2010 Meeting Abstracts
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Oral Presentations

(Ordered as on agenda)

Landscape Conservation Cooperatives

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Starting with a vision of sustainable landscapes for fish and wildlife, Landscape Conservation Cooperatives (LCCs) will facilitate among partners and agree on common goals and then work together develop the science to most effectively achieve those goals. These conservation science-management partnerships will consist of federal and states agencies, tribes, universities and private organizations, focused on collaboratively developing tools to guide conservation actions to sustain fish and wildlife populations. The presentation will include background on Landscape Conservation Cooperatives in general and then include information about the status of these cooperatives in the northeast including more detail on projects that are being funded this year, the converging conservation and climate science needs of partners and partnerships in the northeast and the potential roles of the Northeast Partners in Amphibian and Reptile Conservation in the LCC.

Nesting Movements and the Use of Anthropogenic Nesting Sites by Spotted Turtles (*Clemmys guttata*) and Blanding's Turtles (*Emydoidea blandingii*)

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ABSTRACT:
Spotted Turtles (*Clemmys guttata*) and Blanding's Turtles (*Emydoidea blandingii*) complete extensive upland movements during the nesting season, exposing themselves to risks such as road mortality, predation, and poaching. To better understand the risks faced by females of both species, and to inform potential nest site supplementation, we quantified upland movements associated with nesting, determined the extent to which turtles use nest sites of anthropogenic origin, and estimated the number of years the sites had been available. We radio-tracked 23 adult females of each species and followed them through the nesting period to identify nesting sites. Blanding's Turtles traveled < 1 km during nesting activities, accounting for 30% of the yearly upland distance traveled by breeding females. Anthropogenic locales constituted 84% of the nest sites, and 58% had been available for 5 y or less. Spotted Turtles moved shorter distances during nesting activities, with a median distance of 148 m, corresponding to 21% of the yearly upland distance traveled by gravid females. Of the nest sites used by Spotted Turtles, 64% were anthropogenic, and 29% were recent. The ability to use newly disturbed areas signals that artificial nesting sites can be detected and used rapidly by turtles, and the quality of artificial sites could be managed to enhance nesting success for these at-risk turtle species. The judicious placement of artificial nest sites could modify or reduce upland movements by adult females during the nesting season – a period when the impact of adult loss is particularly damaging to local population viability.

Spatial Variation in Eastern Box Turtle (Terrapene c. carolina) Population Densities and Movement Patterns in Central Massachusetts

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ABSTRACT:
We radio-tracked 91 eastern box turtles (*Terrapene c. carolina*) for 1 – 4 years at eight sites in central Massachusetts. We evaluated the effects of landscape structure and composition on movement patterns and fidelity at seven sites using mixed-effects regression models. Home range size spanned 0.5 – 136 ha using minimum convex polygons and 140 – 2145 m using straight line distance. Turtles in fragmented areas moved significantly smaller distances than those in forested landscapes, both within sites and across the region. The specific nature of the relationship varied significantly by site, however, underscoring the importance of evaluating effects across multiple sites and scales. Estimated population density at five sites ranged from a summer high of 3.8 turtles/ha immediately surrounding nest sites to a winter low of 0.3 turtles / ha. These observed densities suggest a unimodal rather than linear relationship with urbanization; the highest density occurred at a moderately modified site. Our observed home ranges are larger and population densities lower than reported throughout the rest of the species' range. Females also mature later and lay larger, less successful clutches than reported elsewhere. Our results caution that use of non-region-specific population parameters and movement data may result in overly optimistic population viability estimates and insufficient land protection and habitat management. Incidental collection was the largest threat to populations at these predominantly protected sites, suggesting that education is a crucial component of box turtle conservation. Other observed threats to our study animals included habitat loss, road mortality, depredation, and mechanized habitat management.

A Multi-Scale Evaluation of Eastern Hognose Snake (*Heterodon platirhinos*) Habitat Selection at the Northern Extent of its Range

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ABSTRACT:
A complex interaction of variables structure landscapes into a hierarchal assemblage of habitats. Species respond to this hierarchy by selecting habitat based upon a set of ecological variables occurring across a range of organizational levels. However, as the criteria for selection may be scale-dependent, it is vital to quantify the influence these variables have on species distribution at each spatial scale. Two years of telemetry data from 17 individuals were used to examine multi-scale selection process in the northern population of *H. platirhinos* on the New Boston Air Force Station in New Hampshire. Thermal quality, habitat structure, prey availability, and predator avoidance were predicted to be the primary influential variables dictating the selective process, with thermal environment being of particular importance. Statistical comparisons and modeling results revealed that snakes were selective at all three spatial scales, with thermal extremes and habitat cover being the dominant influential variables. At the landscape level, mixed forest maintaining environmental temperatures above thermal minima (7.0 ° C) were highly selected whereas at the home-range level, hemlock forests that didn't exceed thermal maxima (40.5° C) were preferred. Overall optimal habitat was identified as having the following characteristics: 1) mixed and hemlock forests having continuous canopy and understory architecture interspersed with fine-scale openings; 2) close proximity to wetlands; 3) high density of leaf litter, debris, and rocks; and 4) homogeneous surface temperatures within critical thermal limits. Together, this structural configuration likely maximizes thermoregulatory precision while still conferring the secondary biological needs of predator avoidance and suitable prey availability.

Specialization in a Generalist Snake: Movement and Habitat Ecology of the Northern Black Racer (*Coluber constrictor constrictor*) in Maine

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ABSTRACT:
The northern black racer, *Coluber constrictor constrictor*, is a widely distributed, common species over much of the eastern United States. In Maine, however, racers reach the northern extent of their range and thus have a high risk of extirpation due to rarity, habitat loss, and fragmentation. Due to a high volume of environmental review conflicts and a need to better understand racer home range size and habitat requirements, a radio-telemetry study was undertaken by Maine Department of Inland Fisheries and Wildlife between 2007 and 2009 in southern York County. Fourteen racers, 6 males and 8 females, were surgically implanted with radio-transmitters (Holohil 5gram SB-2's) and relocated every 1 to 4 days. Despite their generalist reputation, racers in Maine were observed utilizing a much narrower suite of habitats with most of their activity associated with an open shrubland sandbarren, a rare natural community in its own right. In contrast to other parts of their geographic range, Maine racers occupy extremely large home ranges (100% minimum convex polygon average of 79ha with a range of 30-248ha) with females using nearly double that of males. All radio-tracked snakes overwintered in small mammal burrows in a communal area in the center of the shrubland and females were observed making lengthy migrations (over 2km in some cases) from this area to deposit eggs. This work provides new insights into the wide ranging movements and relatively specialized habitat ecology of the black racer near the northern extent of its range.

Potential Effects of Chytrid Fungus Infection (*Batrachochytrium dendrobatidis*) for Northeastern North American Amphibian Populations

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ABSTRACT:
Chytridiomycosis, caused by the fungus *Batrachochytrium dendrobatidis (Bd),* has been identified as the cause of some of the worldwide amphibian declines. Light *Bd* infections have been found in most New England anurans except grey treefrogs (*Hyla versicolor*). The presence of *Bd* in eastern North America, where widespread amphibian declines have not been documented, raises concern over whether *Bd* has the potential to cause extensive amphibian mortalities. Susceptibility to *Bd* can be species-specific. Some adult amphibians die, but other species develop light infections and do not experience ill effects. For resource managers, understanding whether amphibian species within the region are susceptible to this disease is critical for effective long-term management, particularly in light of changing climatic conditions. The specific objective for this study was to assess the effects of *Bd* on five northeastern North American amphibian species. We inoculated wood frogs (*Rana sylvatica*), green frogs (*Rana clamitans*), Northern leopard frogs (*Rana pipiens*), American toads (*Bufo americanus*), and blue-spotted salamanders (*Ambystoma laterale)* with two different strains of *Bd*. Blue-spotted salamanders and leopard frogs did not die when exposed to *Bd*. Wood frogs and green frogs were susceptible, but mortality was dependent upon fungal strain, host life stage, and environmental conditions. American toads were highly susceptible, and all inoculated animals died. These data suggest that amphibians in eastern North America vary in their susceptibility to *Bd* with the potential for some species to experience large-scale mortality events.

Incidence of *Batrachochytrium dendrobatidis* in Rhode Island Anuran Populations

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ABSTRACT:
Chytridiomycosis is an emerging amphibian disease that has caused mass die-offs and species extinction worldwide. Chytridiomycosis is caused by infection of the keratinized epidermis of amphibians by the fungus *Batrachochytrium dendrobatidis (Bd)*. Several anuran species commonly found in Rhode Island have tested positive for *Bd* in other northeastern states; typically these individuals present few or no clinical signs and do not suffer mortality from infection. Environmental factors have been shown to increase pathogenicity of *Bd*, making the geographical distribution of *Bd* important to know for conservation planning, particularly in light of predicted climate change. This study was conducted to evaluate whether *Bd* is present in Rhode Island anuran populations and to map its geographical distribution throughout the state. We used two-way chi square tests with contingency tables to evaluate relationships between species life history variables and the presence of *Bd*. Adult anurans were significantly more likely to be infected than tadpoles and aquatic species were significantly more likely to be infected than terrestrial species. Skin swab samples (n=47 at 11 sites) were taken from bullfrogs (*Lithobates catesbeianus*), green frogs (*Lithobates clamitans)*, pickerel frogs *(Lithobates palustris),* wood frogs (*Lithobates sylvatica*), American toads (*Anaxyrus americanus*), and tadpoles. Twenty-one percent of samples tested positive for *Bd* in four anuran species. Positive *Bd* samples were found at a variety of habitats including vernal pools. Results from this study will improve our understanding of *Bd* infection and distribution in the northeastern United States and will aid in future anuran conservation planning.

Antimicrobial Properties of Skin Secretions Produced by the Mink Frog, Rana septentrionalis, and its Relatives

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ABSTRACT:
Skin secretions from amphibians, particularly from members of the family Ranidae, contain an interesting array of peptides with anti-bacterial and anti-fungal activities. These peptides offer an innate chemical defense system against various microbial diseases caused by pathogens in the amphibian's environment, including *Batrachochytrium dendrobatidis* (*Bd*) and *Aeromonas hydrophila*. Some of the antimicrobial peptides (AMPs) produced in secretions from the mink frog, *Rana septentrionalis*, have been tested and are effective in inhibiting growth of several strains of bacteria and *Bd*, and ranatuerin-2 from *R. septentrionalis* and *R. clamitans* are currently under study. These different peptides can also be used as markers to investigate phylogenetic relationships, and components of secretions from all members of the *Aquarana* (or *Rana catesbeiana* species group) have been characterized. Cladistic analyses of members of the *Aquarana*, based on comparing amino acid sequences of ranatuerin-2, are consistent with those based on nuclear and mitochondrial DNA, and provide insight into divergences and adaptations that may be responsive to environmental factors.

Influence of Landscape Connectivity on Genetic Structure of a Vernal Pool-breeding Amphibian

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ABSTRACT:
Understanding the consequences of habitat fragmentation and land use change on ecological processes is a priority focus for conservation biology. Vernal pool-breeding amphibians, such as the spotted salamander (*Ambystoma maculatum*), are particularly vulnerable to the effects of habitat fragmentation, as they require both suitable wetland and forested upland habitat during their complex life cycles. Land use changes associated with suburbanization, including increases in the transportation infrastructure, may impede critical metapopulation processes, such as dispersal and recolonization of populations. In this study, we used a landscape genetic approach in a comparative analysis of 2 landscapes, one characterized by suburban development and the other forested. We characterized the genetic structure of spotted salamanders in each landscape and identified landscape features that influenced inter-pond connectivity. Using 11 microsatellite markers, we genotyped 896 individuals from 44 ponds from 3 developed landscapes and 2 continuous forest landscapes. Within each landscape, we estimated inter-pond connectivity using F_{ST} as a measure of gene flow for ponds separated by distances of 100 m – 5 km. We found significant genetic differentiation between ponds at distances as small as 100 m. We used Bayesian clustering methods to identify

genetically similar clusters of ponds within each landscape. We identified genetic barriers associated with Class 1, 2, 3 and residential roads and power line corridors in the developed landscapes and with elevation in the continuous landscapes. Our results suggest that the fragmenting features of suburbanization decrease the genetic connectivity of spotted salamander populations and may negatively impact metapopulation dynamics over the long-term.

Road to Perdition: Impacts of Road Adjacency and Runoff on Wetland Amphibians

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ABSTRACT:
The network of roads on the landscape is vast, and has wide-reaching ecological influence. Chief among these is the influence of road adjacency and runoff on aquatic systems. Much of our understanding of these phenomena concerns rivers and streams, however little remains known about the impacts on ephemeral wetlands. Further, our understanding of the impacts of roads and runoff stops at the species level. Yet, the growing body of literature reporting phenotypic and genetic differentiation among local populations prompts investigation at deeper levels of biological hierarchy. I investigated the influence of road proximity and runoff on the wood frog and spotted salamander, and whether such an influence varies at local scales among populations. I conducted field-based reciprocal transplant and road salt exposure experiments. I sourced wild embryos within 48 hours of oviposition from each of five roadside and five woodland wetlands. When reared in roadside wetlands or exposed to road salt, embryos and larvae of both species survived less and exhibited higher incidences of malformations. The magnitude of these responses depended on wetland origin type: Individuals from roadside wetlands performed worse than those from woodland wetlands. These results indicate that road salt and road adjacency negatively influence these two species of wetland amphibian, and that this influence depends on local wetland origin type (i.e. roadside versus woodland). This suggests that the subset of the population of spotted salamanders and wood frogs most susceptible to the influence of roadside environments may be that which is least capable of persisting there.

Poster Presentations

(In alphabetic order by first author)

The Effects of Leaf Litter and Soil Type on Larval Wood Frog Development: Implications for Vernal Pool Restoration Efforts

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ABSTRACT:
Vernal pools provide critical resources for amphibians; yet, resources differ dramatically among pools. Pool resources depend on energy inputs from terrestrial systems, which provide the ecosystem with food and nutrients. I examined these bottom-up influences by studying the effects of soil and leaf litter on tadpole growth, development, and survivorship. Wood frog (*Lithobates sylvaticus*) tadpoles were raised in in-pool enclosures with five leaf litter treatments: hemlock, rushes, mixed deciduous (black cherry, sugar maple, American beech), boiled spinach (positive control), and none (negative control). Litter from wetland and upland sources was compared to test the effects of microbial colonization on the litter's nutritional value. Each treatment was crossed with mineral or organic soil and treatments (17) were replicated in three pools (51 total enclosures).

Survivorship was lower in mineral soil than organic soil. Survivorship was highest in spinach control treatments and lower in mixed deciduous compared to hemlock treatments. There was an interaction between soil and litter, as mineral soil exerted a greater decline in survivorship in combination with hemlock treatments compared to rushes. Litter source also interacted with hemlock and rush litter types as wetland litter yielded higher survivorship with rush

litter and lower survivorship with hemlock litter. Mass at metamorphosis was highest in spinach controls, lowest in no litter controls, and intermediate in the three litter types. Time to metamorphosis did not differ among the treatments. These results indicate that terrestrial systems impact amphibian development and could have practical applications for vernal pool restoration and land management.

Seasonally-dynamic habitat use by Spotted and Blanding's Turtles in Maine

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ABSTRACT:
We used radio telemetry to investigate the seasonal dynamics of wetland use by Spotted Turtles (*Clemmys guttata*) and Blanding's Turtles (*Emydoidea blandingii*) in southern Maine. Habitat use was examined in a temporally-segregated manner, comparing wetland use among seasonally discrete activity periods. Distinct seasonal movement patterns were detected and logistic regression revealed significant differences in wetland characteristics across seasons for both species. Spotted Turtles exhibited a positive association with wetlands hosting abundant Wood Frog (*Lithobates sylvaticus*) egg masses in spring, and a negative association with forested wetlands from spring through late summer. Blanding's Turtles were closely associated with forested wetlands in spring, wetlands with abundant Wood Frog egg masses and high sun exposure in early summer, and deep-water wetlands in late summer and fall. The seasonal differences in habitat use found in this study highlight the complex and dynamic landscape required to sustain these rare turtles. Spotted and Blanding's Turtles' diverse habitat requirements require frequent terrestrial movements, exposing them to threats for which mitigation requires understanding spatial and temporal shifts in habitats use.

Establishing a Volunteer-based Salamander Monitoring Program in Acadia National Park

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ABSTRACT:
Much of the work on amphibian declines has been postmortem with few studies that address the population dynamics of apparently stable populations. I worked collaboratively with Acadia National Park to establish a volunteer-based terrestrial salamander monitoring program using cover objects to gather baseline data on species found within park boundaries. This project included writing and field testing a volunteer handbook, designing and field testing a salamander measuring device, and compiling monitoring kits for volunteers to use. I also established a second study site within the park to expand data collection beyond a pilot study site. In the process, I found that a handbook had to be self-explanatory for all aspects of instruction to ensure accurate data collection by volunteers. Also, the measuring device needed to be accurate, repeatable and adjustable for different size salamanders. Meeting all of these criteria was more difficult than I anticipated and many materials were tried before I developed a suitable device. I found that my criteria for designating an additional site was too specific and needed to be revised in order to find a suitable site within my time frame. To ensure the longevity of this program I intend for most of the data to be collected by College of the Atlantic students enrolled in field classes. Finally, I found field testing drafts of the handbook and measuring device prototypes were crucial to striking a balance between engaging volunteers and ensuring that accurate data could be collected.

An Assessment of the Correlation between Amphibian Populations, Chytridiomycete Communities, and the Ecological Integrity of the Habitat

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ABSTRACT:
Batrachochytrium dendrobatidis has been implicated in amphibian declines worldwide, but thus far little is known about the chytridiomycete communities and the presence of *Bd* in New Jersey. The New Jersey Pinelands are an ideal location to investigate not only the prevalence of *Bd*, but how changes in environmental parameters caused by habitat degradation may affect the community. Anurans from water bodies of varying ecological integrity were tested for the presence of *Bd*. Despite initial expectations that *Bd* would be found more frequently in impacted water bodies and less frequent or non-existent in pristine locations, results showed that neither lethal nor non-lethal *Bd* was present at any location during any of the sampling events. After the presence of *Bd* was refuted, we investigated how ecological degradation and changing environmental parameters were affecting the chytrid communities that were present in the Pinelands. Through abundance surveys, molecular analyses, and lab manipulations, we found that not only was abundance significantly different between sites, but chytrid species were different and sites of differing ecological integrity were dominated by different chytrids. pH appeared to be the driving factor in these changes in abundance; increasing pH in pristine sites showed a significant decrease in population and decreasing pH found a significant increase in abundance in impacted sites. These studies show the potential importance of chytrids as bioindicators. Future replication of lab manipulations with *Bd* may elucidate *Bd's* ability to survive and proliferate in the Pinelands or if the balance of optimal pH and nutrients is absent.

Toxicity of a Glyphosate-Based Herbicide to Wood Frog Larvae and Green Frog Juveniles

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ABSTRACT:
Glyphosate-based herbicides are the most widely used herbicides in both forest and agriculture management. Recent laboratory and mesocosm studies have shown that exposure to glyphosate-based herbicides can lead to increased mortality and effect growth. However, mortality effects were generally seen at concentrations above those that are likely to occur in nature. When glyphosate herbicides are applied aerially, pond dwelling amphibian larvae are at risk of exposure in the water while juvenile and adult amphibians are at risk of both aqueous exposure and direct overspray. To investigate both avenues of exposure we examined the response of wood frog (*Lithobates sylvaticus*) larvae to 28-day exposures at 6 concentrations of Roundup WeatherMax® (Monsanto, Winnipeg, MB, CA) using small outdoor mesocosms and the response of first year juvenile green frogs (*Lithobates clamitans*) in littoral enclosures to two overspray scenarios of VisionMax® (Monsanto, Winnipeg, MB, CA) for 14 days. We observed a clear dose response relationship between glyphosate concentration and mortality in the larval exposure experiment. Calculated 28 day LC50 estimate was 2.34 mg a.e./L and the LT50 estimate was 25 days at 2.89 mg a.e./L, concentrations that are rarely seen in nature. No mortality was observed in the direct overspray experiment, and no decline in body condition was detected. These results suggest that continuous exposure to glyphosate-based herbicides at concentrations near the high end of environmental realism could have a negative impact on larval amphibian survival. Direct overspray of terrestrial juveniles at environmentally realistic concentrations does not appear to negatively affect survival or growth.

Conservation Planning for *Terrapene carolina carolina*: A Stochastic and Spatially Explicit Population Viability Analysis.

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ABSTRACT:
The eastern box turtle (*Terrapene carolina carolina*) is listed as a Species of Special Concern in Massachusetts. Populations in Massachusetts and northern New York are at the northern edge of the species' range and occur at low densities. Box turtle habitat is rapidly being developed and fragmented, calling for a comprehensive conservation plan that includes provisions for land protection. A population viability model was used to develop a land protection plan and assess the subsequent risk of extirpation within four distinct regions of Massachusetts over a 200-year time period. The mean extinction risk was 3% for three regions: western, south shore, and Cape Cod. There were 15-21

box turtle sites in each of those regions, with only 4–6 sites in each region having >5% probability of extinction. In contrast, the mean extinction risk was 5% for the northeastern region, which consisted of three isolated sites. Metapopulation extinction risk was zero for each region individually and statewide (all regions combined). This population viability analysis estimates that, under the land protection plan, eastern box turtle will have a high probability of persistence throughout the state for more than 200 years. Furthermore, the plan provides a framework to identify and prioritize both needs and locations for research, monitoring, and management.

Effects of Habitat Fragmentation and Water Quality on Genetic Structure of Wood Frogs in Vernal Pools in Southeastern New Hampshire

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ABSTRACT:
Habitat fragmentation has the potential to increase the probability of local extinctions by increasing isolation of populations. Amphibians are considered particularly vulnerable to habitat fragmentation as a result of their complex life cycles, high degree of philopatry, and low mobility compared to other vertebrates. As such, connectivity in the form of gene flow among metapopulations is critical for their long-term persistence. Using a landscape genetics approach, we will assess the effects of fragmentation on a vernal pool-breeding amphibian, the wood frog (*Lithobates sylvatica*). Herein we present an overview of ongoing work. To date, this work has included the collection of 1,840 wood frog embryo samples from 27 ponds in a continuous, forested landscape and 47 ponds in a fragmented landscape, characterized by suburban development and roads. With these data, we will characterize the genetic structure of wood frog populations in these two landscapes. In addition, we will investigate the effects of barriers to dispersal, specifically in the form of roads. Lastly, we will identify the effects of environmental factors, including water quality and hydroperiod, on genetic structuring in the wood frog. The results of this research will aid in increasing our understanding of the effects of habitat fragmentation and environmental factors on population connectivity of vernal pool-breeding amphibians. Such knowledge will be useful for the development of wetland management policies and may be used as a model to study other populations threatened by disturbance.

Why did the Salamander Cross the Road?: A Citizen Science Program to Support Amphibian and Wetland Conservation in New York's Hudson Valley

Laura Heady, Cornell University

ABSTRACT:
In the Hudson Valley, woodland pools are an important wetland habitat of forested landscapes, as they support a group of pool-breeding amphibians that are identified as "species of greatest conservation need" in the New York Comprehensive Wildlife Conservation Strategy. Due to their small size and isolation, woodland pools are usually not afforded protection by state and federal wetland regulations. In some cases, municipalities have passed local laws with more expansive wetland protection, but often they too fail to adequately protect woodland pools.

Each spring, frogs and salamanders travel significant distances to breed in woodland pools. Unfortunately, migration pathways often cross roads and long driveways, leading to mortality of slow-moving wildlife, even in low traffic areas. The combined effects of forest fragmentation, wetland loss, and road mortality are contributing to declines in amphibian populations in the region.

Cornell University and the Hudson River Estuary Program are working together to conserve forests, wetlands, and associated wildlife in the estuary watershed. As part of that effort, a pilot "Amphibian Migrations and Road Crossings" project was initiated in 2008 to achieve multiple
goals: 1) identify and map critical road crossing areas, to inform future planning decisions and volunteer "crossing guard" efforts and 2) raise awareness in landowners and local leaders about the impacts of planning decisions on the fate of these species of concern.

By engaging citizen scientists in learning about the life history of pool-breeding amphibians, and using their observations to support future outreach, we hope to cultivate a landscape perspective and emphasis on connectivity in

local planning and wetland conservation efforts. Over time, we may also learn if the period of spring migration is shifting due to climate change. Project findings will enable program staff to adapt biodiversity outreach messages and technical assistance to local and regional partners.

The Contribution of Red-backed Salamanders to Ecosystem Functions

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ABSTRACT:
Our research focuses on the contributions of amphibians to ecosystem functions and services. Because many amphibians are relatively small and cryptic compared with other vertebrates, their potential contributions to ecosystems are often overlooked. However, amphibians can occur at exceptionally high densities and possess qualities that may make them key players in the trophic dynamics of forest ecosystems. For example, red-backed salamanders (*Plethodon cinereus*) have high energy conversion efficiencies, high calcium concentrations, and are a link between above- and below-ground food webs through their roles as invertebrate predators. To examine the role of red-backed salamanders, we created 10 plots and randomly assigned them as either control or salamander-depletion. Between May 2008 and August 2009, we removed 2,676 salamanders from the five depletion plots. This is an average of 1.70 salamanders removed per m^2. In fall 2009, we visited all plots without removing any additional salamanders. We counted 248 and 114 salamanders in the reference and depletion plots, respectively. This suggests that approximately 54% fewer salamanders currently inhabit the depletion plots. Within the plots, we examined how red-backed salamanders affect (1) leaf litter and fine wood decomposition rates, (2) nitrogen mineralization potential, (3) acorn germination, (4) oak sapling growth and survival, and (5) the amount of insect damage inflicted on oak sapling foliage. These ecosystem functions affect forest community structure and provide critical support for valuable ecosystem services.

Phenotypic Description of the Eastern Mudsnake (*Farancia abacura abacura*) in Virginia

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The Eastern Mudsnake (*Farancia abacura abacura)* is a secretive, semi-aquatic snake found in swamps and lowlands of the Coastal Plain and lower Piedmont regions of the southeastern United States. Although relatively common throughout some parts of its range, little is known about them in Virginia, with existing specimens being primarily the result of road-kill. Three road-kill eastern mudsnake specimens were collected from the counties of Prince George, Isle of Wight and Charles City from 2007-2009. The Charles City Co. specimen is the northernmost record to date and represents the only recorded occurrence north of the James River. Phenotypic characteristics were described for each specimen to compare variation among individuals of the species.

Hot Spots: Bog turtle nest-site selection in New York State

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ABSTRACT:
The bog turtle (*Glyptemys muhlenbergii*) is a federally-threatened species, primarily because the early successional wet-meadow/fen habitat bog turtles require is increasingly rare. However, little is known about bog turtle nesting habitat requirements within this rare habitat. Understanding nest site microhabitat conditions is important because such conditions may not only determine the survival of turtle embryos, but may also determine the sex of individuals (if bog turtles have temperature-dependant sex determination – which is currently unknown). In New York State,

organizations like the NY Natural Heritage Program have delineated bog turtle nesting habitat based on standards for optimal bog turtle nesting habitat produced by The Nature Conservancy (TNC). But the TNC standards have not yet been compared with actual nest microhabitat data. Our goal was to evaluate, and potentially improve, the TNC standards by studying the microhabitat of multiple bog turtle nests. In 2009, we used radio telemetry to track 21 female bog turtles to their nests. We then collected microhabitat nest site data based on the TNC standards. In addition, we measured several supplemental parameters, including woody stem density, distance to open water/muck, and nest temperature. Using CART-analysis, we determined that the most important microhabitat conditions were reduced woody stem density and a distance to open water/muck between 5 and 70 cm. Nest sites were also significantly warmer than nearby random locations. With additional data from the 2010 season, we hope to continue improving our understanding of maternal nest-site selection in bog turtles, especially relationship between vegetative cover, nest temperature, and nest success. With this new information, we will make recommendations for updating the TNC standards with the goal of improving the preservation and management of this species' habitat.

Maine Amphibian and Reptile Atlas Project

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ABSTRACT:
From 1986-1990, Maine's Department of Inland Fisheries and Wildlife (MDIFW), in cooperation with Maine Audubon and the University of Maine, conducted the Maine Amphibian and Reptile Atlas Project (MARAP). During a four-year period, over 250 volunteers contributed approximately 1,200 records of amphibians and reptiles. This initiative culminated in the 1992 publication of the book *The Amphibians and Reptiles of Maine*. By 1998, the number of records had more than doubled and there was increasing demand for updated information on the state's amphibians, reptiles, and other nongame taxa for decisions involving environmental permitting, land acquisition, municipal planning, and other habitat protection initiatives. A second edition was revised in 1999 titled *Maine Amphibians and Reptiles*; this edition incorporated information from 2,500 records into updated range maps and species narratives, added color photographs, and a CD of the calls of the frogs and toads. MDIFW has continued this work and maintains a comprehensive database on the distribution of Maine's 35 amphibian and reptile species. As of Spring 2010, over 6,000 entries from nearly 600 volunteers have been logged. There is much still to learn regarding the distribution and ecology of Maine's herpetofauna and we encourage NEPARC members to share their observations and photographs with MARAP.

Chemical Defense in Hatchling Wood Turtles, *Glyptemys insculpta*: Function of the Mysterious Rathke's Gland

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ABSTRACT:
Turtles rely on long-lived females to continue a modest annual reproductive output spread over many years to increase the chance that some eggs will hatch and that some of those hatchlings will survive to adults. Eggs and hatchlings are extremely vulnerable to predators. We discovered that hatchling wood turtles, *Glyptemys insculpta*, emit a strong, malodorous substance from the axillary region just below the carapace and above the leg when the skin of the turtle is lightly scraped. Previous studies show the presence of a gland, Rathke's gland, with ducts leading to openings in the shell. In 2009, Plummer and Trauth described the structure of Rathke's gland in softshelled turtles. They conclude, however *"the gland's function remains largely unknown and offers a challenging opportunity for behavioral and chemical ecologists"*. We hypothesize that Rathke's gland is the source of the substance emitted from hatchling wood turtles and that the substance functions as a chemical defense. We dissected a pre-hatched individual that died at a late stage of development. A polar solid phase microextration fiber was used to collect the volatile component of the substance emitted from living hatchlings; we used an Agilent GCD Plus gas chromatograph for analysis. The spectrogram of the defensive chemical showed a very distinct peak that was absent in the controls. In preference

experiments, rats show a significant difference in the choice of food items with and without the defensive substance (^X 0.025< p<0.05). This is the first anatomical and functional description of Rathke's gland in wood turtles.

Conserving Maine Vernal Pools through Collaborative Local Initiatives

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ABSTRACT:
Current wetland regulation at the federal and state level does not adequately conserve vernal pools. In September of 2007, a subset of exemplary Maine vernal pools were regulated as Significant Vernal Pools under chapter 335 of the Natural Resource Protection Act. Although this new legislation recognizes vernal pools as Significant Wildlife Habitat, it still falls short of protecting the terrestrial habitat needs of pool-breeding amphibians. The University of Maine and Maine Audubon Society initiated a municipal vernal pool mapping and assessment project to educate communities about vernal pool ecology and proactively map and survey vernal pool resources using trained citizen scientists (local volunteers). Outputs from our collaborative work with 11 Maine towns include the *Maine Municipal Guide to Mapping and Conserving Vernal Pools* and an accompanying website, designed to guide additional communities through this process without the level of support we have provided in the pilot phase. Within the 11 towns participating in this project, nearly 2,500 potential vernal pools were remotely identified on large scale aerial photographs and to date, just over 1,000 have been surveyed on private properties for which permission was granted. We have collaborated with over 25 town officials (planners, managers, tax assessors, code enforcement officers, etc.), and have trained over 250 citizen volunteers to conduct biological inventories. By engaging citizenry and encouraging local control over quality of life through participation in conservation planning this project promotes working relationships among citizens, town officials, and state agencies that lead to increased natural resource protection.

Influences of Aquatic and Terrestrial Habitat and Adult Demographics on Juvenile Recruitment in a Vernal Pool-Breeding Amphibian

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ABSTRACT:
Vernal pool-breeding amphibians are particularly vulnerable to population decline and extinction because of the unpredictable nature of vernal pool hydroperiods, as well as the generally limited protection of vernal pools and adjacent upland habitat. The complex life histories of these species increase their vulnerability to habitat alteration and necessitate that conservation planning considers both their aquatic and terrestrial habitat requirements. One major threat to vernal pool-breeding amphibians is the encroachment of forestry practices (e.g., clearcutting) on vernal pools across the landscape. Forested terrestrial buffers surrounding pools may provide some protection for vernal pool-dependent species; however, there are few studies to date testing the efficacy of forest buffers. From 2004 through 2009, we monitored amphibian populations at 11 vernal pools in central Maine, following a standard drift fence and pitfall trap protocol. Pools were assigned to one of three forest buffer treatments: 30-m buffer, 100-m buffer, and >1000-m buffer (reference) pools. Specifically, we explored population-level (sex ratio, population size, and juvenile recruitment) effects of forest buffer treatments over time, and we examined environmental (e.g., hydroperiod) and demographic (e.g., adult population size) factors potentially influencing juvenile recruitment of pool-breeding amphibians. Here we present preliminary findings for spotted salamanders (*Ambystoma maculatum*) from our six-year study, including the relative influences of terrestrial forest buffer treatments, hydroperiod, and adult population demography on juvenile recruitment, and offer initial recommendations of conservation priorities for vernal pool-breeding amphibians.

Stress and Disease Susceptibility: An Experimental Test Using Wood Frogs (*Lithobates sylvaticus*) and Ranavirus, a Lethal Amphibian Disease

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ABSTRACT:
The emergence and increasing severity of wildlife diseases, especially those associated with amphibian declines, are often attributed to environmental challenges or stressors. It is commonly presumed that chronic stress increases an animal's susceptibility to infectious disease. This study aimed to evaluate that presumption, specifically the timing (days to death) and the probability of mortality from disease as they relate to three stressors. I used wood frog tadpoles (*Lithobates sylvaticus*), common to the Northeast, and a local strain of ranavirus to investigate the links between stress and disease. Tadpoles were chronically challenged with low food, predator cue, high density, or a combination of high density and predator cue for the duration of the study (Gosner stage 25 through death or metamorphosis). To determine whether animals responded physiologically to each challenge and how these responses affected disease outcome, the tadpoles were either sacrificed for measurement of corticosterone –a vertebrate stress hormone– or exposed to an LD_{50} dose of virus when they reached Gosner stage 33. Initial analyses suggest that neither the timing nor magnitude of mortality varied among the treatments relative to a manipulation-free control. The wood frogs in these experiments demonstrated a surprising amount of resilience to common challenges. The results, contingent upon corticosterone assays, indicate that these sources of stress do not significantly increase the severity of an epidemic. The stressors studied are common in the natural environment; further study involving novel challenges like chemical pollution should be considered.

Habitat Use and Movements of Northern Map Turtles (*Graptemys geographica*) in an Altered River System in Maryland

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ABSTRACT:
Riverine turtle species are declining worldwide and many populations have been extirpated due to anthropogenic stressors. Last recorded in Maryland in the early 1990's, the Northern Map Turtle (*Graptemys geographica*) is listed as state endangered and is currently only known in the lower Susquehanna River in northern Maryland. This river is divided by a hydroelectric dam, heavily used for recreational activities, and has increasing shoreline development, all of which may negatively impact this population. Given the absence of basic ecological data of map turtles in Maryland, we used visual encounter surveys, basking trapping, hand captures, and radio-telemetry to understand the habitat utilization and movement of this population. Impacts of dam operations on river water levels are dramatic but largely predictable. Low flows are caused by little to no hydroelectric power generation, whereas high flows are at peak electric generation. Our data suggest that high flows from the Conowingo Dam hinder basking activity and movements of turtles. During periods of high flow turtles take shelter behind rocks or in log snags. Basking sites are submerged during high flows, drastically reducing the availability of suitable basking habitat. Releases from the dam are dictated by rain and are variable among seasons. Given the proximity of the river to the Chesapeake Bay, tidal influence below the dam further increases the water level when combined with dam discharge. We suggest the turtle's reaction to sudden changes in river flow and depth is crucial in understanding potential impacts on this population.

Amphibian Communities in Maine's Fishless Lakes: Facultative Breeding Occurrence by Vernal Pool Amphibians

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ABSTRACT:
Fishless lakes are an increasingly rare aquatic ecosystem in Maine. Previous studies documented differences in invertebrate community composition and abundance among lakes in Maine with and without fish. Historically and currently fishless lakes also may contain unique amphibian communities, particularly in landscapes with few alternative fishless breeding sites. We surveyed seven fishless and five fish-containing lakes and ten vernal pools in Hancock and Washington Counties, Maine, for amphibian community composition from 2006 to 2009. Amphibian species typically associated with vernal pools were detected breeding in all lakes. *Ambystoma maculatum* egg mass counts exceeded the state threshold for vernal pool significance in five out seven fishless and in all fish-containing lakes. *Ambystoma maculatum* egg mass density per area of suitable ovipositioning habitat was greatest in vernal pools indicating that this ecosystem supports greater *A. maculatum* breeding populations than lakes. Egg masses in both lake types were oviposited deeper than in vernal pools; however, egg masses were oviposited closer to shore in fish-containing lakes than in fishless lakes or vernal pools. This indicates that adults may alter breeding and ovipositing behavior in relation to different threats perceived at breeding sites. Furthermore, in egg mass enclosure experiments, *A. maculatum* embryo survival to hatching was greater in vernal pools than either lake type. Results from this study indicate the importance of lakes for facultative breeding by vernal pool-associated amphibians while highlighting vernal pools as the preferred breeding habitat for *A. maculatum.*

Potential Impact of Human Transportation on Amphibian and Reptile Populations

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ABSTRACT:
In spring, amphibians and reptiles emerge from their wintering locations in the woods and migrate to nearby ponds or pools in order to breed. Their migration pathways are often intersected by roadways; road mortalities are often identified at the crossways during the migration season. This project examined potential wildlife mortality caused by human transportation. Twenty-four pitfall traps (5 gallons in size) were installed approximately 15 ft from the roadway. Traps were placed at 25 ft intervals along a silt fence parallel with the roadway. Organisms found in the traps were recorded twice a day at 12 hour intervals. Daily temperature and precipitation data were obtained from the New Jersey Weather and Climate Network. Between March 14 and May 26, 2010, 782 organisms representing 12 species were recorded including American toad (*Bufo americanis*), bull frog (*Rana catesbeiana*), Fowler's toad (*Bufo fowleri*), green frog *(Rana clamitans*), northern grey tree frog (*Hyla versicolor*), spring peeper (*Pseudacris crucifer*), wood frog (*Rana sylvatica*), red spotted newt (*Notophthalmus viridescens*), spotted salamander (*Ambystoma maculatum*), snapping turtle (*Chelydra serpentina*), red back salamander (*Plethodon cinereus)* and eastern garter snake (*Thamnophis sirtalis sirtalis*). The most dominant species was American toad at 60.3%. Green frog, red-spotted newt, and spring peeper were also abundant. Based on the traffic volume, the probability of killed at the study site was estimated to be 0.4755. The result suggested that, during the 10-week study period, human transportation had a potential to impact 368 amphibians and reptiles within an approximately 625-ft segment of this two-lane roadway in a New Jersey suburban area.

Frog Quiz: an on-line training and assessment tool for calling survey observers of the North American Amphibian Monitoring Program (NAAMP)

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ABSTRACT:
In 2006, the Frog Quiz became a required component of the North American Amphibian Monitoring Program (NAAMP). Observers are required to pass an on-line quiz that plays a series of random sound files for the species found in their state or region. States with higher species diversity have divided their states into regions, to allow observers to focus on the species they might encounter. Observers may take the quiz more than once, if needed to

pass. In 2009, 67% of observers passed on their first quiz attempt, 17% passed on their second attempt, and 16% took 3 or more times to pass the quiz. The poster also displays for each state or region the average time it takes for observers to complete a quiz (ranges from 10 -60 minutes, with states with greater diversity taking longer time).

An Evaluation of the Benefit Gained Through a Spatially Explicit Approach to Conserving Pool-breeding Amphibian Habitat.

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ABSTRACT:
Conservation planning for pool-breeding amphibians on private lands has been constrained by the focus placed on the individual breeding pools as opposed to the larger landscape. Until now, the dominant conservation paradigm has been uniform radial buffer zones that are inadequate in size and lack the spatial specificity to address multiple habitat needs which potentially require more habitat than is affordable given competing demands for conservation funds. The high cost of land in developable areas, a situation worsening as development pressure rapidly increases over much of New England, uses funds more quickly than past years and protects less land per dollar. To address these problems, we developed a spatial model to expand the planning focus and include the important non-breeding habitat (adjacent to breeding pools) where the amphibians spend most of their lives. We used published average minimum and maximum seasonal migration distances of pool-breeding amphibians to create six spatially-explicit GIS models that represented both breeding and non-breeding habitats. We compared the size of area required to enclose these habitats, which allowed for movements outside published buffers, with a large uniform radial buffer zone of 368m. Results showed that spatially-explicit areas representing 48% to 83% of the large radial buffer could conserve a larger portion of the important non-breeding habitat, implying lower cost to conserve.

Natural History of Wood Turtle (*Glyptemys insculpta*) Populations in Southwestern New Hampshire and Recommendations for Conservation Management.

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ABSTRACT:
The project is a study of habitat use and nesting ecology for the wood turtle, *Glyptemys insculpta*, which is listed by the NH Fish and Game Department as a Wildlife Species of Special Concern and listed in the NH Wildlife Action Plan as a NH Species of Special Concern. We are studying three well-established, small populations of wood turtles using standard methods of individual identification marking and radio telemetry to determine habitat preferences and nesting behavior. Some individuals are known to have dates carved on the plastron (we have found two individuals to date) and we will compare the dates with known methods of estimating age. The results of our study are population demographics with spatially explicit data analysis offering insight into the risks facing this species from changes in land use and from climate change, particularly from the threat of more frequent flooding events. At the end of the research season, we will offer suggestions to local landowners and local and state agencies for land conservation measures aimed at better protecting the species through mitigation planning. This study is in its second season studying wood turtle populations in the Ashuelot River watershed in New Hampshire. Initial counts from first and second seasons yield only a small number of reproducing females. Tracking results from the first year indicate that the tracked turtles each appear to have an identifiable home range but do not stay within the bounds of the NH Shoreland Protection Act of 250 ft, illustrating the lack of habitat protection for this species.