuracy. The model indicated high probability of occurrence in streams at the southern end of the basin, and a low probability of occurrence at the northern end of the basin. Stream order and stream sinuosity had the highest contribution to the model showing that *C. taylori* prefers 3rd and 4th order streams with low sinuosity. To confirm the model's predictive accuracy, high and low probability sites will need to be ground validated.

Examining Population Genetics of Reintroduced Rocky Mountain Elk in Southern West Virginia

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Eastern elk (*Cervus canadensis canadensis*) were abundant in the eastern United States until their extinction in the late 1800's due to overharvest and loss of quality habitat. Since then, many states including West Virginia have conducted reintroduction efforts of Rocky Mountain elk (*Cervus canadensis nelsoni*) to repopulate the historic range. Genomic DNA was extracted from 23 individuals reintroduced into West Virginia in 2016. The control region of the mitochondria (D-loop) and ten polymorphic microsatellite loci were amplified through polymerase chain reaction (PCR). Two mtDNA haplotypes were identified with group sizes of 10 and 13 for each haplotype. Using both the mtDNA and microsatellite data, the program STRUCTURE identified a single genetic population (K = 1). However, four populations were identified using the Discriminate Analysis of Principle Components (DAPC), indicating the presence of genetic substructure. An effective population size (N_e) of 10 (3.3 – 28.2) was calculated using NeEstimator (v2.1). The results of this study provide insight on the genetic diversity and differentiation within the initial stocking. Continued stocking or migration from neighboring populations is required to maintain and improve the genetic diversity of the reintroduced elk herd.

Riparian Wildlife on the WVU Reedsville Farm

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Wetlands provide valuable ecosystem services such as erosion control, acting as natural filters of pollutants, and providing fish and wildlife habitat. To maintain ecosystem services, restoration and mitigation of streams and wetlands have become important approaches. However, effectiveness has often been questioned. Moreover, few studies have documented riparian wildlife response before restoration or mitigation occurs. The restoration and mitigation efforts for Ruby Run at the West Virginia University Reedsville Farm provide a unique opportunity to assess wildlife communities in wetland, riparian, and stream habitats before, during, and after restoration. Through monitoring, we will be able to characterize and quantify the ecological response of riparian and stream restoration at Ruby Run. Pre-restoration monitoring was conducted on a year-round basis during 2017 and 2018 and included surveys on abundance and diversity of birds, small mammals, turtles, and anurans. Collection of these data will be important for the enhancement of obtaining ~80% originality of the biodiversity for post-restoration efforts at Ruby Run. Our results indicate a typical assemblage of at least 60 species (e.g. song sparrows (*Melospiza melodia*), Canada geese (*Branta canadensis)*, meadow voles (*Microtus pennsylvanicus)*, and spring peepers (*Pseudacris crucifer)*) occurring on this primarily wetland and grassland riparian zone.

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