



**TRANSITIONS ACROSS LANDSCAPES:  
THE ECOLOGY OF CHANGES**

**ABSTRACTS**

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## Oral Presentation and Poster Abstracts

(in alphabetical order by first author's last name)

### **Cultivating healthy soils: Developing reliable indicators of soil quality for pasture soils**

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*Poster Presentation #22*

Sustainable management represents a balancing act between meeting current needs for food, fiber, and energy while conserving resources for future generations. Soils are the fundamental support system for terrestrial ecosystems; any management practice that alters the natural function of the soil has the potential to influence the vitality, productivity, species composition, and hydrology of the larger ecosystem. Developing sustainable management practices requires monitoring tools for accurately, easily, and inexpensively assessing changes in the status of the soil resource that are calibrated for local soil conditions and can be evaluated in conjunction with other indices of ecosystem productivity. This paper reports on initial results from a multi-agency effort to develop and test a suite of simple, cost-effective "indicator" variables for monitoring soil quality in conjunction with vegetation, biomass, and microbial community assays. Studies were conducted along a management gradient of working farms in the New River Valley and consisted of both field assessments and lab analyses (slake test, pH, aggregate stability, nutrient content). Microbial diversity was assessed using Ecolog microplates. Results will be used to develop quantitative models, calibrated for southwestern Virginia, that link these indicator variables to ecosystem function and help conservation agents evaluate the environmental and economic benefits of different management options.

**Validation of a bioenergetics model linking primary production and Atlantic menhaden growth in Chesapeake Bay**

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*Oral Presentation – Session III*

Atlantic menhaden (*Brevoortia tyrannus*) hold a unique position in the estuarine food web of Chesapeake Bay, serving as primary consumers filter feeding on phytoplankton, and as a high energy forage fish for other species. We used a bioenergetics model to describe the variability of young-of-year (YOY) menhaden growth as a function of primary production and water temperature. Our model used remotely sensed surface chl-a levels and field measured temperature data coupled with physiological parameters developed in previous studies to estimate a potential growth curve for menhaden specific to the conditions in each year (1995-2004). We made substantial improvements to previously developed functional responses describing YOY menhaden filtering efficiency on phytoplankton and swimming speed while filter-feeding. Our model was calibrated and validated using field observations of menhaden size. Approximately 70% of the variability in menhaden growth was explained by the model, indicating that chl-a levels play an important role in the size of YOY menhaden. Only ~10% of the measured chl-a concentration was required to attain growth observed in the field. Growth potential for YOY menhaden varied regionally and was highest in the oligohaline (northern) region and lowest in the polyhaline (southern) region of the Bay. Our results represent the first calibrated and validated, coupled foraging-bioenergetics model for Atlantic menhaden and establish a quantitative link between chl-a standing stock and menhaden growth potential.

**Consequences of population size structure for intraspecific competition and predation in red-eyed treefrog larvae (*Agalychnis callidryas*)**

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*Poster Presentation #3*

The role of body size is important in determining the outcome of competition and predator-prey interactions. Size structure of a population (i.e. relative proportion

of large and small conspecifics) may be particularly important in organisms with prolonged breeding periods and rapid growth. Predators can further alter competitive interactions by changing the density or behavior of prey. Here we study the importance of size structure in the Neotropical leaf-breeding tree frog, *Agalychnis callidryas*. This species is a prolonged breeder such that multiple overlapping cohorts of differing sizes are common. Specifically, we examine size-specific intraspecific competition between *A. callidryas* tadpoles and then explore how predation affects these interactions. To determine the strength of inter-cohort competition, we manipulated the density and relative proportion of large and small tadpoles in a response surface design and quantified growth. We then observed the effect of a dragonfly larvae predator (*Anax sp.*) on tadpole growth at different size-structured treatments. Large tadpoles had a stronger negative per capita effect on the growth of both size classes, suggesting that large tadpoles consume resources more effectively than hatchlings. However, hatchlings had a greater per unit biomass effect on both size classes. Predators significantly lowered hatchling survivorship and growth, but had no effect on large tadpole growth or survival. Surprisingly, predators reduced growth rates in hatchlings significantly more than large tadpole competitors. The magnitude of the negative effect on hatchling growth by *Anax* predators is likely important in determining the long-term fitness of adult frogs in this system.

**Characterizing spatial, temporal, and seasonal changes in dissolved oxygen concentration within vernal ponds in south-central Pennsylvania**

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*Oral Presentation - Session IV*

Vernal ponds have been the focus of considerable research on amphibian ecology. Little research, however, has been performed on the abiotic parameters of these temporary aquatic environments. We examined the spatial, temporal, and seasonal variation in dissolved oxygen (DO) concentration in six vernal ponds in south-central Pennsylvania. Samples were taken at different depths over a 24-hour period during the spring, early summer, and mid-summer of 2009. We also sampled water temperature, percent canopy cover, dry leaf mass, and concentrations of chlorophyll a, dissolved organic carbon (DOC), nitrate-nitrogen and soluble reactive phosphorus to determine their relationship with DO concentrations. One pond with minimal canopy cover and abundant aquatic vegetation showed diel changes in surface DO concentration; heavily shaded ponds did not. Collectively, all ponds showed similar trends in DO across seasonal sampling dates. During the spring, the upper depths of each pond were well oxygenated while the pond bottom remained hypoxic. During the early summer, DO concentrations decreased steadily from top to

bottom of the water column. Mid-summer sampling showed that surface DO concentrations were highest and all other depths had hypoxic or anoxic conditions. Statistical analyses revealed strong negative relationships between surface DO and DOC concentration during the spring, and surface DO and canopy cover during early and mid-summer. These results demonstrate that hypoxic conditions are prevalent in vernal ponds throughout much of the season, which could potentially influence hatching success and predator-prey interactions among pond organisms.

**The impact of partial or complete defoliation on starch reserves and growth of Japanese barberry**

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*Poster Presentation #17*

New Jersey is host to a number of non-native invasive plant species that out-compete native plants for space, sunlight, and soil. One of those plant species, Japanese barberry (*Berberis thunbergii*), has become particularly wide-spread in certain regions of New Jersey. Various theories exist to explain the ability for non-native organisms to become invasive. One of these theories states that they have a competitive advantage as a result of a lack of natural predators. In 2008, extensive defoliation of Japanese barberry by barberry geometer larvae (*Coryphista meadii*) was documented across a wide geographical distribution in New Jersey. This project was set up to address if Japanese barberry possesses certain properties that help it maintain its invasiveness following defoliation. The main goal was to assess how Japanese barberry may be affected by partial or complete defoliation. Our working hypothesis is that Japanese barberry starch reserves and growth will be negatively impacted by defoliation. To study this hypothesis, we defoliated leaves on new stem growth of large and small-sized barberry plants by either 50% or 100%. We measured response to defoliation by measuring carbon uptake through photosynthesis, carbon allocation to growth, and starch content of the plant. Our results indicate that starch reserves were not affected by either partial or total defoliation thus giving the plant an advantage over its native competitors. Furthermore, we found that larger plants had more starch reserves, indicating that as plant size increases the harder it will be to inhibit growth and control its spread by defoliation alone.

**An evaluation of bacterial and fungal contributions to litter decomposition along a soil moisture gradient**

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*Poster Presentation #12*

The primary decomposers of plant litter are bacteria and fungi, though there is no consensus which group is dominant, or how the populations change over time. This study's objectives were to examine the relative contributions of these two groups to leaf organic matter (OM) decomposition, while considering the effect of hydrology and litter source. Research was conducted across three habitats of differing moisture regimes: an upland terrestrial site, an emerging freshwater marsh, and an established freshwater swamp. Litterbags were constructed using a standardized substrate, maple leaves, and the site-specific vegetation, and sampled after 0, 3, 6, 10, and 16 months of field incubation. Analyses included decomposition (% OM remaining), carbon and nitrogen content (C:N), dissolved organic carbon (DOC) release, microbial respiration via <sup>14</sup>C acetate uptake, and microbial community composition via terminal restriction fragment length polymorphism (T-RFLP) analysis. Q-PCR reactions are currently being run to determine fungi-to-bacteria ratios. Microbial communities were unique at each site and temporal shifts were observed for both the bacterial and fungal populations. Changes in community structure were correlated with changes in OM quality and quantity, though specific relationships varied by site. Fungi were found to be a significant contributor to respiration at sites of high moisture, which suggests a need to better incorporate their activity in carbon budgets. Overall, these results have important implications for our understanding of how the decomposition of plant litter aids in nutrient cycling and energy transfers within and between ecosystems.

**Historical trends in pond abundance and sediment accumulation rates**

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*Oral Presentation – Session IV*

Ponds have increased more than 18-fold in the Brandywine watershed, southeastern Pennsylvania since 1937. These ponds reduce sediment loading to stream

networks, also influencing pond longevity. We investigated how sediment characteristics vary within ponds as a function of depth and distance from shore, and how sediment accumulation rates vary among ponds as a consequence of differences in size, age, and drainage basin. Ten ponds representative in size of most ponds in the watershed were sampled during summer 2009. Five had influent headwater streams, and five had no surface inflows. Ten sediment cores were obtained from each pond, allowing for measurements of dry bulk density (dBD), organic matter (% OM), or % sand. Pond volume was determined using ArcView 3D Analyst, and used to compute total sediment volume, mass and organic matter storage. Within ponds, dBD, % OM, and % sand were all strongly intercorrelated ( $p < 0.001$ ). Based on simple linear regressions, decreased dBD and sand content, and increased %OM, accompanied increasing distance from shore, and (to a lesser extent) increasing depth. Among ponds, total sediment volume, mass, and OM storage were all intercorrelated ( $p < 0.001$ ). Older ponds with larger watersheds showed increased sediment volume, mass, and OM ( $p < 0.001$ ). Area-specific sediment accumulation (SARAS;  $m^3/ha/yr$ ) declined with increasing pond size, however, and were significantly higher ( $p = 0.029$ ) among ponds with stream inflows. Given our relatively high SARAS estimates and rapidly increasing pond densities, small ponds show an increasing potential to modify water quality within the Brandywine watershed.

**Effects of spatial scale and shared prey density on intraguild predation among aquatic invertebrates**

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*Oral Presentation – Session III*

Intraguild predation (IGP) is an interaction in which predators that compete for the same resources also interact as predator and prey. The simplest form of IGP occurs between a top predator, intermediate predator, and shared prey and IGP relationships have been studied extensively in invertebrate communities. Previous studies have produced conflicting results concerning the effect of prey density on IGP interactions, perhaps due to the variation in spatial scale of experimental mesocosms. To examine these differences we manipulated shared prey density and the spatial scale of the mesocosms in a community with dytiscid water beetle larvae (*Dytiscus sp.*) as the top predator, larvae of the dragonfly *Anax junius* as the intermediate predator, and larvae of the dragonfly *Sympetrum semicinctum* as the shared prey. IGP-related mortality was observed at all 3 spatial scales and each of the 4 shared prey densities. Shared prey density significantly influenced the intensity of IGP; *A. junius* mortality was greatest in



treatments with no shared prey and the intermediate level of shared prey, but less in treatments at low and high shared prey densities. *S. semicinatum* mortality was not affected by density. Spatial scale was marginally significant for *A. junius* mortality but *S. semicinatum* mortality was significantly affected by spatial scale. Foraging strategies and other behavioral changes likely account for mortality differences. These results advance our understanding of how spatial scale and shared prey density influence the outcome of IGP experiments. Ultimately, a better understanding of the effect of experimental spatial scale will help ecologists design small-scale experiments that more accurately represent natural ecosystems.

### **Habitat partitioning by native and invasive species of crayfish in Maryland's Monocacy River**

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Poster Presentation #6

We examined habitat preference of three species of crayfish found in the Monocacy River (Frederick County, Maryland) at sites where individual species were dominant and at sites where they were in competition with another species. *Orconectes rusticus* is a recent invasive species, *O. virilis* is an established invasive species that has been present for approximately 30 years, and *O. obscurus* is a native species to the Monocacy River. Five habitat types were included in our study: glide, pool, riffle, run, and emergent vegetation (*Justicia americana*, or American water-willow). Our results showed that *O. rusticus* juveniles (<16 mm) and adults (>16 mm) willingly utilized any type of habitat when in areas of no competition. When unimpeded by other species, *O. virilis* and *O. obscurus* juveniles utilized pool, glide, and emergent vegetation as their habitat, but preferred to use emergent vegetation as their habitat as adults. In areas of competition with *O. rusticus*, *O. virilis* juveniles were restricted to emergent vegetation and adults were greatly reduced in abundance. Adult *O. virilis* abundance was also greatly reduced in areas of competition with *O. obscurus*, particularly in emergent vegetation. Our results indicate that *O. rusticus* is a strong competitor capable of displacing other species as its range expands. Behavioral studies are needed to ascertain the behavioral mechanisms used by *O. rusticus* to drive other species from their preferred habitat.

**Rusty crayfish (*Orconectes rusticus*) feeding behavior and associated effects in a simulated submerged aquatic grass bed environment**

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*Oral Presentation – Session III*

Rusty crayfish (*Orconectes rusticus*) have been known to significantly alter, through consumption and removal, macrophytes or submerged aquatic vegetation (SAV) in streams and lakes they have invaded. The invasion of the rusty crayfish into the lower reaches of the Susquehanna River creates the possibility they may eventually invade the northern Chesapeake Bay. The potential effects of rusty crayfish on such an estuarine system are unknown. Using microcosms simulating SAV composition of the Susquehanna Flats region of the Chesapeake Bay, we monitored for consumption and removal effects from a rusty crayfish invasion on three species of SAV (*Vallisneria americana*, *Najas guadalupensis*, and *Myriophyllum spicatum*). Microcosms were separated into three treatments (controls, crayfish, and crayfish and alternative food source) with each trial lasting five weeks. Data show that reduction of biomass of larger species, such as *V. americana* and *M. spicatum*, was limited with the exception of the consumption or senescence of *V. americana* flower and bud stems. However, biomass of a smaller-sized species like *N. guadalupensis* was almost completely removed. Our data also show that biomass reduction can be related to a seasonal component of crayfish feeding and behavior. Data supported strong indirect effects from the crayfish including increased levels of total suspended solids leading to decreased ambient light levels.

**Seasonal changes in water quality in a small pond in Auburn, PA: A pre-restoration study**

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*Poster Presentation #19*

The goal of this project was to document the seasonal changes in water quality in a small oligotrophic pond in Auburn, Pennsylvania. The pond is undergoing a restoration project that removed accumulated sediments and will re-introduce native plants to the littoral zone. Grab samples were collected from the inlet stream and outlet pipe on a monthly basis from January to November 2009. It was hypothesized that there would be differences in the nutrient concentrations, water temperature, and dissolved oxygen between the inlet and outlet. Water temperature, dissolved oxygen, pH, and turbidity were monitored with an YSI 85 Multimeter and HF Scientific

Turbidimeter. Nitrate, ammonium, and orthophosphate were measured using standard methods with a Thermo Orion Colorimeter. Calcium, potassium, sodium, magnesium, zinc, and iron concentrations were determined using Flame Atomic Absorption Spectroscopy. In addition, plankton samples were collected throughout the summer. The inlet and outlet orthophosphate and metals concentrations were extremely low throughout the study. There was a decrease in the nitrate levels from inlet to outlet, especially during the growing season. There were no significant differences in the ammonium levels from inlet to outlet, except during the months of February and April 2009. The biological samples reflect the water chemistry with low species diversity and abundance. It is hoped that the dredging and replanting will add some more diverse habitat to this oligotrophic system.

**Analysis of a horizontal subsurface flow constructed wetland system for wastewater treatment at Hundredfold Farm Cohousing Community in Orrtanna, PA**

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*Poster Presentation #21*

Natural wetlands provide an important ecological service by removing harmful pollutants from aquatic environments. Artificial wetlands, using natural biogeochemical processes, can serve as tertiary sewage treatment systems, removing additional nutrients from wastewater. Hundredfold Farm Cohousing community in Orrtanna, PA utilizes a horizontal subsurface-flow constructed wetland for tertiary treatment of wastewater from nine single-family homes. The treated effluent is recycled back to the homes for toilet flush water. Excess treated effluent is discharged through drip irrigation pipes to agricultural fields on the property. Recycling of wastewater, along with other conservation measures adopted by community members, has resulted in per capita water consumption 80% less than the national average. We analyzed wastewater sampled at different stages of the treatment process. Effluent levels of biochemical oxygen demand (CBOD), total suspended solids (TSS), and fecal coliform count (FCC) were well below the maximum levels allowed by PA DEP regulations and average removal efficiencies for CBOD (97.5%), TSS (98.9%), and FCC (>99.9%) meet or exceed those reported for similar systems. Higher than expected levels of nitrogen and phosphorus compounds in the treated effluent, however, indicate that further optimization of the system would be beneficial. The wastewater recycling system at Hundredfold Farm reduces human impact on the environment by lowering water consumption and limiting the contamination of groundwater.

**A comparison of sampling methods of crayfish in the Monocacy River, Maryland**

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*Poster Presentation #7*

Our study examined the relative efficiency of two methods of quantifying crayfish abundance. Our research focused on resource partitioning between invasive and native species of crayfish and required a sampling device that could quantify abundance in a variety of different habitats. We compared the kick-seine methodology used by the Maryland Department of Natural Resources in stream studies with a quadrat sampling technique. The kick seine was deployed by holding the seine net downstream, while two people rushed toward it from upstream and disturbed the substrate with their feet. The quadrat was deployed by placing the walled frame on the bottom of the stream and the substrate was dug out of the enclosed area. To compare abundance estimates we applied both sampling methods at the same time and immediately adjacent to each other at two sites on the Monocacy River (Frederick County, Maryland). Using the quadrat sampling method we collected a greater number of individuals per square meter (0.12 and 0.071 m<sup>-2</sup> for kick net, 2.50 and 4.28 m<sup>-2</sup> for quadrat) and a greater range of sizes (6-28 mm for seine and 3-38 mm for quadrat). The kick seine method also captured fewer species and tended to miss species that were less than 7% of the population. The kick seine method was easier to deploy and appeared useful for assessing presence or absence of dominant species. However, the quadrat sampling technique yielded much higher estimates of abundance on an areal basis, suggesting that kick seining greatly underestimates the abundance of crayfish.

**Restoration of normal stream functioning following wastewater treatment plant upgrades.**

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*Oral Presentation – Session III*

Owasco Lake, one of the Finger Lakes in New York, has had considerable water quality concerns in the past. Several recent studies highlighted the Groton Wastewater Treatment Plant (WWTP) as a major point-source contributor of pollutants into the Owasco inlet. A 2006 DEC consent order forced the plant to upgrade their facilities and reduce phosphorus discharges from 16 lbs/day to 2 lbs/day. To determine if this reduction restored normal stream functioning, we conducted a comprehensive study of inlet health by evaluating water quality, periphyton growth, and macroinvertebrate

community structure. Six sites were sampled twice in the fall of 2009. Sites isolated the effects of the WWTP and major tributaries to the inlet. Water samples were collected on both field dates and analyzed for total phosphorus, soluble reactive phosphorus, and nitrates. One macroinvertebrate survey was collected and samples were analyzed to family level. Periphyton tiles were installed for three weeks to measure benthic algal growth. It was found that nutrient levels downstream of the Groton WWTP were significantly lower than 2006 and 2007 levels (average soluble reactive phosphorus decreased from 78  $\mu\text{g/L}$  to 13  $\mu\text{g/L}$ ; average nitrates were reduced from 1.2  $\text{mg/L}$  to 0.3  $\text{mg/L}$ ). Periphyton ash-free dry mass increased downstream of the WWTP (8.6  $\text{g/m}^2$  upstream of the plant; 21.1  $\text{g/m}^2$  downstream). Macroinvertebrate community structure improved directly downstream of the WWTP (percent model affinity index of 0.43 before the upgrade, 0.58 following the upgrade). Combined, these parameters indicate that the health of the inlet improved significantly following the WWTP upgrades.

**Smut fungus infection and detection in the perennial grass *Andropogon virginicus***

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Poster Presentation #11

*Andropogon virginicus*, a dominant grass in mid-Atlantic old fields, can be attacked by the smut fungus *Sporisorium ellisii*. This pathogen causes systemic or partial infections, reduces/eliminates seed production, and increases mortality. Our ability to establish infections experimentally is crucial for further research on host resistance and the modes of transmission and infection. We collected 25 partially infected plants from a New Jersey population. These had some tillers infected, indicating susceptibility and providing a source of fungal inoculum (teliospores), and some uninfected tillers, providing a source of seeds matched to inoculum. We prepared four inoculum types: teliospores matched from the same plant as the target seed, mixed teliospores, mycelial cultures grown from single, matched teliospores, and mixed mycelial cultures. We applied each inoculum to four seeds, four seedlings, and four seed-grown adults per maternal plant, with controls. The inoculated adult plants flowered, at which point infection can be detected (sporulation in the grass spikelets), but we saw no infections for any inoculation type. We are monitoring plants inoculated at the seed and seedling stage until flowering. Since visual detection of infection must wait until flowering, we also are developing a molecular method of detection, which tests for the presence of *S. ellisii* DNA within the plant. We have developed primers that amplify *S. ellisii* DNA but not *A. virginicus* DNA, and have tested different plant tissues from field-collected infected plants. So far, in plants collected in both winter and summer, we have detected smut DNA only in root crown tissue.

### **Distribution of invasive crayfish in the Monocacy River, Maryland**

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*Poster Presentation #8*

Distribution patterns provide an important first step in assessing the expansion of invasive species in aquatic ecosystems. We surveyed crayfish in the Monocacy River to determine the distribution and abundance of *Orconectes rusticus*, *O. virilis*, and *O. obscurus*. *O. rusticus* is an invasive species discovered in the upper Monocacy in 2007 and has become the dominant species (97%) upriver from the Mumma Ford Road crossing (Appolds, MD). *O. virilis* is an invasive species that has been established in the Monocacy River for the past 30 years and is present throughout the Maryland portion of the Monocacy River. However, this species was only dominant (98%) from the Mumma Ford Road crossing downstream to approximately the Interstate 70 crossing (Frederick, MD). *O. obscurus* is native to the Monocacy River and can be found in the southern portion of the river coexisting with *O. virilis*. The native *O. obscurus* was the dominant species (77%) in the vicinity of Buckeystown, MD. We also found the native crayfish, *Cambarus bartonii*, in the Monocacy River near Buckeystown, MD. This species has previously been reported in the tributaries of the Monocacy River, but not in the main stem. The extent of the newly invasive *O. rusticus* species was approximately 2 km further downstream in 2009 than it was in 2008. This suggests that the species is slowly advancing downstream. It also appears that it is displacing *O. virilis* as it moves downstream.

### **Habitat preference and distribution of tropical butterflies in peat-swamp forest: Impacts of forest fragmentation on butterfly diversity**

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*Oral Presentation – Session II*

In tropical environments, species richness and distribution are largely influenced by the successional state of the forest. It is likely that the rapid destruction of Borneo's unique peat-swamp forest habitat correlates to a decrease in butterfly diversity. The study investigates the impacts of forest light gaps on populations of fruit-feeding butterflies in the Sabangau National Park, located in Central Kalimantan, Indonesia. Along with the assistance of researchers and volunteers from the Orangutan Tropical Peatland Project (OuTrop), fruit-baited traps were used to capture butterflies during a 3-month period in 2009, from June through September. A network of 34 traps at 17 sites was assembled in a grid, covering an area of 0.35 km<sup>2</sup>. All sites

had one low trap with an average height 1.67 m, and one high trap with an average height 8.27 m. Traps were checked regularly during the dry season. In this time, 445 capture events were recorded, including 378 individuals from 10 species. The low traps attracted a higher average number of species than the high traps, with averages of 5.47 and 3.41, respectively. The traps within shaded, intact forest resulted in an average of 4.90 species per trap, whereas the traps in the light gaps had an average of 3.78 species per trap, indicating that species diversity is lower in areas of higher forest disturbance. As tropical forest destruction continues, there is great importance in monitoring the effects on biodiversity and encouraging conservation efforts in these environments.

**The role of disturbance in controlling stand dynamics of high elevation pine ecosystems in northeastern West Virginia**

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*Poster Presentation #13*

Successful conservation of rare high elevation (>1200 m) pine-dominated ridges in northeastern WV depends on understanding the natural role of fire. We hypothesized that periodic fire is essential for regeneration and structures communities on hillsides and plateaus, but pines can persist without periodic fire on environmentally stressful cliffs and sphagnum bogs. We sampled forty-four 400-m<sup>2</sup> sites, paired on gradients from a cliff or bog to 100-200 m downslope or upslope, respectively. We measured tree diameters, extracted ~12 increment cores per site, estimated plant percent cover, counted pine seedlings <1 m tall, and recorded physical evidence of fire, including bark charring and soil charcoal. Fire evidence was found at 100% and 93% of plateau and hillslope sites, and at 89% and 43% of cliff and bog sites. Of 258 pitch pine seedlings encountered, 42% occurred on cliffs and 53% in bogs, indicating a lack of regeneration on plateaus and hillslopes and supporting our hypothesis. Cliff and bog sites were older on average than plateaus and hillslopes (90th percentile of tree age was 101 vs. 82 years), however this was not always true for individual site pairs. The standard deviation of tree age was not higher at cliff and bog sites where multigenerational stands were expected (28 years vs. 27 years at plateaus and hillslopes). Preliminary dendrochronological analysis of radial growth patterns shows an individualistic disturbance history for each site that does not consistently support our original prediction of even-aged stands on hillslopes and multigenerational stands on cliffs and bogs.

### **Temporal patterns in microbial communities associated with freshwater marsh sediments**

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*Oral Presentation – Session I*

Despite their importance, relatively little is known about how environmental parameters constrain the distribution of microorganisms in freshwater marshes. This study examined temporal changes in microbial communities in an emergent marsh (James River, Virginia), and sought to determine: (1) How do sediment microbial communities change during early marsh succession? and (2) To what extent do these changes correlate with environmental parameters (e.g., hydrology, plant community, moisture, pH, redox, and organic matter)? Plots were established in two distinct areas of the marsh and monitored for two years. Terminal Restriction Fragment Length Polymorphism (T-RFLP) DNA fingerprinting was used to separately profile the bacterial and archaeal portions of the microbial community. Soil parameters and the wetland vegetation showed strong seasonal patterns, and both types of data were correlated with successional changes in the soil microbial community. However, the nature of the relationships depended on sampling depth and site. For example, in the wetter areas, bacterial community composition was strongly correlated to changes in diversity of the above-ground vegetation. In contrast, the bacterial community at the dry site varied primarily in response to soil moisture and redox status. In the deepest soil profile, bacterial communities at both sites were correlated to changes in redox status and pH. Archaea exhibited greater diversity at depth and were correlated to soil moisture and redox status. This study reinforces the importance of understanding temporal patterns and environmental controls on microbial community structure and function, which are essential to preservation of overall ecosystem function in marsh habitats.

### **Scales of transition: Of edges and ecotones**

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*Oral Presentation – Session II*

The concept of 'edge' has long interested ecologists and edge quantification has been facilitated by the advent of GIS. However, considering edges only at the scale of plant communities (i.e., ecotones), which is the typical case, implies that 1) there are relatively few types of edge in a landscape and 2) individually, those edges are relatively extensive spatially. An alternate view contends that myriad edges of



numerous types are present at many scales, both between and frequently, within plant communities. Under this latter concept, an ecotone such as that between a forest and a hayfield represents but one general type of interface / boundary that itself contains multiple "edge types" recognized by various species or guilds of wildlife. Along this continuum, smaller animals use progressively more fine-grained edge types. Thus, edge-associated species may use ecotone-scale edges (e.g., red-tail hawk, white-tail deer), intermediately scaled edges (e.g., flycatchers = canopy-opening; song sparrow = shrub-grass) or much more localized subsets of edges (insects = edge between a leaf and adjacent air). At the small imagery (large geographic) scales typically employed in GIS analysis of habitat use (e.g., Landsat = 1:40,000), even intermediate scales of edge are completely unmeasurable. Furthermore, even with larger scales of imagery, GIS metrics (or researchers) frequently equate (i.e. lump together) all edge types or reduce specific edge types to "levels of contrast", with a concomitant apriori loss of information. The presentation will examine the consequences for model development of failing to match analytical scale with the scale at which species actually use habitat.

**Forest disturbance and recovery: The effects of gypsy moth (*Lymantria dispar* L.) defoliation on nitrogen, carbon, and hydrologic cycling in an oak-pine forest**

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*Oral Presentation – Session IV*

Climate change may result in range expansions of invasive insects, thus defoliation and subsequent tree mortality will likely have dramatic effects on forested landscapes. Invasive insects alter forest carbon (C), nitrogen (N), and hydrologic cycling by affecting leaf area and litterfall of high-N leaf fragments and frass during the growing season. We used biometric, eddy covariance, and N deposition measurements to characterize the rates of recovery of C, N, and hydrologic cycles following complete defoliation of an oak-pine stand by gypsy moth (*Lymantria dispar* L.) in the New Jersey Pine Barrens. Net ecosystem exchange of CO<sub>2</sub> (NEE) and evapotranspiration (ET) were directly related to leaf area (LAI). NEE was -246 g C m<sup>-2</sup> during defoliation in 2007 (LAI = 2.2) and recovered to +77 g C m<sup>-2</sup> in 2008 (LAI = 3.4) and +9 g C m<sup>-2</sup> in 2009 (LAI = 4.5). ET during the defoliated period was 92 mm compared to an average of 193 mm in previous years (2003-2006), suggesting a two-fold increase in drainage water. Nitrogen flux to the forest floor during defoliation

was 29 kg N ha<sup>-1</sup> which increased annual litterfall N flux by 58%. Following defoliation, canopy oak mortality totaled 14.5% of stems and 25% of basal area. Large canopy gaps led to increased understory LAI, and total LAI recovered to 97% of pre-defoliation values by 2009. N mass in foliage was slower to recover and reached only 60% of pre-defoliation levels within one year. Although the ultimate cause of canopy oak mortality is unknown, our results indicate a possible link between N stress and mortality in defoliated stands.

**Woody plant colonization of a reclaimed anthracite surface mine in northeastern Pennsylvania**

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*Poster Presentation #15*

Woody plant colonization was examined within an anthracite surface mine located 10 km southwest of Wilkes-Barre reclaimed in the late 1990s following SMCRA guidelines. Initial investigations conducted in 2003 revealed high density of grasses and legumes planted at the site inhibited colonization by woody species, especially of woody species common to mature forests in the region. However immature black locust (*Robinia pseudoacacia*) ramets were commonly found in the study plots. In the six years following that analysis, the black locust became a dominant woody species, suggesting a conversion from a meadow to developing woodland. To determine whether black locust is facilitating the colonization of later successional hardwood trees onto the reclaimed area, the site was examined in summer and fall 2009. All plots contained high densities (85%) of cool-season grasses, legumes, and other broadleaf herbs. Black locust trees growing to 15-20' tall were found in 75% of the plots. Plots also included non-native trees introduced during community planting projects in the past five years. No native tree species typical of regional mature forests were noted in any of the plots, however, even as juveniles under black locust canopy. Nor was any colonization by natives seen at the edge of the mine adjoining a mature forest. These results suggest that while the site is shifting from meadow to forest, it does not appear to be on a trajectory leading to a species composition typical of regional forests. Thus, introduction of such species may be needed, following the Forest Reclamation Approach (FRA).

**Goals and objectives in preventing overbrowse and invasive collapse of Mid-Atlantic forest habitats: What to detect and measure for effective action**

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*Oral Presentation – Session II*

A challenge in conservation biology is what to measure and when, in managing the twin threats of deer damage and exotic invasive plants in Mid-Atlantic forests. Recent changes in hunting laws for parks and conservancy lands in Maryland and other states make it possible to conserve forests with their plants and animals before irretrievable damage. This presentation first outlines photographic and quantitative evidence of forest habitat damage at Jug Bay Wetland Sanctuary in Maryland, and notes crop losses at adjacent farms. Next are results of the first brief management hunt. Then I present goals and plausible measurable objectives to save this forest community. I outline 15 plausible measures of vegetation change, based on 6 published studies. I also outline 11 low effort deer detection methods. This illustrates general problems: there are more measurable aspects than time and funds to measure in deciduous forest communities, and most vegetation objectives have slow response times. The question is how to allocate effort to (1) detect and measure vegetation change beyond obvious checks for oak regeneration and spread of invasive plants favored by deer, and (2) detect and remove deer that re-enter a park in winter, its most vulnerable time, after the last scheduled hunt days. Reason: in a severely browse-depleted forest, a few more herbivores each taking several pounds of browse daily could make recovery tenuous. What we choose to detect and when, can shape outcomes of conservation action or inaction. What biodiversity will survive? I invite comments.

**Which to use: NWI Maps or Corps of Engineers Wetlands Delineation Manual?**

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*Poster Presentation #20*

Two methods, National Wetlands Inventory Maps (NWI) and the Army Corps of Engineers Wetlands Delineation Manual (ACOE) are used to delineate wetlands. The U.S. Fish and Wildlife Service (USFWS) rely on remote sensing technology to

create wetland maps in the NWI. This study compared the results of the two wetland delineation methods on 473 study sites. Of the 473 study sites, 252 sites (53.2%) are classified as wetlands on the NWI map; the remaining 221 sites (46.7%) were not classified as wetlands. ACOE wetland delineation manual utilizes field indicators to assess hydrology, soil, and vegetation status; an area is determined as wetlands when observed with all three indicators present. Wetland hydrology and vegetation status of the 473 study sites were observed and recorded in the summers of 2005 and 2006 using the ACOE field delineation method. Evaluation of wetland soil was determined using the Natural Resources Conservation Service soil maps and the New York State Hydric Soils List. 187 of the 473 sites, 39.5%, were observed to have all three wetland indicators present; 286 sites, 60.5%, were found to have at least one indicator missing. 52.4% (248/473) of the interpretations were consistent: 22.6% (107/473) were determined as wetlands and 29.8% (141/473) as uplands by both methods. 30.7% (145/473) are listed as wetlands on the NWI maps but as uplands by ACOE; 16.9% (80/473) are listed as non-wetlands on the NWI but as wetlands by ACOE. The high percentage discrepancy, 47.6% (225/473), exemplifies the margin of error between the two methods.

**The relationship between white-tailed deer impact and native and non-native plant species composition in five suburban/exurban forests**

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*Poster Presentation #16*

Many ecologists think that invasive plant species in eastern forests suffer little herbivory from overabundant white-tailed deer compared to resident natives, thus promoting invasion; logically, higher browse pressure on the native population should provide stronger advantages to the non-natives. We tested this hypothesis in five suburban/exurban forests in New Jersey. We assessed deer impact on the native plant community by measuring native foliage cover and deer browse on native woody species in the understory, and then assessing species richness of both native and non-native species in 40 4-m<sup>2</sup> plots per forest. On average, native species outnumbered non-native species in these forests by about a 13:1 ratio. Surprisingly, we found correlations opposite to what we initially hypothesized for non-natives. In more heavily impacted forests, there were lower means of species richness per plot for both natives and non-natives, and lower mean percentage of non-native species per plot. These results suggest that, in severely impacted forests, deer may be browsing on both natives and non-natives, depressing numbers of all species types. In forests where deer pressure is reduced by deer management or was historically lower, both natives and non-natives appear to improve recruitment and/or survival. Deer may, in fact, be keeping non-native species richness in check; therefore, a native species restoration

program using deer control would also require non-native removals. An extension of this research will be to measure browse directly on non-natives and examine the relationship between deer impact and the abundance of each native and non-native species.

**Preliminary analysis of microsatellite DNA diversity of *Orconectes rusticus* in the Monocacy River**

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Poster Presentation #9

*Orconectes rusticus*, commonly known as the rusty crayfish, is a non-native invasive crayfish species in the Monocacy River. *O. rusticus* is native to the Ohio River watershed. This species was first discovered in the Monocacy River in 2007, but it has more recently invaded Antietam Creek and the area north of the Susquehanna Flats. Rusty crayfish have already invaded 14 other states and caused devastation to their aquatic ecosystems by destroying local vegetation and competing with native crayfish for resources. There is concern that *O. rusticus* could travel down the Susquehanna River to the Chesapeake Bay. Our study aimed to begin genetically characterizing the distribution of this invasive species in order to enhance survey and management efforts. Rusty crayfish were collected from their most northern and southern extent of the Monocacy River from two different locations in 2007 and 2008. Four microsatellite DNA loci were used to determine genetic diversity between the two sample groups. Preliminary analysis of these microsatellite loci suggests that there is little genotypic differentiation between the 2007 and 2008 sample groups. Our preliminary analysis also suggests that there is little genetic differentiation between rusty crayfish samples from their northern and southernmost points in the Monocacy River. We hope that our genetic assessment will help in characterizing the distribution of this species, understanding its levels of genetic variation, and ultimately determining how many introduction events might have led to the establishment of *O. rusticus* in the Monocacy River.

**Genetic analysis of the smut fungus *Sporisorium ellisii* using direct polymerase chain reaction (PCR)**

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*Oral Presentation – Session I*

To understand the interaction between a fungal plant pathogen and its host plant population, it is necessary to have genetic information for both populations, but little work has been done to characterize the population genetics of wild plant pathogens. We seek to develop and use an efficient method for acquiring molecular population genetic data from fungal pathogens. Specifically, we are interested in fungal genetic diversity within hosts, among hosts, and among populations of *Sporisorium ellisii*, a smut fungus in the Basidiomycete family. This fungus causes systemic infection, decreased fecundity, and increased mortality in its host plant, the perennial bunchgrass *Andropogon virginicus*. Our goal was to design a more efficient method of obtaining genetic data from fungal spores. Individual fungal spores within a plant may have different genotypes, thus necessitating the culturing of single spore races for genetic work, but these cultures take weeks to grow and often have high contamination rates. We have developed a technique of performing polymerase chain reaction (PCR) directly on germinated teliospores of *S. ellisii*, without first extracting DNA from cultures. Using this technique with inter-transcribed sequence (ITS) markers from ribosomal genes, we have shown that DNA bands can be produced on a gel, extracted and sequenced for genotype. While three spores per PCR reaction showed a higher success rate (80%), sequenceable DNA was also produced from single spores (50% success rate). We are currently optimizing our method for use with highly variable inter-simple-sequence-repeat (ISSR) markers.

**Microarthropods as bioindicators of grazing management in Appalachian pasture systems**

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Poster Presentation #23

Grassland and pasture-based livestock production accounts for approximately one-quarter of the land use and the majority of the agricultural acreage of the Appalachian region. Developing sustainable nutrient management practices requires simple, intuitive, and repeatable indicators of soil function response to management. Microarthropods are closely associated with soil nutrient cycles and may be particularly responsive indicators for forage and grazing management. This study applies Indicator Species Analysis (ISA) to determine bioindicator taxa and evaluate their response to pasture management and seasonality. Samples were collected every three months during grazing trials in 2005 and 2006 on a USDA-ARS experimental farm located in Raleigh County, WV. Forage treatments consisted of three replicates of *Medicago sativa*, *Trifolium pretense*, and *Dactylis glomerata*. Abundance, richness, and diversity all differed significantly as a function of forage species and season ( $p < 0.001$  for all); interactions between species and season were not significant. Averaged across the two year sampling period, abundance, species richness and diversity were all significantly lower in grazed versus ungrazed soils. Restricting ordination to significant indicator morphotaxa reduced the dimensionality of the community data matrix while only slightly decreasing the efficiency of unsupervised classification. ISA appears to overcome many of the limitations associated with parametric and multivariate approaches for identifying indicator species and has the potential to greatly reduce the taxonomic expertise and labor costs associated with sorting and identification of soil microarthropods.

**Suburban white-tailed deer: Spatial and temporal pattern of land use.**

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*Oral Presentation – Session II*

We monitored the movement of seventeen individual white-tailed deer (*Odocoileus virginianus*) in a land preserve adjacent to suburban Bryn Athyn College. The preserve is managed by the Pennypack Ecological Restoration Trust (PERT), which is a private, non-profit conservancy located ~25 km (15 miles) northeast of Philadelphia. PERT manages 3.1 km<sup>2</sup> (771 acres) of mature forests, regenerating woodlands, riparian forests, and fields of cool and warm season grasses in the Pennypack Creek valley, and is open to the public from dawn to dusk. Deer were fitted with GPS/GSM radio-collars that transmitted data at 5 minute interval fixes for 3 to 6 months. Some collars were programmed with occasional lower frequency periods. We collected over 200,900 GPS fixes from the monitored deer and calculated deer daily minimum convex polygons and trajectories. Deer movements were analyzed with respect to age of deer, vegetation type, land ownership, habitat parcel size, and public visitation. The study area was divided into two categories based on human accessibility: open access and restricted access. Daily movement patterns demonstrated two peaks of activity that alternated with periods of relative quiescence. Peaks of activity represent deer movement between daytime and nighttime habitats. In the daytime the monitored deer showed a lower preference for open access habitat than at night. Deer with the highest social rank (related to age and size) avoid open access land, whereas individuals with lower social rank are exposed to humans to a greater extent. Our results suggest that human accessibility affects deer use of habitats.



**When white-tailed deer cross roads: A case study at the Pennypack Ecological Restoration Trust.**

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*Poster Presentation #18*

We monitored the movement of seventeen individual white-tailed deer (*Odocoileus virginianus*) in a land preserve adjacent to suburban Bryn Athyn College. The preserve is managed by the Pennypack Ecological Restoration Trust (PERT), which is a private, non-profit conservancy located about 25 km (15 miles) northeast of central Philadelphia. PERT manages 3.1 km<sup>2</sup> (771 acres) of mature forests, regenerating woodlands, riparian forests, and fields of cool and warm season grasses in the Pennypack Creek valley. The preserve is open to the public from dawn to dusk and PERT allows controlled deer hunts during the state-sanctioned hunting season. Deer were fitted with GPS/GSM radio-collars, which transmitted spatial and temporal data at 5-minute interval fixes for a period of 3 to 6 months. Some collars were programmed to send 5-minute interval fixes continuously, while some alternated with low frequency time periods. We collected over 200,900 GPS fixes from the monitored deer and constructed trajectories for all individual instrumented deer. Within ArcGIS® we calculated intersects of deer tracks with public roads and analyzed the time of each crossing. The time of road crossings is most probable during the morning and evening hours when the deer are most active. There are some portions of the roads that the deer cross more frequently. However, the deer tend not to repeat the same crossing places.

**Examining microbial communities and their responses to saturation and vegetation in an emerging freshwater wetland.**

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*Oral Presentation – Session I*

Wetlands are often regarded as expendable ecosystems; however, the functional biology of these habitats is complex. Of particular importance is the relationship that exists between wetland hydrology, vegetation, and the soil microbial community. To examine these interactions, plots were established in three hydrologically-distinct regimes (wet, intermediate, and dry) within a non-tidal freshwater wetland along the

James River (Virginia). Inside each main plot, ten subplots were cleared of all aboveground plant material; five plots were left to re-grow ("vegetated"), while the remaining five were weeded each week to maintain bare soil ("non-vegetated"). Manipulations started in April and continued until the following winter. Soil cores (30 cm) were collected in eight-week intervals, divided into two depth increments, and analyzed for soil properties (e.g., pH, OM, C:N, redox), bacterial community structure (16S-rDNA-based T-RFLP), and extracellular enzyme activity. Thus far, each of the hydrological regimes exhibit unique physio-chemical properties and plant species composition. Enzyme activity was similar between dry and wet sites, while responses in the intermediate correlated to slight changes in saturation. Within a given hydrological regime, depth was not a significant factor, and only small differences have been characterized between treatment plots. Drastic differences between the three hydrology conditions indicate saturation is a significant variable in soil development in an emerging wetland, while physical and functional responses to vegetation are slower to develop. In older marshes, the environmental feedbacks are likely quite different, and the influence of vegetation and plant diversity may have a greater impact on microbial diversity and thus ecosystem function.

#### **Integrity of eggs from aquatic organisms**

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*Poster Presentation #2*

Eggs from horseshoe crabs, whitefish, salmon and salamanders were used to study cellular process such as osmosis in order to understand the integrity of the egg in relationship to the organism's ecology. For this study, horseshoe crab eggs were obtained from Pickering Beach on Delaware Bay in June, 2009 during the spawning season and then frozen. Salmon and whitefish eggs were obtained from a specialty deli and salamander eggs were purchased from Carolina Biological Supply Company. The eggs were weighed before placing them in water or various salt and sugar solutions, and weighed again after. The eggs gained or lost weight depending on the solution in which they were placed. Visible differences in appearance were noted. The eggs were photographed under a dissection scope using a Motic camera. The horseshoe crab eggs displayed the most resistance to environmental change, which perhaps reflected the fact that they receive the most abrasion through sand and wave action. There appears to be a relationship between degree of change in egg weight and

appearance when placed in various solutions and the ecology of the organisms that produced the egg.

**Growth of three different plant species in soilless medium**

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*Poster Presentation #24*

The purpose of this project was to determine the best method in which to germinate and grow catnip, alfalfa, and grass seeds in a water-absorbing crystal medium. Our goal was to determine how important soil is for plant growth. In the first and third experiments, the three seed types were grown in plastic containers that were subdivided into three independent sections. The three seed types were grown in different environments: sand only, sand only covered with Saran wrap, crystals only, crystals only covered with Saran wrap, sand with crystals, and sand with crystals covered with Saran wrap. In the second and fourth experiments, only bleach treated catnip was grown in the plastic containers with crystals only. Saran wrap was used to cover some of the containers to test whether another difference in germination and growth would occur. In all four experiments, germinating seeds and growing plants in the crystals-only medium proved to be the least successful approach. Plants were more successful germinating and growing in either sand only or a combination of sand and crystals. For all seed types regardless of the growth medium, germination of the seeds was generally better when the containers were covered with Saran wrap, but survival of the plants was better without the covering. Across all treatments, catnip grew the worst and grass grew the best. Alfalfa fared reasonably well.

**Influences of a popular landscaping plant on native woodland salamanders.**

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*Oral Presentation – Session II*

A major conservation concern in urban environment is the spread of nonnative species. The spread of nonnative predators, competitors, and diseases is a significant threat to many amphibians. However, few studies have investigated the effects of nonnative plants on native amphibian populations. I assessed the effects of invasive English Ivy (*Hedera helix*), a common North American landscaping alien plant, on the Eastern Red-backed Salamander (*Plethodon cinereus*) in remnant woodlots in urbanized

environment of Baltimore, Maryland. I found that the Eastern Red-backed Salamanders were absent from rocks or fallen logs covered by English Ivy. Our results suggest that the spread of English Ivy can reduce the amount of available habitats for the Eastern Red-backed Salamander and can cause their decline in remnant habitats of urban areas. My ongoing study investigate the mechanisms leading to the trend found in my preliminary study.

**Population study of freshwater turtles on a Pennsylvania college campus: The effects of suburban habitat on population structure**

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*Poster Presentation #4*

The population composition of freshwater turtles has been of interest as researchers are finding skewed age and gender ratios. Degradation and loss of habitat, high predator numbers, and roads commonly found in suburban areas may be causing male-skewed populations. In addition, unsuitable nesting habitat in these areas may be causing adult-skewed populations with low recruitment. To determine if the freshwater turtle population in Elizabethtown, Pennsylvania, is skewed, we conducted a mark-recapture study of painted turtles (*Chrysemys picta*) and snapping turtles (*Chelydra serpentina*) in three ponds at Elizabethtown College during the fall of 2009. The population of painted turtles caught demonstrated a male-skewed (25 adult male: 13 adult female) and adult-skewed (34 adults: 4 sub-adults/juveniles) population. The snapping turtle population was also adult-skewed (9 adults: 2 sub-adults). These results provide reasonable doubt for the long-term persistence of the freshwater turtle population at Elizabethtown College, as well for other populations currently residing in suburban landscapes.

**Wastewater effluent reduces P buffering capacity of receiving streams**

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*Oral Presentation – Session IV*

Nutrient pollution, including phosphorus (P) pollution, is a primary concern in the Chesapeake Bay watershed. As point sources of pollution are already regulated, state and federal governments have focused primarily on reducing non-point sources of nutrients. However, point sources, like wastewater treatment plants, may still have significant impacts at the local scale. The objective of this study was to determine to

what degree wastewater effluent affects the P cycle of the receiving stream. Water and sediment samples were collected just upstream and 50 m downstream of three wastewater effluent discharges in Tom's Creek watershed on three dates in 2008-09. In addition a longitudinal series of samples were collected on a single date downstream of two of the discharges. Dissolved reactive P concentration in stream water was as much as 75 times higher downstream compared to upstream. The sediment P concentration and equilibrium P concentration ( $EPC_0$ ) were both significantly greater downstream compared to upstream of the discharge at all sites on all dates. Furthermore, the P buffering capacity,  $k$ , was significantly lower downstream at all sites on all dates. Longitudinal sampling showed that the effects on  $EPC_0$  and  $k$  extended as far as 2.5 km downstream of the effluent discharge. Wastewater effluent drastically alters P nutrient dynamics in substantial sections of receiving streams which has implications for productivity and P transport further downstream.

### **Functional diversity of *Platanthera* orchid mycorrhizas**

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*Oral Presentation – Session I*

Terrestrial orchids are dependent on mycorrhizal fungi during their lifecycle. Therefore successful orchid conservation requires an understanding the diversity and specificity of associating fungi. Further, understanding the functional ecology of mycorrhizas is important for maintaining these essential interactions in the face of environmental change. This study investigated the diversity and specificity of mycorrhizal fungi associated with the terrestrial orchid genus *Platanthera*, and the functional diversity of selected fungi based on the production of enzymes related to nutrient cycling. Fungi were isolated from 15 *Platanthera* species in 34 populations in eastern North America. Sequencing of two DNA regions revealed that *Platanthera* associates with diverse soil fungi, including known orchid mycorrhizas, ectomycorrhizas and ascomycete fungi. While the majority of fungal isolates were identified as orchid mycorrhizal fungi in the form genus *Tulasnella*, the broad diversity of fungal associations in *Platanthera* contrasts with most terrestrial orchids which associate with narrow fungal clades. Two hybrid taxa associated with fungi that were also identified in their parent species; however, one hybrid also associated with a novel fungus. Fungal enzyme activity was investigated colorimetrically based on enzymes that decompose organic substrates to release C, N and P. Enzyme activity was not related to genetic similarity of fungi or associated orchid species, suggesting that environmental conditions may be more influential than phylogenetic relationships. Some fungi consistently showed activity of all enzymes, while others remained inactive. This research provides novel information about the functional

diversity of orchid mycorrhizal fungi and how they provide nutrients that orchids need for germination and survival.

**Developing podcast trail guides: Using technology to merge community-based learning with public ecology education**

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*Poster Presentation #14*

The development and maturation of new technologies can improve the public's understanding of natural history and ecology. Podcasting is an especially promising technology because it affords users with on-demand access to rich content about a wide range of topics. Well-conceived podcasting programs are being developed for museums and nature centers to augment docent-based and paper guides. The same principle can be employed along hiking trails, where podcast episodes can be developed around marked stations. Podcasting programs that involve undergraduate students can have an added benefit through opportunities for community-based learning. For the past four years, faculty and students at Wilkes University in Wilkes-Barre, PA have engaged in a Podcast Trail Guide initiative. Students created podcast series for three selected trails in northeastern Pennsylvania. Each series consists of image-enhanced podcast episodes developed using GarageBand software for the Macintosh OS. The number of episodes per series varies from 12 to 37. Each episode lasts 45 - 100 seconds, and is linked to a marked location along the selected trail. The Podcasts are available to the public for free via Wilkes University's iTunesU website (<http://itunes.wilkes.edu>). The Podcast Trail Guide project has been reported in local and regional media outlets, and has generated considerable interest among trail enthusiasts and educators. Since the technology is widely available and easy to use, it is adaptable to hiking trails nationwide, and beyond. We seek to develop a collaborative of podcast trail guide creators, and welcome partners.

**Disease ecology in complex landscape mosaics: Song sparrows and their hematozoan parasites**

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*Oral Presentation – Session II*

Humans turn natural landscapes into complex mosaics, which include agriculture, urban, developing, and natural remnants as land cover. Population responses to these landscapes are just as varied. Consequently, interactions between organisms are likely to be altered including parasite-host interactions. Here, we investigate the relationship between song sparrows (*Melospiza melodia*) and several hematozoan parasites in a complex landscape. Fifty-four sparrows were captured in various habitats from urban centers to relatively rural sites. From each bird, a blood smear was made and examined for 15 minutes (30 minutes total) by two observers noting presence/absence of hematozoans. Capture sites served as centers of circular buffers from which we extracted the proportion of urban and forest cover. Buffers had diameters of 90, 210 and 990 m around each point. We created a number of logistic models with presence/absence as the response variable and arcsine-square-root transformed landscape variables as the explanatory variables. Using Akaike Information Criterion (AIC) to rank models, the top model included percent forest cover in 90 m buffers and percent urban in 210 m buffers. These results suggest local effects drive parasitism rates, even in the context of highly contrasting environments.

**Amphibian use of agricultural streams**

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*Poster Presentation #5*

Amphibian populations are declining worldwide. Agriculture is a leading cause of this decline due to habitat conversion and resulting alteration of stream characteristics. Streams in agricultural settings in the northeastern United States often consist of a single, deeply incised channel, surrounded by steep banks, comprised of fine-grained sediments that rapidly erode. These stream characteristics may not be suitable to amphibians. Our goals were to document amphibian use of agricultural streams and determine which variables influence that use. We sampled eight streams in the Mill Watershed of Lancaster County, PA for the presence of amphibians and

took measurements of physical stream variables (channel morphology, water conditions, and vegetation), biological stream variables (macroinvertebrates), and surrounding landscape characteristics. Based on macroinvertebrate surveys, all of the sampled streams had poor water quality. We found larval *Eurycea longicauda* (long-tailed salamanders) in five streams and *E. bislineata* (northern two-lined salamanders) in two streams. None of the measured variables were statistically significantly related to salamander presence. When salamanders were present in a stream, we found substrate size to be a likely factor affecting their distribution along the channel bed. Salamanders preferred larger substrate sizes, with larger interstitial spaces. This preference is likely due to foraging and predator avoidance behavior. Salamander populations do exist in a subset of impaired agricultural streams but we have not yet identified associated stream and landscape variables. This research is a step towards better understanding amphibian ecology and conservation in agricultural systems.

### **The effect of habitat disturbance on common Lepidoptera in the New Jersey Pinelands**

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*Poster Presentation #1*

Anthropogenic impacts have been implicated in the worldwide decline of lepidopteran species; however, little research has been conducted on the effects that human activities are having on common species. We report the preliminary results (2008-2009) for an ongoing study conducted at the Warren Grove Gunnery Range (WGR) on the impact of military habitat disturbance on the local populations of common Lepidoptera. The WGR supports a mosaic of New Jersey Pinelands habitats. Baseline data on species composition, habitat use, and abundance will be important for detecting shifts in population trends and developing conservation strategies for species that are in decline. We conducted timed searches (sensu Pollard Walks) and calculated species-encounter-rate (SER = #species/minute) and individual-encounter-rate (IER = #individuals/minute) along permanent transects to compare differences between disturbed and undisturbed habitats. Disturbed dry-grassland habitat within the target zone had the highest SER (0.071/min), followed by naturally disturbed pitch pine-lowland habitat (0.061/min) last burned in 2004, Atlantic-white cedar bog (SER = 0.050/min), and recently restored pitch pine habitat (SER = 0.025/min). Atlantic-white cedar bog had the greatest IER (0.553/min), followed by dry-grassland habitat (0.532/min), disturbed pitch pine-lowland habitat (0.229/min), and restored pitch pine forest (0.082/min). Atlantic-white cedar bog (n=10) supported the greatest number of unique species, followed by dry grassland (n=8), pitch pine-lowland (n=7), and restored pitch pine forest (n=1) habitats. These results demonstrate that a patchwork of



habitats with different disturbance regimes provides resources for common as well as more unique species.

**Impact of solar radiation on the infectivity of *Cryptosporidium parvum* oocysts associated with environmental biofilms**

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*Oral Presentation – Session I*

*Cryptosporidium parvum* infection can be fatal for immunocompromised people. Previous work has shown that ultraviolet (UV) disinfection inactivates oocysts in water supplies, and solar radiation reduces oocyst infectivity in the environment. We hypothesized that biofilms may provide a protective barrier against oocyst exposure to UV radiation. Natural microbial assemblages from a Pennsylvania stream were used to grow biofilms in laboratory microcosms; biofilms were inoculated with oocysts and exposed to solar radiation in a temperature-controlled water bath. Oocyst permeability was determined with DAPI/PI, and oocyst infectivity was determined using in-vitro cell culture. Biofilm attachment was protective: less than 1% of solar UV radiation (compared to 82% of longer wavelengths) passed through the biofilm. The infectivity of oocysts attached at the biofilm surface (20%) was less than that of oocysts attached at the base of a 32- $\mu$ m biofilm (39%) and not significantly different than the infectivity of oocysts suspended in water (19%). Sloughed oocysts were less permeable, and subsequently more infectious (35%), than oocysts which had never been associated with a biofilm (19%). Disinfection efficacy for biofilm-associated oocysts is important because most oocysts will associate with potentially protective biofilm and/or fecal material at some point in the life cycle.

**Assessing genetic variation in the grass *Andropogon virginicus***

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*Poster Presentation #10*

*Andropogon virginicus* is an indigenous grass of eastern North America that plays a significant role during succession in old fields throughout the mid-Atlantic

region. It is introduced in California, where it is naturalizing in hydric soils of the Central Valley, and in Hawaii where it ranks as a serious invasive species. About 50% of native populations are infected with a smut fungus pathogen, but this disease is absent in the introduced ranges. We seek to characterize the population genetic structure of this grass in the context of its invasion and disease ecology, so we are optimizing the use of highly variable ISSR (inter simple-sequence-repeat) molecular markers for use with *A. virginicus*. To date, no molecular markers have been developed for use in this important species. We selected a group of 18 ISSRs to screen, based on their published use in related grasses. We experimented with different PCR (polymerase chain reaction) conditions to try and produce clear, repeatable, DNA bands that exhibit polymorphism among plants that we collected from a population in Tyler State Park, PA. We experiment with different combinations of PCR annealing temperatures (45 - 50°C) and particular ISSRs, with PCR products run through 1.5% agarose gels. Of the initial 12 ISSRs tested thus far, four show repeatable, polymorphic bands. We aim eventually to use an expanded set of ISSR markers to compare the level of genetic variation among infected and uninfected native populations, and between native, naturalizing, and invasive populations.