1. Impact of host plant species on larval success of *Epimecis hortaria*

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The larvae of many Lepidoptera are oligophagous or polyphagous, with spatial and/or temporal variation in host plant food sources. We are interested in the impact of host plant diet on larval fitness for the polyphagous larvae of the Geometrid moth *Epimecis hortaria*. These larvae are found on multiple host plants, including *Liriodendron tulipifera*, *Asimina triloba*, *Sassafras albidum*, and *Lindera benzoin*. We collected larvae of *E. hortaria* at Alapocas Run State Park in DE from the common understory shrub *L. benzoin*, and the common small tree *A. triloba*. Offspring of wild-caught larvae were raised in the laboratory and fed a single host plant diet (*A. triloba*, *S. albidum* or *L. benzoin*) until pupation. Larval weights were recorded every 2 to 3 days until pupation. Initial pupal weight, emerging moth weight and moth sex were also recorded. Larvae raised on *A. triloba* grew more slowly than larvae raised on *S. albidum* or *L. benzoin* and took significantly longer to pupate ($P<0.001$). This resulted in higher maximum larval weights for larvae fed *A. triloba* than for larvae fed *S. albidum* ($P=0.019$). However, weight loss during pupation was greater in larvae raised on *A. triloba* ($P<0.001$), transforming the larvae with the highest larval weights into the pupae with the lowest pupal weights ($P=0.019$). Pupal weights were positively correlated with moth weights at emergence ($P<0.001$), suggesting an effect of host plant on adult moth fitness. In ongoing studies, larvae reared on individual host plant diets are subjected to host plant food choice assays.

2. Reef accessibility and fishing: Analyzing the impacts of artisanal fishing on the fish diversity of Tanzania's coral reefs

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Artisanal fishing practices are known to negatively affect the health of coral reef ecosystems worldwide. Along the coastline of East Africa, many coral reefs are within relatively close proximity to the shore, providing easier accessibility for fishermen. Fish diversity was studied in two Indian Ocean reef communities off of Tanzania. One reef was located four hundred meters from the Ushongo fishing village, and the second reef was located six kilometers from Ushongo, near Fungu-Zinga Island. The reefs were non-randomly surveyed during the month of November, 2010. Plots of $100m^2$ were setup at various locations throughout the reef, best representative of the overall coral reef composition. Throughout the duration of the project, 25 plots were sampled, covering 10% of the Fungu-Zinga reef and 50% of the Ushongo Village reef, and recording a total of 2622 individuals from 154 species. Results indicate that species richness is significantly higher ($P<0.001$) in Fungu-Zinga's reef than in the Ushongo reef, where Fungu-Zinga recorded 119 species (89 unique), Ushongo recorded 65 species (35 unique), and 30 species were present in both sites. Simpson's index of diversity was used to calculate reef diversity at the Fungu-Zinga and Ushongo reefs, where values equal 0.83 and 0.67, respectively. The lower richness and diversity in the Ushongo reef suggest that its reef ecosystem is incapable of sustaining the niche diversity present at Fungu-Zinga, indicating poorer reef health at the more accessible Ushongo reef.

3. Urban green spaces: traps or havens for migratory birds?

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We aim at understanding the role that small, scattered patches of vegetation within urban spaces have in bird migration. The presence of suitable habitats within an urban matrix can be critical for the survival of many migratory birds. It is possible that potential urban stopovers are been overlooked because of their small size. Therefore, the study is focused on a 520 m² wooded plot in Newark, NJ (Rutgers Campus). We investigate habitat selection and stopover duration in addition to birds' weight condition. During fall 2010, 630 passerines were banded and measurements of body conditions were obtained. Nets were deployed almost daily from September to mid November and recaptured birds were re-weighed and their fat deposits assessed. Four species yielded 69 recaptures which corresponds to a recapture rate of 26% (10-47%). The average stay on the site was 2-8 days. These results might indicate that the urban habitat patch indeed acted as stopover site. Analysis of body mass indicates contrasting stopover strategies amongst the four species. Short range migrants such as Hermit Thrush and Swamp Sparrow gained in body weight during the first days after presumed arrival and longer staying individuals remained weight constant. On the contrary, Ovenbird, a relatively long-range migrant, showed a decrease in body weight soon after arrival. Long-staying Ovenbirds remained weight constant. Finally, overwintering White-throated Sparrows, increased in weight after more than 5 days from initial recapture. These findings suggest that overwintering and short-range migrants appear to benefit from isolated urban stopovers while long-range migrants might not.

4. The relationship forest cover and topography through time at Mount Vernon.

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While basic concepts of forest succession are well understood, their application meets with varied success, depending on the geography and history of the forest in question. This study attempts to discover what factors have driven successional processes in the forests surrounding George Washington's estate at Mount Vernon, a tract of land along the Potomac River with a primarily agricultural land use history. Using GIS software, historic maps showing forest cover, land use, and boundaries were georeferenced and overlaid to create a measurable, graphic representation of forest cover from the early nineteenth century to present day. The average RMS error of the eleven historic maps which were georeferenced is 40.334 (meters). In conjunction with these historical maps and satellite digital elevation models (DEMs) showing topography, the study examines the relationship between historic and present day forest cover and slope. Using slope values determined from DEMs, the distribution of slopes underneath forested cover are compared with the range of observed slopes across the entire property for the entire 200 year time range. Additionally, the use of digital elevation models allows historic maps to be rendered in three dimensions, providing a unique perspective of the landscape as it once was. These rendered perspectives are compared with the earliest known oblique photographs of the property, dating from the 1910s.

5. Micro-scale measurement of metal distribution in plant roots and sediments in rhizosphere.

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Liberty State Park, NJ, is a part of NJ urban estuarine- coastal system that has been severely degraded due to anthropogenic activities. Heavy metals are released into the coastal area from municipal wastewater and solids. Toxic metals (As, Cr, Pb, Zn and V) showed high concentrations in this area. The vegetation growing in this area showed ability to uptake and storage heavy metal in root, leaf and stem. This could be considered as a potential remediation tool for coastal brownfield remediation. The new knowledge in understanding the micro-scale reaction mechanisms and approaches for coastal ecosystem preservation and pollution prevention should be developed in order to accommodate the sustainable coastal development. The goal of this study is to investigate spatial distribution of metals in dominant wetland plants through the micro-scale measurements using synchrotron facility in the National Synchrotron Light Source at the Brookhaven National Laboratory. The results demonstrate that synchrotron radiation measurement is innovative for micrometer scale analysis to measure metal distributions in the plants and sediments.

6. Estimating biomass of down woody materials for U.S. forests from FIA data.

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Biomass estimates of coarse and fine woody detritus (CWD and FWD) duff and litter (Mg/ha) were compiled for 12,025 plots and linked to corresponding data from the nationwide Forest Inventory and Analysis (FIA) data for aboveground biomass and forest structure variables. Results will be posted online at Virginia Tech web site. (The USDA Forest Service FIA annually surveys all forest lands throughout the U.S.) Although FIA has sampled DWM measurements for more than 20 years, our compilation is the first national scale biomass summary (Mg/ha) that will be readily available to scientists. DWM measurements are publicly available on FIA website but there is little documentation or protocol available for compiling DWM biomass; and sample design and data base structure are extremely complicated. Our effort required reading more than 500 files just to acquire data, and writing more than 10,000 lines of computer code to complete and document the project. We somewhat scaled back initial plans to model DWM as function of forest structure, geographic and climatic variables for producing broad scale maps of DWM data. Although DWM data were somewhat correlated to climatic variables and dead standing trees, successful modeling necessitated detailed stand disturbance history which was unavailable. We found that estimating means within Bailey's Ecoregion subsection a useful tool for disseminating DWM data for use throughout the U.S. Ecoregion subsection-scale maps are presented for the U.S. illustrating DWM variables for various forest structure variables.

7. Finding the spectrum from best to worst conditions: Can we rapidly detect recovery from damage by deer and exotic invasive plants in forested habitats?

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I am developing methods to rapidly assess forest conditions, because where control of deer and of exotic invasive plants is implemented adequately in eastern US forests, habitat recovery is possible. Loss of oak reproduction and woodland herbs has differed over time and location, and recovery is also expected to differ. The method combination I use to search for the ends of the condition spectrum is: 360 degree visual sweeps that look for specific best and worst conditions in a habitat range, plus parts of deCalesta's Kinzua plot assessment methods of browse damage. I assessed five sites in Jug Bay Wetland Sanctuary in Maryland where deer management was recently restored after being prohibited for 35 years. First results of the new methods are: rapid documentation of site impacts including complete absence of oak saplings 1 to 6 feet high at 5 of 5 sites as detectable in early March 2011, a uniform ranking of very high deer impact by the Brose 2008 criteria, conspicuous highly browse-resistant species, notable variation between areas 400 m apart in invasive species and cover, and unexpectedly easy detection of an early exotic invasion. This approach can be supplemented with effort-intensive randomized methods that show frequency distributions, and can test for their external validity. I encourage discussion because reversing habitat collapse in our forests is biologically important, the methods provide context for a broad range of research including on animals in those habitats, and the 360 sweeps can lead to seeing forest habitats in a new way.

8. Using radio telemetry to investigate secondary dispersal of acorns by small mammals.

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Scatter-hoarding rodents selectively disperse and cache seeds below the ground surface in individual, widely spaced caches for subsequent use. This behavior has important implications for seed dispersal, seedling establishment, and tree regeneration. Small mammals (e.g. tree squirrels) are often assumed to manage these caches by recovering and eating some caches and moving and re-caching others. However, this process of secondary dispersal is poorly understood. Here, we evaluate the importance of secondary dispersal in the management of acorn caches by eastern gray squirrels (*Sciurus carolinensis*) using radio telemetry. We implanted radio transmitters into red oak (*Quercus rubra*) acorns and presented these acorns to squirrels in a natural setting over a three-year period. After the acorns were dispersed, we used telemetry to track the acorns and determine their fates. Cached acorns were checked periodically to document evidence of recovery and re-caching. For each dispersal event, the distance from the source and the compass bearing were recorded and then mapped with Arc-GIS. Over three years, we tracked 92 acorns, 22 (23.9 %) of which were dispersed on 2 or more occasions. One acorn was moved five times. These results suggest that gray squirrels may engage in significant cache management during periods of long-term caching and that such behavior may influence seed dispersal and seedling establishment.

9. Long term ecology research in an introductory lab: What do students learn?

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Long term research is critical to answering many important ecological questions. Since 1998, Ecology Lab students have participated in long-term studies on the Stockton Campus. Student teams prepare a research proposal, using previous years' reports and preliminary investigations. Their results are published in an in-house journal. Projects include phenology of highbush blueberry, analysis of the tree stratum along environmental gradients and assessment of stream macroinvertebrate assemblages. New baseline studies are underway for a forest management plan. Other new projects, such as restoring native plants to roadsides and mapping invasive species, carry over from the fall Environmental Issues class. The question is what the students learn from participating for one term in a project that extends over as much as a decade. The response of interest is what the discussion/conclusions from current reports show that the students are learning from their studies, in the context of the ongoing project. Although there is a high degree of year to year variability attributable to the makeup and group dynamics of the student teams, as the data and reports have grown to a substantial body, what the students learn has reflected an increasingly long term perspective. Results from 2009 to early 2011 indicate that the lab teams and the individual participants are learning more from the long-term aspects of the projects. A further quantitative assessment will be included in the spring 2011 labs, to evaluate students' perceptions of their understanding of the previous work.

10. Tadpole density changes the relationship of red-eyed treefrog morphology and jumping performance

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As organisms develop, increased body size is often accompanied by shape changes that alter the morphology–performance relationship. Animals with different growth histories may also have different shapes at similar body sizes. To investigate how larval growth history affects the morphology–performance relationship, we raised red-eyed treefrog tadpoles (*Agalychnis callidryas*) at three densities (5, 25 and 50 tadpoles per 400 L tank) and measured jump distance during metamorphosis. We predicted that tadpoles grown at low density would metamorphose into larger frogs with relatively longer legs than those grown at higher densities. We also expected low density frogs to jump further – both absolutely, because of their larger body size and relative to their size if they had longer legs. Frogs from low density had longer snout-vent lengths (SVL) than those from higher densities and longer tibiafibula lengths and greater masses relative to their SVL. Jump distance was strongly correlated with tibiafibula length; however, there was a significant density*tibiafibula interaction. While longer tibiafibulas in high and medium density frogs were correlated with longer jump distances, there was no such correlation in the frogs from low density tanks. We interpret these results as a consequence of the greater relative mass of the frogs from low density tanks. The relatively long legs of these frogs may not fully compensate for their disproportionately higher mass. This study demonstrates that different larval densities can change red-eyed treefrog morphology, but also the morphology–performance relationship.

11. Herbivory and disease symptoms in non-native, invasive plants co-occurring in the deciduous forest herb layer: garlic mustard, Japanese stilt-grass, and Norway maple.

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Forest herb layers in urbanizing landscapes are colonized by multiple non-native species, but few studies compare their ecology within their shared communities. Invasive species are thought to be affected little by natural enemies, so comparison of enemy damage on these species should show little difference. We tested this idea with garlic mustard (*Alliaria petiolata*, ALPE), Japanese stilt-grass (*Microstegium vimineum*, MIVI), and Norway maple (*Acer platanoides*, ACPL). In an experiment replicated across three New Jersey forests, we planted 120 seedlings of each into individual plots in a randomized design. Each focal seedling grew alone, with two seedlings of one of the other species, or with two sugar maple seedlings (a native). We harvested survivors near the end of the growing season, scanned the leaves digitally, and quantified herbivory (holes) or disease symptoms (necrosis). Presence of competitors had no effect on herbivory for any of the focal species, which was similar for all, at 15% leaf area missing, indicating that these invasive species have not escaped herbivory. Necrosis in ALPE and MIVI was decreased by an order of magnitude in the presence of ACPL, to only 0.2% leaf area for ALPE and 0.4% for MIVI. Presence of the native maple had no effect. After excluding ALPE and MIVI plants with ACPL competitors, we could compare all three focal species. ALPE leaves had about half the necrosis (6%) of MIVI and ACPL (13-14%) , which could confer an advantage to ALPE in communities invaded by a mixture of these species.

12. Competition and simulated herbivory in two co-invasive, non-native plants of the mid-Atlantic forest: garlic mustard and Japanese stilt-grass.

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Invaded forest communities often experience simultaneous invasion by multiple plant species. When co-invasive species become dominant, their own interactions may become important drivers of subsequent community dynamics. Also, in forests with overabundant deer, even invasive plants may become subjected to herbivory. We tested the interactive effects of competition and herbivory on garlic mustard (*Alliaria petiolata*, ALPE) and Japanese stilt-grass (*Microstegium vimineum*, MIVI), two co-invasive plants that can dominate the herb layer of mid-Atlantic forests with high deer pressure. We grew plants in the greenhouse from seedlings, for three months. We crossed three plant densities with four ALPE:MIVI ratios, crossed with clipping of ALPE, MIVI, ALPE and MIVI, or neither species, and we measured per capita dry mass of roots and shoots. Generally, growth of both species decreased as plant density increased, as intraspecific competition increased, and with clipping. Clipping influenced the outcome of competition; when a single species was clipped, it was outgrown by the other species, at all densities and ratios. Without clipping of either species, the species with lower intraspecific competition outgrew the other, except at the highest density, when MIVI always outgrew ALPE. When both were clipped, ALPE outgrew MIVI in all cases, because clipping was much more detrimental to MIVI than ALPE. The implications for natural populations should be field-tested; they include that MIVI should be able to invade and dominate dense ALPE stands, unless ALPE is a target for deer herbivory, which we have detected previously in forests with high deer pressure.

13. Measuring white-tailed deer pressure and density in suburban/exurban forests.

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Overabundant white-tailed deer appear to have profound effects in Mid-Atlantic suburban forests, causing depauperate understories, lack of tree recruitment, and possibly fostering the spread of unpalatable invasive plants. Study of the ecological role of deer in these forests relies on accurate measures of their density and impact, which is challenging in small forest stands embedded within a human-dominated landscape. We compared three measures of deer pressure in six suburban/exurban forest fragments in central New Jersey. We estimated current deer density by surveying pellet group accumulation over 6 months in 15 112-m^2 plots per forest. We surveyed browse damage in 2008 and 2010 on native, woody twigs on three 100-m transects in each forest, for 30 observations per forest. In 2008 and 2010, we also measured chronic deer pressure with quantitative visual assessments of the vertical percent shrub foliage cover of native, woody plants at 40 points per forest. Browse damage and shrub cover showed similar, but not identical, patterns of pressure; the three forests with little shrub cover generally showed higher levels of browse than the three forests with greater shrub cover. However, the pellet group survey indicated higher deer density in forests with lower deer pressure, although this match was not exact. These results suggest either that 1) deer tend to avoid the open understory of highly browsed forests but, when present, are likely to browse whatever food plants are still available, or 2) that the pellet method does not accurately capture deer density.

14. EcoEd Digital Library: Supporting innovative undergraduate ecology education through peer-reviewed collections and data discovery.

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EcoEd Digital Library is ESA's searchable online catalog of resources for teaching undergraduate ecology. Using EcoEd, faculty can find free teaching resources that are peer-reviewed for quality, scientific accuracy, and pedagogical use. Teaching resources include photographs, figures, tables, datasets, articles, laboratory exercises, and simulation programs. Faculty who have developed their own visual resources (photographs, figures, tables) or student activities like lab, field and classroom exercises, are encouraged to submit them to the library for peer review and publication. In 2010, EcoEd DL switched to a new web platform to enhance community-building, including use of social media and user feedback of its resources. In 2011, ESA is partnering with Science Pipes and three other professional societies to develop tools to promote the use and analysis of large datasets in undergraduate classrooms. ESA's long-term goal for EcoEd is to build and maintain a library that is user-friendly and used by ecology researchers and educators to obtain current information and ideas for teaching resources.

15. Inhibition of woody colonization on a reclaimed anthracite mine: Seed rain and seed bank dynamics.

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Minelands reclaimed by grasses/legume mixtures resist tree invasion, thereby creating states of arrested succession in the northeastern US. Poor tree colonization can result from lack of seed rain, poor seed germination, or poor seedling survival. In this project, we investigate whether the lack of tree colonization on a reclaimed anthracite mine site near Wilkes-Barre PA is due to insufficient seed rain. We deployed 21 seed traps along five parallel transects each extending up a hill within the reclaimed mine to a remnant forest in fall 2010. Seed banks were concurrently assessed by obtaining thirty 10” x 8” x 1” deep soil samples from the reclaimed mine. Samples were placed in aluminum pans in a greenhouse, and watered periodically. Seedling emergence within the pans was subsequently monitored. Examination of the seed traps in December revealed no tree seeds, regardless of distance from the forest. Flushes of seedlings were observed in each pan. However, all were of herbaceous weedy species such as *Daucus carota*, *Erigeron* sp., and *Solidago* sp. No tree seedlings were noted. The data collected to date suggest that poor tree colonization results from lack of seed rain, though further yearlong investigation is warranted.

16. Fire and the development of high-elevation pitch pine communities in northeastern West Virginia

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We investigated the influence of historic fire on the development of pitch pine communities above 650 meters in northeastern West Virginia. We hypothesized that the fire frequency is correlated with species composition of existing pitch pine stands. We sampled plant species composition in 29 study sites using 400 m² plots. Trees were cored and the presence of charred trees, soil charcoal, and other clues were used to create a fire evidence index (FEI). We measured annual ring widths, graphed radial growth patterns, and identified possible disturbance dates for each site when radial growth increased concurrently in least 2 trees per site in the same year. We statistically analyzed plant community characteristics against evidence of disturbance using ANOVA and Pearson correlations. We found a significant relationship between FEI and plant community type (based on cluster analysis of percent cover of all species); however there was no significant connection between FEI and tree community type (using relative density and relative basal area of trees > 7cm in diameter). We found a significant relationship between FEI and landform type (cliff, slope, plateau, bog). Possible disturbance dates were not significantly related to plant community or to the fire evidence index. Although fire has played a role in shaping community composition, there are other environmental and anthropogenic factors influencing succession. Analysis of fire scars will be needed to pinpoint dates, locations, intensity, and frequency of fire to develop a greater understanding of the degree that fire has influenced pine community development relative to other factors.

17. Possible interactions between intestinal parasites and tick feeding success in *Sciurids*

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Tick borne diseases are complex systems involving numerous species interacting on multiple scales. They are typically characterized by extreme within-species variability in host parameters such as body burden (the number of ticks infesting a host) and reservoir competence (the probability that a tick feeding on a host will become infected with a pathogen). We investigated the possibility that co-infection by intestinal parasites may modulate the immune response to ticks and explain some of the variation in body burden in 3 *Sciurid* species that commonly host black-legged ticks (*Ixodes scapularis*), the vector for Lyme and several other tick-borne diseases. We trapped red squirrels (*Tamiasciurus hudsonicus*), grey squirrels (*Sciurus carolinensis*), and eastern chipmunks (*Tamias striatus*) at the Cary Institute of Ecosystem Studies in Millbrook, NY and measured 3 day larval tick body burdens by holding animals in the lab. Intestinal parasite egg shedding rates were determined via fecal floatation. Preliminary results show no consistent relationship between egg shedding rates and tick body burdens in either of the squirrel species, but indicate a significant positive relationship between eggs produced by protist and helminth parasites and tick body burden in chipmunks. This pattern is consistent with that observed in 2009. Further investigation into other factors influencing within-species variability in tick body burdens, such as host behavior and environmental factors, should lead to a greater understanding of what mechanisms drive tick infestation.

18. The effects of exotic crayfish on arthropod community structure in a New Jersey stream.

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Exotic crayfish are known to have a number of effects on the environments into which they are introduced, including reduced macrophyte abundance, disruption of amphibian breeding, and displacement of native crayfish species. A growing body of literature reveals that exotic crayfish also impact the structure of invertebrate communities in streams and lakes. In this field study, we are considering the possible effects of the exotic virile crayfish (*Orconectes virilis*) on arthropod community structure in New Jersey. We selected two streams, Wickecheoke Creek and Stony Brook, that are similar in a number of characteristics but differ in their crayfish fauna. In our surveys, we have found only the native common crayfish (*Cambarus bartonii*) in Wickecheoke Creek and only *O. virilis* in Stony Brook. Our study is ongoing, but the data collected to date indicate that the arthropod community in Stony Brook is less diverse and less even than the community in Wickecheoke Creek. In particular, the two streams differ in the abundance of midge larvae (Chironomidae). Stony Brook samples contain substantially more chironomids than Wickecheoke Creek samples. This finding is consistent with previous work on exotic crayfish, but dominance of the arthropod community by chironomids is also associated with poor water quality. Additional work will be necessary as we continue the project to tease apart the relative effects of exotic crayfish and water quality on the arthropod community in Stony Brook.

19.Differential use of forest and field habitat by the White-footed Mouse, *Peromyscus leucopus*

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We investigated the use of two different habitat types by white-footed mice (*Peromyscus leucopus*) in a suburban landscape northwest of Philadelphia. The first habitat type comprised two forest fragments separated by the second type, a gas pipeline right-of-way (ROW) that was mowed annually in the fall and covered by herbaceous vegetation in the spring and summer. Although *P. leucopus* are most commonly found in forests, these generalist rodents sometimes prefer the edge between forested and herbaceous habitats and will even use the latter if vegetation complexity is reasonably high. A 144 meter x 162 meter sampling grid, with Sherman live traps placed at 9 m intervals, was centered on the 40m wide ROW and extended approximately 50 m into each of the flanking forest fragments. Captured *P. leucopus* were marked with PIT tags and toe clips, and location, sex, weight, and reproductive condition recorded at each capture. Density measured as captures per trap-night showed that *P. leucopus* preferred forest to ROW habitat. Captures in the two central ROW transects were significantly fewer than in other transects. Captures in the two ROW transects flanking the forests were also significantly fewer than in the adjacent forest. Use of the central ROW diminished from summer to fall and virtually ceased during winter, which suggests that, as the structural complexity of the ROW herbaceous plant community diminishes after summer, its attractiveness to *P. leucopus* also wanes.

20. Community composition and fire dynamics of high-elevation pitch pine woodlands in northeastern West Virginia

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I investigated the role of historic wildfire in high (> 650 m) elevation pine stands in eastern West Virginia and tested the hypothesis that disturbance by fire is necessary to perpetuate pitch pine woodlands on backslopes, plateaus, and uplands, but not cliffs and bogs. Cliffs and bogs are environmentally stressful, but provide safe sites for pine recruitment and are relatively free of competing tree species. Vegetation, pine recruitment, and evidence of fire were recorded at 46 high elevation sites in the Ridge and Valley and Allegheny Front of northeastern West Virginia. Increment cores and wedges from trees with fire scars were extracted and their analysis is ongoing. Ten community types were identified and described using cluster analysis of plant abundance data. Results indicated the widespread presence of fire evidence across all community types, but that species composition of sites as represented in NMS ordination space is correlated with the presence and predominance of fire evidence. A complex picture of the role of fire emerged that did not confine it to any particular community type or landform; however cliffs and backslopes had significantly more evidence of fire than other types. Current seedling regeneration in pine stands was most strongly determined by landform, with 94% of all seedlings (< 1 m tall) growing in either cliff or bog habitats. It is likely that a patchy disturbance history and edaphic factors that vary by landform work together to influence community composition and stand dynamics in these high elevation woodlands.

21. Forest growth responses to climate over different types of bedrock in southeastern Pennsylvania

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Previous research has explored soil properties versus bedrock type and forest growth versus soil properties, but few studies have examined relationships among all three variables. This study was designed to examine how bedrock-related soil differences might interact with climate to affect tree growth. Five sites in Lancaster and southern Lebanon Counties, PA were used, with one site per bedrock type (limestone, sandstone, schist, shale and quartzite) and one 0.16 ha plot per site. Increment cores were extracted from a total of 61 trees (5-17 cores/site) with diameters at breast height (DBH) greater than 30 cm. Annual ring widths were measured, detrended and normalized to compile stand-level ring width indexes (RWI) across all species. The indexes were used to compare annual growth to annual and growing season mean temperature and total precipitation both within and across sites. Mean growth across all five sites showed no significant relationship to temperature or precipitation as individual climate factors, but there was a significant negative linear relationship for growth to temperature in years of low precipitation. Individual sites showed varying growth responses to temperature within different precipitation ranges, however no sites showed a significant relationship solely between growth and precipitation. The growth-climate relationships in mesic mixed-species forests cannot be explained using only current-season average temperature or total precipitation. Factors such as topographic location, seasonal and inter-annual patterns of cloud cover, temporal distribution of rainfall, and lag effects of previous-year climate on current-year growth may all contribute to the complexity of growth-climate relationships.

22. *Artemisia vulgaris* control methods without the use of broadcast herbicides

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Artemisia vulgaris (mugwort) is an herbaceous weed native to temperate Europe and Asia. It is thought to have been introduced to the United States by European settlers. *A. vulgaris* is most commonly found on roadsides, waste areas, landscapes and many highly disturbed areas. It is extremely difficult to contain the growth of *A. vulgaris* due to its ability to spread through both rhizomes and seed dispersal. Herbicides are most commonly used to control *A. vulgaris*, however herbicides can have harmful effects on the surrounding ecosystem and water ways. Through manual manipulation of removal of above ground biomass, litter cover, soil disturbance and carbon levels, we were able to alter the density and height of *A. vulgaris*. The treatments included mowing, litter removal, addition of sawdust (carbon), tilling of soil and addition of sawdust combined with tilling. Densities were measured by counting and identifying all species in a one-meter square sample along a transect inside a 2-2.5 meter plot. Three samples were taken per plot to ensure homogeneity across the plot. Results show that sawdust addition, a alteration of the carbon nitrogen ratio, combined with tilling had the most significant affect on the density and height of *A. vulgaris*. The density of *A. vulgaris* was decreased by 40% and the height was decreased by 60%. The results suggest that it is possible to reduce the density of *A. vulgaris* without the need of broadcast herbicides.

23. Temperature effects on out-crossed pollen tube growth in flowers of Christmas cactus (*Zygocactus spp.*) and testing for self-compatibility

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Several species of *Zygocactus*, commonly known as Christmas cacti, originate in Brazil but have become popular as house plants worldwide due to their tendency to flower in late autumn or early winter. Temperature and day length influence bud development and flowering time in these species. We studied the effects of temperature on pollen tube growth in out-crossed flowers of one *Zygocactus* sp. Because in some flowers, there is little distance between stigma and anthers we also tested for self-compatibility. Flowers were hand-pollinated and plants were placed either in an environmental chamber at 12°C or in a greenhouse where temperatures ranged from 15-27°C. Self-compatibility trials were done in the greenhouse. Flowers were stained with 0.1% aniline blue and observed using fluorescence microscopy. Preliminary results indicate pollen tube growth cessation just below the stigma in flowers kept in the cooler environmental chamber temperature. Flowers harvested from the warmer greenhouse temperatures have pollen tube growth almost the entire length of the style. There appears to be some variation in pollen tube growth among individual plants as well. These results are similar to other plant species that have shown slower pollen tube growth in colder temperatures.

24. The role of pollen tube growth and pollen viability in the sexual reproductive failure of the federally endangered Florida ziziphus (*Ziziphus celata* Rhamnaceae)

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Florida ziziphus (*Ziziphus celata*) is a clonal shrub endemic to central Florida's Lake Wales Ridge. Due to habitat loss and fragmentation, the species is genetically depauperate and half of the 14 wild populations are uniclonal. *Ziziphus celata* has a gametophytic self-incompatibility system (GSI), which limits the number and availability of mates, and many of its 42 wild genotypes are cross-incompatible. In addition, even compatible crosses often fail to produce viable seeds. We hypothesized that pollen sterility, ineffective pollen tube growth, and fruit abortion contribute to sexual reproductive failure in *Z. celata*. We used fluorescence microscopy to examine 268 flowers hand-pollinated with compatible, self, or incompatible pollen. We scored flowers for pollen retention, germination, and extent of pollen tube growth. Overall, 77.6% of flowers retained pollen and of those, 81.3% had pollen germination. Compatible, self, and incompatible crosses showed significant differences in pollen retention, pollen germination, and the proportion of flowers with pollen tubes in the style, with self crosses surprisingly performing best. Subsequent research indicated that some genotypes consistently produced low percentages of viable pollen, and thus were poor pollen donors. In a pairwise comparison of compatible and incompatible crosses (selfs + incompatible outcrosses), a significantly greater proportion of compatible crosses had flowers with pollen tubes in the ovaries. Dissection of aborted fruits revealed that 60% of late-aborted seeds contained a fully formed embryo. Several pre- and post-zygotic factors contribute to sexual reproductive failure in this highly imperiled species.

25. Effect of forest age and past land use on organic carbon content of Mount Vernon, VA soils

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Forest age and past land use both affect the amount of organic matter contained in soil. George Washington used his Mount Vernon plantation for the farming of various crops. Crop rotation, fertilizer application and mulching were used to increase soil fertility and field productivity. Different crops require different quantities of nutrients and therefore, depending on which crops were grown on a particular plot, the soil organic carbon (SOC) may vary across abandoned agricultural fields. Perhaps even more importantly over long periods of time, SOC content of soil samples taken from forested areas may differ as older forested areas are expected to have higher SOC contents than younger forested areas since the soil has had more time to replenish the nutrients lost. In January 2011, two or three replicate soil samples were taken from each of 14 plots across forest stands of varying age within the Mount Vernon property. Samples were taken from the top 10cm of soil since that layer is most sensitive to disturbances in land use. The loss on ignition method was used to determine the percent organic carbon contained in each subsample. Soil samples were first dried overnight in a drying oven set at 105°C and were then placed in a furnace which was programmed to reach a temperature of 550°C. Samples remained in the furnace for 4hrs. Both belowground biomass and SOC are estimated from these analyses and compared with estimates of forest stand age from tree rings.

26. The recent dramatic drop in Amazon deforestation and its importance for global warming

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Over the past six years the rate of deforestation in the Amazon, particularly in Brazil, has decreased in dramatic fashion. In the Brazilian Amazon, which makes up 60% of the basin, deforestation is down by 67% compared to the ten-year average of the years 1996-2005, and there is also progress in some of the other countries. This change is particularly impressive in that it has come during a period in which prices for agricultural commodities, which are the principal drivers of deforestation, have twice spiked to record levels (in 2008 and 2010). Several factors are responsible for this important progress. Government actions at both the federal and state levels, including setting aside more than 20% of the Brazilian Amazon as indigenous reserves and an additional 30% as other kinds of protected areas, has played a major role. Pressure from civil society led to moratoria on buying commodities from deforested areas in two key industries, soybeans (since 2006) and beef (since 2009). The incentive for reducing deforestation created by the REDD+ agreement between Norway and Brazil, under which compensation is provided based on results (remote-sensing data showing reduced deforestation) has been an important incentive. The Brazilian reduction alone has decreased emissions of greenhouse gases by about 850 million metric tons per year. This is by far the largest reduction in global warming pollution made by any country on earth, and contrasts strongly with continuing increases in emissions from fossil fuels.

27. Linking resource availability to the structure and function of microbial nitrate reducers in freshwater wetlands

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Human activity has drastically altered the global nitrogen cycle, and increased research has lead to the discovery of novel microbial pathways that could fundamentally alter our understanding of nitrogen biogeochemistry. New mechanisms of nitrate reduction have been found to be important, but the ecology of these processes remains understudied. To address this deficit, this study used organic matter (OM) and nitrate amendments to investigate the regulation of denitrification and dissimilatory nitrate reduction to ammonium (DNRA) in freshwater wetland soils. Soil was amended with OM (either compost or wood) and/or nitrate (KNO_3) fertilizer and incubated *in situ* for three months. Upon recovery, samples were analyzed for functional group abundance (qPCR) and activity (anoxic slurry assay utilizing ^{15}N). Clear differences were observed in the abundance of organisms associated with each process. Denitrifiers dominated the ecosystem, but DNRA-capable organisms were present in appreciable numbers; both groups were responsive to treatments. For example, two-way ANOVA on denitrifier abundance found significant main effects of OM (compost) and nitrate, as well as a significant interaction effect ($p < 0.05$). Stable isotope analysis found nitrate and/or OM treatments had a significant impact on ^{15}N nitrogenous gas production rates, and this change in microbial community function could potentially impact nitrogen cycling at the ecosystem scale. Overall, this work indicates OM and nitrate interactively dictate the microbial nitrate-reducing community structure and function. These relationships are important drivers that effect how wetlands attenuate nitrogen loading, which could have implications for eutrophication of costal habitats and ecosystem greenhouse gas emissions.

28. Male fence lizards (*Sceloporus undulatus*) use female behavior and size to choose a mate

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Male mate choice is not well documented, especially in lizards, because males have lower energetic costs associated with the production of gametes. This usually means that males tend to be less choosy than females when it comes to reproductive strategies. We conducted 17 male mate choice trials using *Sceloporus undulatus* (eastern fence lizards) by giving a male the choice of two females in an arena. We video-recorded interactions and quantified behavioral interactions from this footage. Male and female behavior was ranked according to degree of receptivity: males were ranked from 0 (ignored female) to +4 (mated with female) and females from -1 (fled from male) to +2 (mated with male). We tested how female behavioral and morphological traits affected male mate choice. Our results revealed that males chose females that have more receptive behavior. This could benefit males as mating with a receptive female could reduce the time spent conducting costly courtship behavior. We also found evidence for size-assortative mating: large males would choose large females, and small males would choose small females. Larger females are able to lay more eggs, thus having higher fecundity, which would increase a male's reproductive success. Small males may not be able to convince large females to mate with them, and so instead mate with small females, which at least give them some reproductive success. This study reveals that males use both female behavior, which indicates their receptivity to mate with a male, and their size, which reflects their fecundity, when choosing a mate.

29. Comparing microbial community structure and function in tidal freshwater wetlands of the Chesapeake Bay watershed in Virginia

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Wetlands provide billions of dollars in ecosystem services to the United States each year. In an era where there is great concern for global climate change, a wetland's ability to sequester carbon is one of its most important features. Understanding how wetlands function at the microbial level can provide important insight into the preservation and restoration of this crucial ecosystem. Here, we compare soil microbial community structure and function of eleven different tidal freshwater wetlands dominated by *Peltandra virginica*. Bacterial and archaeal community DNA was extracted from five replicate soil samples from each site, and analyzed using terminal restriction fragment length polymorphism (T-RFLP). In addition, extracellular enzyme activity (EEA) was measured to assess community function, and data was collected to describe the soil physicochemistry and the wetland plant community associated with each site. A strong relationship was observed between community structure (T-RFLP), function (EEA), and the environmental parameters. Further, the composition of the bacterial and archaeal communities was strongly correlated. Bacterial community composition appears to be less related to the soil properties than the archaeal communities; the most important environmental factors were above-ground plant biomass, temperature and soil redox conditions. Of the six EEAs performed, the strongest relationship between community structure and function was for the enzyme phenol oxidase, which is responsible for the break down of more recalcitrant carbon compounds. Ongoing work will examine microbial biogeography, and consider how the community fingerprints vary at increasing scales (e.g. within and between wetlands, along rivers, etc.).

30. Selective dispersal of smaller acorns by blue jays: The effects of multiple prey loading

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Studies from both tropical and temperate systems show that scatter–hoarding rodents selectively disperse larger seeds farther form their source than smaller seeds, potentially increasing seedling establishment in larger-seeded plants. Size-biased dispersal is particularly evident in some oaks (*Quercus spp.*) and is true both across and within species. Here, we predict that intraspecifc variation in seed size also influences acorn dispersal by the blue jay (*Cyanocitta cristata*), but in an opposite manner. Blue jays are gape-limited and tend to selectively disperse smaller acorn species (e.g., pin oaks [*Q. palustris*]), but often carry several acorns in their crop during a single dispersal event. Thus, we predict that jays foraging on smaller acorns will load more prey per trip and disperse seeds to greater distances than when single acorns are carried in the bill. To test this, we presented free-ranging blue jays with pin oak acorns of different sizes over a two-year period. In each of 16 experimental trials we monitored the birds at a feeding station with remote cameras and observed birds to determine the number of acorns removed and the distance acorns were dispersed when cached. Jays were significantly more likely to engage in multiple prey loading with smaller seeds in both years of the study, and during one year, these smaller acorns were dispersed significantly farther than larger acorns. We suggest that under some circumstances smaller acorns of pin oak may have a dispersal advantage. Similar mechanisms may constrain seed size in some plant species.

31. Differences in forest dynamics across ridge sites in the New Jersey Highlands

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Many New Jersey Highland forest stands are in a highly dynamic state as invasive herbivores and diseases cause population declines of common tree species. The purpose of this study was to examine forest dynamics across sites with slightly different environmental conditions. Detailed surveys of trees of all sizes were conducted on a southeast facing, relatively xeric slope and on a northwest facing, relatively mesic slope of the same ridge. Over 3,600 juveniles and adults of 23 tree species were surveyed across a total of four hectares. On the drier site, a mortality index, a seedling browse index and comparisons of tree species composition across vertical strata all together suggest that populations of all four *Quercus* species are in dramatic decline due to periodic defoliation by *Lymantria dispar* and seedling browsing by *Odocoileus virginianus*. Similarly, *Fagus grandifolia* and *Fraxinus americana* are declining due to fungal pathogens. As a likely result of reduced competition, populations of *Acer saccharum* and several less common tree species appear to be increasing. In sharp contrast, the tree community on the moister site appears to be experiencing much less disturbance, with relatively low rates of mortality and little evidence of impending shifts in species composition. A subsequent survey of *Quercus rubra* and *Q. velutina* across twelve ridge sites confirmed that at least for these species, mortality tends to be significantly higher on sites with more southerly aspects. Overall, forest stands on drier slopes appear to be in a much more dynamic state than those on moister sites.

32. Detecting the presence of a den by modeling the home range behavior of brown bears.

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Determining the mechanisms for how an individual bear chooses its home range is becoming increasingly important as their populations become threatened. The home range typically encompasses both good habitat and a den. Here we create a model that can detect whether an individual bear is returning to a den and where the most likely location of the den is. The model can estimate the strength of the selection parameters towards both the den and the surrounding habitat. For a movement pattern of at least 125 steps, the den selection parameter must be at least 0.2 to predict the presence of a den with 80% reliability. We fit the model to individual walks of brown bears from the Kenai Peninsula, Alaska. We were able to detect the presence of a den in an individual bear walk. For many individuals it appears as though the strength of selection parameter is higher for the surrounding habitat than for the den. This model can help determine important locations within a bear's home range that are critical for its survival and reproduction.

33. Subsurface hydrologic controls on sensitive wetland ecosystems in the New Jersey Pinelands.

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The New Jersey Pinelands Reserve is an ecologically sensitive area managed with the goal of preserving the local natural resources, protecting the underlying potable aquifers from contamination and enabling appropriate human usage of the land. The management plan bears all of these facets in mind and acknowledges the integral nature of the biosphere, geosphere and hydrosphere. Small, isolated wetlands formed within shallow depressions are present within forest canopy gaps throughout the Pinelands. The genesis of these wetlands and their relationship to the surrounding forest is poorly understood. Many of these wetlands are ecologically sensitive vernal pools that potentially harbor niche endangered species. These ponds (if wet from April to June) may also be critical breeding habitat for the federally listed endangered pine barrens treefrog, *Hyla andersonii*. Similarly sized spung wetlands are characterized by modest peat accumulations (<90cm) and may be influenced by similar hydrology. In this study, we estimated properties of the near-surface wetland soils using geophysical methods such as electrical resistivity, ground-penetrating radar and electromagnetics. Our hypothesis was that variations in the subsurface geology impact local surface hydrology. We were able to identify spatially extensive clay layers in the subsurface below the wetlands using direct sampling and geophysical methods. These geologic strata likely influence the hydroperiod and vegetation assemblages of these wetlands. The encroachment of trees on the wetland margin and presence of aquatic plants and peat appears to be related to the geometry of the depression and the presence of clay layers that restrict water infiltration.

34. Moonlight and suburban white-tailed deer movements.

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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. Deer were fitted with GPS/GSM radio-collars (Followit, Sweden), which transmitted spatial and temporal data at 5-minute interval fixes. We constructed trajectories for all individual instrumented deer; these trajectories were coupled with the information on the presence of the moon in the sky, as well as the segments of the night with the moonshine ("evening moon," "morning moon," and "moon throughout"). Within ArcGIS® we calculated intersects of deer track portions separated by the "moonshine" factors with four types of habitat ("field," "forest," "homestead," and "industrial"). These intersects gave us preference/avoidance statistics for particular habitat at the mentioned "moonshine" factors. Results show that when the moon shines, the deer preferred fields, while during periods with no-moon in the sky, the deer preferred cover in the forested habitat. Industrial habitat was avoided regardless to the moon presence. Amongst sampled deer, there were two individuals that preferred 'homestead' habitat. These individuals were not affected by the presence or absence of the moon in the sky. We speculate that the preference of open fields during moonshine periods is determined by the ability of the deer to detect possible danger from further distance. Visibility declines when there is no moon in the sky.

35. Impact of snow cover on movements and habitat choice of suburban white-tailed deer.

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We monitored the movement of twenty-five individual white-tailed deer (*Odocoileus virginianus*) in the Pennypack Ecological Restoration Trust (PERT), a land preserve adjacent to suburban Bryn Athyn College. Deer were fitted with GPS/GSM radio-collars (Followit, Sweden), which transmitted spatial and temporal data at both low frequency (once per 6 hr) and high-frequency (5-minute interval) fixes. Nine individuals (four does and five bucks) were monitored during severe snowfalls, as well as during periods when snow of various depths blocked the ground. We use cumulative habitat choice of all monitored deer to find general preferences for daylight and night periods, and compare the habitat choice during snowfall or during periods of deep snow accumulation. We found that thin snow does not affect deer movement. In deep snow, the deer travel less, and stay within a smaller area for longer periods of time. Formation of ice crust might expand the daily home ranges of the deer if the crust can withstand the weight of the deer. If the ice crust does not hold the weight of the deer, the daily home ranges shrink to very small areas. In such weather, as well as during periods of very deep snow, the deer tend to use public roads to avoid danger if disturbed. During periods of snow thaw, the deer prefer southerly exposed slopes that melt and dry first. Northerly exposed slopes are avoided, as they continue to contain snow patches.

36. Competitive displacement of crayfish species in the Monocacy River.

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The most abundant crayfish in the Monocacy River is the non-native, *Orconectes virilis,* introduced 40 years ago. The invasive *Orconectes rusticus* was recently introduced and is displacing *O. virilis* as its range expands. The resulting distribution provides an opportunity to examine mechanisms of competitive displacement as each species can be observed in the presence and absence of interspecific competition. Habitat use varied with the presence of competitors. In the absence of interspecific competition, juvenile and adult *O. virilis* showed strong preference for spatially complex emergent vegetation beds. *O. rusticus* showed some preference for vegetation but were abundant in riffle, run, glide and pool habitats. In the presence of competition, habitat utilization by *O. rusticus* was unchanged, but *O. virilis* was displaced from vegetation habitat. Displacement was most intense in the young adult portion of the life cycle. When in competition with *O. rusticus*, the young adult size classes of *O. virilis* were diminished or absent. Juvenile *O. virilis* were present indicating successful reproduction at the site. The remaining adult *O. virilis* were larger than 32 mm (carapace length) which was the maximum size attained by *O. rusticus* at the site. Our findings suggest the presence of a size refuge for *O. virilis.* We hypothesize that the competitive exclusion of *O. virilis* takes place in the early life stages. This likely impacts the transition from juvenile to mature adults. Our research group is presently examining potential mechanisms of displacement including adult and juvenile behavior, fecundity, and juvenile mortality.

37. Species composition of crayfish populations in the Monocacy River.

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The introduction of invasive species has been detrimental to many river systems and often results in the displacement of native populations. Two species of invasive crayfish have been reported in the Monocacy River in Maryland. *Orconectes virilis* was introduced approximately 40 years ago and has an extensive presence in the Monocacy, *Orconectes rusticus* was first reported in the northern Monocacy in 2007 and appears to be advancing downriver. Our research examines changes in the species composition of the Monocacy crayfish over time. We established four long-term monitoring sites on the Monocacy River and sampled crayfish populations in 2009 and 2010. We looked at how the population structure and species composition changed at sites where species are in direct competition and sites where only one species was dominant. We found that the invasive *O. rusticus* appears to be increasing in abundance and potentially displacing the *O. virilis* at two of the three sites where both species are present. The population of native crayfish, *Orconectes obscurus,* appears to be stable at the one site where they are present. Our continuing research will monitor these populations and examine potential mechanisms used by *O. rusticus* to competitively displace other species of crayfish.

38. The effects of simulated nitrate and salt deposition on soil nitrogen mineralization in a roadside ecosystem.

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Anthropogenic sources of pollution are an increasing issue in a world with an increasing amount of human activity. This is especially true of vehicle and roadway associated pollutants, including nitrous oxides (NO_x), ammonia (NH_3), and salt (NaCl). In roadside ecosystems, these pollutants can have a myriad of impacts, including a potential impact on soil nitrogen (N) mineralization. Our study looked at a roadside ecosystem situated along Interstate Highway 81 (I-81), located in Binghamton, NY. We conducted a five month long simulated deposition study, where $NaNO_3$, NaCl, and a water control were sprayed bi-weekly on 1 m^2 plots, in a blocked one-way ANOVA experimental design. At the end of the experiment, soil samples were collected, and an initial KCl soil extraction was performed along with a 28-day lab incubation. Concentrations of NO_3^--N and NH_4^+-N were analyzed on a Lachat Autoanalyzer. Soils collected near the roadway (0 m transect) had lower soil N mineralization rates and nitrification rates than soils collected far away from the road (60 m transect). Net N mineralization rates were 0.41 and 0.49 mg/kg/day, and net nitrification rates were 0.19 and 0.30 mg/kg/day, at the 0 m and 60 m transects, respectively. There was no treatment effect on soil N mineralization rates over this five-month period. Our study indicated that long-term salt deposition could negatively affect soil N mineralization; therefore long-term experimental study is needed. Soil N mineralization rates and other soil measurements were also quantified in four additional roadside sites, along with atmospheric deposition collections.

39. The relative abundances of native and non-native emydid turtles across an urban to rural habitat gradient in central New Jersey.

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Slider turtles, *Trachemys scripta*, are native to the Mississippi River Basin, northern Florida, and the southeast Atlantic coastal plain of the United States. They have been introduced to several different countries through the pet trade and might negatively impact freshwater ecosystems. Sliders also have many localized, non-native ranges within the United States, including New Jersey. The impact sliders have on New Jersey's native turtle species is unknown. In order to provide an initial assessment of the possible threat slider turtles pose to natives, this study determined the relative abundances of five native emydid turtles versus non-native sliders across an urban to rural habitat gradient in central New Jersey. This was accomplished by identifying and counting turtles via binocular surveys at several sites associated with different degrees of development. Slider turtles were found to be more abundant in developed areas and rare or non-existent in rural areas. The two species that occurred together with *T. scripta,* most frequently, were *Pseudemys rubriventris* and *Chrysemys picta*. Individual sliders were usually outnumbered by these two native turtles when cohabitation occurred. The other three species counted during the study barely occurred with *T. scripta* at all. Because sliders are still associated with areas of human activity and development, it is logical to assume that these areas are original sites of release used by people to rid themselves of unwanted pet turtles. If sliders are remaining near their places of release, then they are not successfully spreading on their own in New Jersey.

40. Phase separation of liquid mixtures: A novel environment-friendly extraction of liquid solvents.

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This research project focuses on developing a novel separation process of liquid-liquid extraction, called Phase Transition Extraction (PTE). This new process is an alternative to traditional liquid-liquid extraction (LLE) processes that require a lot of time to obtain complete separation and a need of mixing with the risk of breaking valuable molecules. In this novel extraction process, partially miscible binary liquids are used that form a homogeneous, one-phase mixture at one temperature, and form two phases, one solvent-rich and the other water rich, at higher or lower temperature. The temperature at which both phases separate is called critical temperature. The advantages of this new process over the conventional liquid-liquid extraction, or LLE, process are: (1) Improved extraction yield: the amount of the final product extracted is much higher than in conventional methods. This is particularly important in the extraction of natural products and fermentation broths. (2) Ability to handle emulsion-forming systems: no stable emulsions are formed that usually slow down the extraction process. (3) Equipment saving: since there is no need to use centrifuges to break stable emulsions, as we do when using the traditional LLE process, the equipment required to perform PTE is only a tank. PTE is significantly cheaper to perform than LLE. (4) Lower product degradation. Any possible shear stress damage to large solute molecules is prevented in the PTE process, where only a mild mixing is required, as opposed to the high centrifugation of traditional LLE. In addition, the fact that in the PTE process a small amount of the native solvent is contained in the extract will help prevent the unfolding of large solute molecules, such as proteins. (5) Replacement of chlorinated solvents. The PTE process is more powerful and versatile and also permits the use of solvents which are environment friendly.

41. Behavioral interactions of two invasive and one native crayfish in the Monocacy River.

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The Monocacy River in Maryland is inhabited by two invasive species of crayfish, *Orconectes virilis* and *Orconectes rusticus*, and one native species, *Orconectes obscurus*. There is concern for the displacement of the native species, and an interest in which invasive will prevail. We conducted a microcosm experiment to investigate effects of substrate on group interactions of *O. rusticus* and *O. virilis*, based on field sampling that demonstrated habitat partitioning. We also conducted dyad trials (paired species behavioral trials) to determine dominance among the three species. *O. virilis* won significantly more fights in a cobble dominated substrate than the gravel dominated substrate in the intraspecific treatment group. Furthermore, *O. rusticus* and *O. virilis* appear to interact differently with conspecifics in gravel-dominated and cobble-dominated substrates, respectively. Neither *O. rusticus* nor *O. virilis* established dominance over the other in the microcosm trials. However, in the dyad trials, *O. virilis* was dominant over both *O. rusticus* and *O. obscurus*, while *O. rusticus* was dominant over the *O. obscurus* crayfish. The number of grabs/strikes performed by a crayfish did not predict dominance and there was an overall negative correlation between the number of grabs/strikes and dominance. The native crayfish demonstrated longer encounter time, higher numbers of grabs/strikes, lower intensities, and lower numbers of interactions than the two invasive species. Further research is needed to more accurately predict dominance under field conditions, and to determine what other factors will affect future displacement of the native species.

42. Characterizing the distribution of planktonic fecal bacteria in the James River along an urban gradient in Richmond, Virginia.

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High population density, outdated wastewater infrastructure, precipitation runoff from impervious surfaces, and industries increase chemical and microbial loadings to urban rivers. Fecal microorganisms introduced by these sources are a major health concern, and represent potential causes of waterborne disease outbreaks through primary and secondary contact. Standard EPA culture-based methods were used to characterize the distribution of *E. coli* and fecal coliforms at 14 sites along the James River through Richmond, VA during 2009-2010. Samples were also analyzed for physicochemistry and nutrients. Using effects screening and standard least squares analysis, a mathematical model was formed to predict concentrations of *E. coli* (R^2=0.65, p<0.0001) and fecal coliforms (R^2=0.65, p<0.0001) at these sites based on field measurements, recent precipitation, location, and river discharge. *E. coli* and fecal coliform concentrations correlated strongly (p<0.0001); further, recent precipitation and the location of the site along the urban gradient strongly and positively influenced the concentration of these organisms. This model permits instantaneous and reasonable estimation of fecal contamination of the river, and associated public health risks, even in the absence of any microbiological assessment. Ongoing work on preserved samples will use PCR and multiplex-PCR methods to determine the suitability of *E. coli* and fecal coliforms as indicators of five specific enteric pathogens: *E. coli* O157:H7, *Campylobacter spp*., *Salmonella spp.*, *Shigella spp.* and *Enterococcus faecium*. Combined, these methods may permit more sensitive and accurate risk estimates for occurrences of specific waterborne illnesses.

43. Growth responses of three wetland plant species under single and multi-pollutant wastewater conditions.

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Urban wetlands receive storm runoff that contains contaminants from many different pollutant classes (e.g. nutrients and heavy metals), yet most studies focus on the remediation of single pollutants or pollutant classes. The objective of our research was to evaluate three common wetland plant species' (*G. grandis, T. latifolia* and *S. latifolia*) growth responses to single and multi-pollutant wastewater types. We planted six replicate blocks within the research greenhouse at Binghamton University, NY. Planted and sediment only plots were treated weekly with one of 3 treatment solutions (nitrate [NO_3], metal mixture [Zn, Cu, Pb, Cd], or nitrate and metal mixture). Effluent was collected weekly to determine NO_3-N efflux. After 12 weeks, roots and shoots were harvested to determine total aboveground and belowground biomass and N, P, Zn and Cu accumulation. Sediment was collected to determine net N-mineralization rates. We found that experimental treatments had no negative affect on plant growth and nutrient (N, P) content. However, we found significant variation in biomass production, N and P sequestration across the plant species. Efflux NO_3-N was reduced by both plants and sediment and net N-mineralization rates were unaffected by experimental treatment. However, plant presence caused significantly higher N-mineralization rates and reduced efflux NO_3-N significantly more than sediment alone. Our findings indicate that wetland plants can grow well under single and multi-pollutant conditions and that optimal ecosystem function in urban wetlands would more likely occur in systems with multiple species assemblages.

44. Behavioral aggression interactions and aggression levels between juvenile *Orconectes rusticus* and *Orconectes virilis*.

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Orconectes rusticus, a crayfish species native to the Ohio River Valley, is expanding its home range and has recently been found as far south and east as the Monocacy River, Frederick County, Maryland. In the Monocacy, the most abundant crayfish, *O. virilis*, is being displaced as *O. rusticus* invades the river. A possible reason for this trend is that *O. rusticus* obtain superior resources due to higher aggression levels and behavioral dominance. We examined aggression levels and behavioral dominance of juvenile *O. rusticus* and juvenile *O. virilis* through interspecies and intraspecies, head to head, size matched agonistic bouts. Juvenile *O. virilis* exhibited higher aggression levels and also won behavioral dominance over juvenile *O. rusticus* in our trials. Our results suggest that juvenile aggression and behavioral dominance is not the mechanism *O. rusticus* uses to outcompete *O. virilis,* therefore, other life history and ecological mechanisms should be explored.

45. Effects of algal diversity on lined shore crab preference and performance.

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Consumers often exhibit preferences for certain types of foods, and there is evidence that diet can affect consumer fitness; however, how preference and performance correlate is less well understood. In this study, we fed the lined shore crab, *Pachygrapsus crassipes*, mixed and non-mixed diets of five species of algae to determine the crab's preference for and performance, or growth, on different algal diets. *Pachygrapsus* preferred certain species of algae over others and grew more when fed a mixed diet rather than some non-mixed diets. Optimal diet theory helps to explain this finding, but other possible reasons for *Pachygrapsus* to exhibit diet preference and differing growth rates when fed different diets are algal toughness, toxin load, and presence of meiofauna. As crab preference and performance both depend on algal composition and species identity, there is a potential for feedbacks between lined shore crab abundance and intertidal algal composition.

46. Trophic transfer of heavy metals and avian feeding ecology in an urban brownfield.

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The objective of this study is to assess the habitat quality of a polluted urban forest. Urban wildlands provide valuable habitat for birds; however, it is vital to determine if these habitats impart a greater risk than benefit to the species they attract. Our study was conducted at a brownfield in Liberty State Park (LSP) in New Jersey. Research has shown that insectivorous house wrens are accumulating heavy metals at LSP. To determine how metals are entering the wrens' food chain and if these metals are biomagnified, we collected invertebrates from nesting sites throughout our study area and analyzed the samples for metals. We further investigated avian feeding ecology at LSP by determining how dependant birds are on invasive versus native fruiting plants. We conducted point counts at fifty sites and recorded the number of birds that fed from native and invasive fruits. Fruit samples from five species of native and invasive plants were tested for heavy metals. Results of the invertebrate analysis show that metal concentrations are generally higher in predatory invertebrates than in herbivorous invertebrates indicating bioaccumulation of heavy metals in the food chain. Results of the fruit analysis show interspecific and intraspecific variation in metal load; however, only Cu was found in concentrations above the minimum detection level. No significant differences were found between avian use of native and invasive fruiting plants. Birds preferred large fruiting trees over shrubs and vines. Therefore, avian preference of fruiting plants is more likely based on plant morphology than plant origin.

47. Elongation of cotyledonary petiole allows chestnut oak acorns to escape predation of rodents.

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The early germination of white oak species is widely interpreted as a general adaptation to escape predation by rodents. Rodents, however, frequently harvest acorns by separating the acorn from the anchored taproot. Here we report how acorns of chestnut oak (*Quercus prinus*), a common white oak species in the eastern USA, successfully escape acorn damage and radicle pruning by rodents and eventually produce seedlings even after removal of the acorn. During germination, chestnut oak acorns develop an elongated cotyledonary petiole, which extends well beyond the apical end of the acorn (1-2 cm) to the point at which the epicotyl and radicle diverge. However, rodents (e.g., squirrels) often prune the taproots above (embryo excision) or below the embryo (taproot cutting) when eating or caching these acorns. We simulated rodent pruning by removing the entire embryo or cutting off the taproot at different stages of acorn germination to evaluate the capacity for these taproots to regenerate. Preliminary results showed that the pruned acorns still containing the embryo germinated into seedlings regardless of the length of taproots removed. However pruned taproots with a cotyledonary petiole containing the embryo also successfully germinated and survived, provided these taproots were > 4 cm in length. Taproots without an attached embryo also were observed to produce new lateral roots and may eventually regenerate into seedlings. We predict that the elongated cotyledonary petioles typical of most white oak species, but not found in red oak species, represent an adaptation for escaping even severe rodent damage and predation.

48. Microhabitat use by songbirds on a capped landfill during three autumn migration seasons.

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Little is known about the usage of capped landfills as stopover sites for migrating songbirds. Mist net surveys were conducted during three autumn migration seasons, 2008, 2009, and 2010, at the Erie Landfill in Lyndhurst, New Jersey. Specifically, bird activity was surveyed in three microhabitats, each characterized by a different dominant plant species: a) *Artemisia vulgaris* (common mugwort shrub)*;* b) *Populus deltoides* (Eastern cottonwood tree)*;* c) *Robinia pseudoacacia* (black locust tree). Results reveal that capped landfills may provide critical stopover sites for migrating songbirds. The surveys yielded 2,058 captures of 70 bird species over 38 survey days during the fall 2008 migration, 2,721 captures of 62 species over 35 survey days during the fall 2009 migration, and 2,153 captures of 69 species over 37 survey days during the fall 2010 migration. Activity of the most common bird species (e.g., *Passerculus sandwichensis* (savannah sparrow), *Melospiza melodia* (song sparrow), *Melospiza georgiana* (swamp sparrow), *Spinus tristis* (American goldfinch)) was generally highest in the common mugwort patches – but patterns of microhabitat usage varied widely among different bird species and years. The complexity of trends, which are most likely influenced by a combination of spatial/temporal trends in food supply and the dietary/cover needs of different bird species, suggests that significant microhabitat diversity will best serve restoration efforts that aim to improve bird habitat on capped landfills.

49. Biodiversity as a goal? Semi-natural assembly of restored upland vegetation.

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Ecosystem restoration aims at recreating natural states in perturbed environments. Often it is not clear how much human intervention is needed to guide recolonizing communities towards a prescribed restoration goal. The revegetation of a remediated former chromate-polluted urban brownfield at Liberty State Park, NJ, provided a "natural experiment" to follow almost natural assembly. Following largely failed seeding attempts, we followed the unaided vegetation assembly on a 125 acre upland and wetland habitat for 3 years since remediation. The vegetation developed extremely high species richness in the first year, that appears to be unparalleled in the region, and consisted of a mixture of native and non- native species. In later years the vegetation stabilized towards relatively species-rich communities, however, now they are dominated by native species. Besides representing an esthetically pleasing hotspot of urban plant diversity, the upland areas provide migration stop-over and foraging habitat for a wide range of open-habitat birds (e.g., native sparrows). The question is raised whether less forced restoration efforts can achieve goals of restoration and what these goals actually are and should be.

50. Clonal diversity and resistance to invasion in remnant salt marsh patches

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Use of appropriate local ecotypes of species in restored communities and inclusion of genotypic information is critically important in restoration ecology. East Coast marshlands, such as the Hackensack Meadowlands, are extensively invaded by a non-native, European genotype of the common reed, *Phragmites australis*, resulting in only a remainder of isolated patches of native *Spartina patens*. As these patches vary in size and seem to resist encroachment by *Phragmites* differentially, we investigated whether larger patches are able to resist invasion more than smaller patches and are better-suited for restoration efforts. Through transects, competition and common garden transplant experiments, genetic and chemical analysis, we monitored border dynamics and assessed performance of differential patch sizes. Results indicate genetic differentiation between large and small-patch clones and greater clonal diversity in large patches. Further, these distinct clones have differential competitive capacities. Border zones between the invader and *Spartina* are more defined in large *Spartina* patches, and *Spartina* increases in dominance at large-patch borders but decreases in small-patch borders. Also, large-patch *Spartina* is able to reduce growth of invading *Phragmites* fragments and is less reduced by it. We conclude that small patches are not the remnants of the formerly extensive, homogenous stands, rather, the current mosaic of patches is the result of differential invasion-resistance. Mechanistic questions remain as clone-specific root exudates were explored but no clear differences were found. Our results strongly suggest that some genetically-defined *Spartina* clones are more suitable for restoration efforts than others, a notion that has strong implication for future restoration projects.

51. Characterizing microsatellite DNA diversity of rusty crayfish in Maryland.

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The rusty crayfish (*Orconectes rusticus*) has been seen in the Monocacy River in Maryland since 2007 and in Antietam Creek since 2010. This species is indigenous to the Midwestern United States and presents problems for plants and animals in the Monocacy. Rusty crayfish were likely transported to non–native waters by fishermen using them as bait and releasing them alive. Hood College and the Maryland Department of Natural Resources have been documenting crayfish distribution in order to assess the effects of the species' invasion and to track its spread. We are using genetics to assist in these efforts. A former Hood College student (Ann Neeley) characterized four genetic markers, microsatellite DNA loci, in 79 rusty crayfish from the Monocacy River and found that genetic diversity may be high. I supplemented this previous study by increasing the sample sizes, adding a fifth locus, and expanding the range of sampled individuals to include a new site, Antietam Creek. I hypothesized that rusty crayfish have high microsatellite diversity and show no differentiation over their range in the Monocacy. I also hypothesized that the Antietam Creek population is genetically distinct; it probably was established by a separate introduction event. Understanding genetic variation of rusty crayfish may give insight into their evolution in a new habitat and their ability to invade other ecosystems. An increased understanding of their population dynamics can influence management tactics for the ones already established in Maryland.

52. Effect of heavy metals on photosynthesis in *Betula popufolia* and *Populus deltoides* in contaminated urban brownfields, at Liberty State Park, New Jersey, USA

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With increasing rates of urbanization and increasing CO_2 levels in the atmosphere, structure and function of urban brownfield sites need to be investigated. Urban brownfields in Liberty State Park, New Jersey, are one example where heavy metal contamination has affected the vegetative assembly and productivity in this ecosystem. Previous studies have shown that *Betula popufolia* and *Populus deltoides,* two dominant species in the ecosystem, accumulate zinc in the leaves. We analyzed A/C_i (net assimilation (A) *versus* internal stomatal CO_2 concentration) and light (PAR) response curves (A *versus* PAR) from gas exchange measurements in leaves of *B. popufolia* and *P. deltoides* at three different canopy levels once a month over the growing season in 2010. The compensation of CO_2 points for *B. popufolia* and *P. deltoides* were generally higher with a maximum of 148 µmol CO_2/mol in *B. popufolia*. The results show that photosynthesis saturation levels with C_i and irradiance were not significantly different between *B. popufolia* and *P. deltoides* (p= 0.31). Stomatal conductance in *P. deltoides* was relatively insensitive to changes in PAR, as compared to *B. popufolia* where it increased initially with increasing PAR before saturating. The results indicate that the photosynthesis process is limited due to increased CO_2 compensation points and behavior of stomatal conductance in brownfields. A better understanding of factors affecting the plant productivity in these ecosystems is not only critical for studying the metal and nutrient cycling but also understanding the potential of these ecosystems to serve as a carbon sinks.

53. Ecophysiological study of native *Spartina alterniflora* and invasive *Phragmites australis* in a restored salt marsh of New Jersey, USA

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In recent decades, many northern American marshes dominated by native *Spartina alterniflora* (saltmarsh cordgrass) have been invaded by exotic *Phragmites australis* (common reed) having a negative impact on native community that has received considerable amount of attention for more than a decade. To see whether the two species differ in their ecophysiological parameters, we analyzed monthly A/C_i curves (curves generated by plotting net photosynthesis (A_{net}) against internal stomatal CO_2 concentration (C_i)), and light-response curves for both species during July to September of 2010 in a restored salt marsh. The measurements were made at three different canopy heights (bottom, middle and top). The carboxylation efficiency (CE) was higher for *P. australis* than for *S. alterniflora* (0.07 to 0.12 for *P. australis* and 0.06 to 0.11 for *S. alterniflora*). The photosynthesis in *S. alterniflora* saturated well below the present atmospheric CO_2 concentration (around 300 ppm, which correspond to 200 ppm C_i value), where as photosynthesis continued to increase above the current CO_2 concentration in *P. australis.* The dark respiration calculated from photosynthesis light-response curves showed that the respiration was consistently greater in *S. alterniflora* than in *P. australis* (1.43-2.75 µmol CO_2 m^{-2} s^{-1} in *S. alterniflora* and 0.35 to 2.12 µmol CO_2 m^{-2} s^{-1} in *P. australis*). Hence, higher CE values, lower dark respiration, higher CO_2 concentration for saturated photosynthesis and low light compensation point in *P. australis* are some of the likely characteristics that have assisted this plant to invade *S. alterniflora* dominated native vegetation of salt marshes.

54. A hexagonal grid layer for geographic information systems: Applications in ecological modeling and land-use planning.

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The US Environmental Protection Agency (USEPA) produced a hexagonal tessellation of the conterminous United States in the 1990s as part of the sampling protocol for the Environmental Monitoring and Assessment Program (EMAP). An array of hexagons is isotropic, provides even spatial coverage, and is less likely to be coincident with anthropogenic features such as parcel boundaries or roads. Nested hexagon grids of larger and smaller scales can easily be generated. In previous work, we described a hexagon-based model of terrestrial wildlife habitat suitability for Montgomery County, New York. Each hexagon had an area of approximately 10 square kilometers, an analysis unit corresponding to scales at which many conservation data sets can be used – including hydrographic features, roads, and Natural Heritage Program records – and coarse enough to encompass a mosaic of landscape features. Building on this effort, we have produced a state-wide hexagonal grid at the same scale, using the original EMAP grid algorithm to generate hexagon vertices, and ESRI *ArcMap* 9.3.1 to create the hexagons from the points and project them to the NYS UTM coordinates. We edited individual hexagons to remove gaps or areas of overlap. The final feature class is therefore topologically correct, with 13121 hexagons covering New York State (mean area = 1013.3 ha ± 0.1 %.) We will demonstrate potential applications for ecological modeling and land-use planning, including assessment of the spatial distribution of energy development footprints at multiple scales.

55. Does spatial variation in prey resources influence morphological variation among subpopulations of eastern newts?

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Significant phenotypic variation is often observed among populations of a single species. Such intraspecific variation may be generated by differences between habitats, either directly through environmental influences on phenotypes or indirectly through the effects of selection on gene frequencies. Identifying relationships between phenotypic variation and environmental variables is a necessary step before determining whether differences are mainly the result of environmental or genetic influences. Eastern newts in central Pennsylvania occupy ecologically-divergent habitats, including both vernal pools with dense tadpole populations and large beaver ponds with few small tadpoles. We measured the mass, body length, and head width (gape size) of newts from 12 ponds. We expected newts from ponds with high tadpole densities to be heavier and longer, due to the abundant prey, and to possess wider heads to enhance their capacity to feed upon tadpoles as they grow. Alternatively, shorter time periods spent in temporary ponds may reduce annual growth rate and result in smaller sizes. We found that the presence and abundance of small tadpoles (potential prey) was associated with the mass, body length, and head width of newts. The data suggests that mass is correlated with food resources within the pond, and head width is associated with prey within complexes of multiple ponds, a possible indication that head width is genetically influenced and constrained by gene flow. Future research will involve expanding the number and geographic extent of the study ponds and raising newts in a common laboratory environment.

56. Development of a rapid method for detection of bloom-forming cyanobacteria and algae in selected New Jersey waterbodies.

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Harmful algal blooms, that have been reported in many parts of the world, are affecting water quality, climate change, and human and animal health. Timely intervention against the algal blooms depends on the early detection of bloom-forming algae and cyanobacteria. The objective of this study was to develop a PCR based assay for rapid detection of potential freshwater algal blooms. In this study, water samples were collected from 15 lakes in northern New Jersey and were processed through both coarse (3.0µm) and fine (0.45µm) filters. Both filters were dried and then frozen at -20^{0}C. Small segments of the filters were randomly selected; organisms on the selected filter segments were re-suspended in water for microscopic identification. No conclusive results could be determined regarding the distinction and identification of the algae and cyanobacteria based on their morphology. Two genes of interest, cyanobacterial phycocyanin and16S rDNA genes, were selected for polymerase chain reaction (PCR) analysis using three different primers. The primer pairs used in this study included: CPC1F/CPC1R, specifically for cyanobacterial phycocyanin gene; 27FB/785R, for 16S rDNA in bacteria and photosynthetic plankton; and 27FB/PSr, for 16S rDNA photosynthetic plankton. A rapid DNA extraction protocol (using 5% chelex-100) was performed for the various laboratory cultures and freshwater samples, all of which was followed by a PCR based assay. Cyanobacteria and algae were detected through microscope observations and PCR based assay. Results suggested that the three primers can be used to quickly detect the presence of cyanobacteria and/or algae in water samples.

57. Energetic efficiency: optimal shape of territories with application to modeling species-habitat relationships.

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In an energetics context, a circle is the optimal shape in horizontal space for an all-purpose territory. This is the result primarily of two properties of circles: 1) A circle has the minimum perimeter to area ratio; therefore, it has the minimum amount of border per unit area to defend against conspecifics; and 2) it has the shortest average distance between points within it, which optimizes foraging. Few, if any, landscape metrics directly consider (energetically) optimal habitat shape from this species-centric perspective, and no variables in widely available GIS metrics packages such as FRAGSTATS consider size, optimal shape and habitat type simultaneously. This presentation will review two GIS variables developed to address this shortcoming and illustrate their explanatory power in modeling the presence and abundance of several species of breeding birds. These types of predictive species-habitat models can be applied to the design of reserves for listed species, management of game and nongame species on public lands, or restoration / creation projects targeting habitat for specific taxa.

58. Using educational seining programs to enhance knowledge of aquatic biodiversity.

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St. Francis College (SFC) has partnered with the Brooklyn Bridge Park Conservancy and the Beczak Environmental Education Center in an effort to teach SFC students about aquatic biodiversity through seining. By assisting with "Catch of the Day" data collection (often conducted by K-12 school groups), and examining past collection data, students have compiled species lists, richness, evenness and diversity. The latter, species diversity, was determined by using the Shannon Weiner Diversity index. As the two environmental education programs are almost twenty miles apart in proximity, it has been interesting to note similarities and differences both spatially and temporally. The BBPC has also planted *Spartina* spp. (Fall 2010) in an attempt to create a salt marsh. Comparisons of the salt marsh at both locations will be elucidated as well.

59. Invasive Plant Management using Hydroraking at the New Jersey School of Conservation

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Lake Wapalanne is a shallow oligotrophic lake in Montclair State University's New Jersey School of Conservation located at Sandyston, NJ. The lake was observed to be overgrown with an invasive plant species, Eurasian water milfoil (*Myriophyllum spicata*), and an invasive plant management program using hydroraking began in summer 2009. In summer 2010, the management program hydroraked five cubic meters of sediments and plant, predominantly Eurasian water milfoil. This study investigated the changes in distribution and abundance of water milfoil in Lake Wapalanne as a result of hydroraking. Water transparency and total suspended solids were measured prior to and post hydroraking to examine the impacts of hydroraking on water clarity. A significant increase in total suspended solids and a decline in water transparency were observed one week after the hydroraking. The lake was observed monthly following the hydroraking. Hydroraking was observed to have limited impact on water transparency and total suspended solids after the completion of the management activity. Hydroraking was found to successfully remove the invasive Eurasian water milfoil in the target area. However, the results of post monitoring Eurasian water milfoil populations found that the plant populations recovered quickly. This might have been a result of the species' high growth and dispersal rates. Identifying other alternative management options to successfully manage this invasive plant population is strongly recommended.

60. A tail of two newts: Aquatic tail size carries-over but does not impair terrestrial locomotion in eastern newts (*Notophthalmus v. viridescens*).

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Individual organisms experience regular environmental changes during a lifetime. Some species utilize phenotypically flexible traits, adjusting phenotypes to match shifting optima. Traits failing to change as rapidly as the environment may be costly, as they carry-over between seasons and can cause a mismatch with the optimal phenotype. We used eastern newts (*Notophthalmus v. viridescens)*, to determine whether a phenotypically flexible trait, tail size, carries-over between breeding and non-breeding phases and the impact of tail size on locomotor performance during both phases. Newt tail size beneficially increases during the aquatic (breeding) phase and decreases in the terrestrial (non-breeding) phase, with males displaying a more dramatic difference in size. Failure to reduce the tail when returning to land could decrease fitness. To determine the effects of tail size carry-over, we measured tail area and tested locomotor performance at each phase. We found a strong correlation between tail area in the aquatic and terrestrial phases, suggesting a carry-over between environments. A positive relationship between tail size and locomotor speed in the aquatic phase was observed. No relationship was present between maximum locomotor speeds in aquatic and terrestrial phases, indicating no apparent fitness cost. Instead, we propose that other, untested costs of larger tails in the terrestrial environment will explain tail size variation during the aquatic phase. Future research may investigate potential physiological costs of tail size between phases. We maintain that different phenotypic optima exist between the aquatic and terrestrial phases, favoring the seasonal change in tail size.

61. Comparison of heat balance (Cermak) and thermal dissipation (Granier) sap flow measurements in ring-porous oaks and a pine species

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Sap flow measurements have become integral in many physiological and ecological investigations. There are a number of methods to estimate sap flow rates, but probably the most popular is the Granier, thermal dissipation method because of its affordability and ease of use. However, the validity of the Granier system in ring porous species and the necessity of species-specific calibrations have been questioned. We made concurrent measurements of sap flow rates using Granier sensors and the Čermák, heat balance method in two oak species (*Quercus prinus* and *Quercus velutina*) and one pine species (*Pinus echinata*). Measurements using 1cm and 2cm long Granier-style sensors were also made in both oak species. We found that both systems matched well in the pine species, but sap flow rates were underestimated by the Granier system in the two ring-porous oak species. Underestimation of sap flow rates by the Granier system was nonlinear and increased at higher flow rates. We also found that 2cm long Granier sensors tended to underestimate flow rates compared to 1cm long sensors and these underestimations also increased at greater flow rates. These results suggest that 1cm long sensors are appropriate for use in ring porous species and 2cm long sensors are appropriate in species with deeper sapwood like pines. This study shows that as long as the appropriate methodologies are taken, the Granier method can provide reliable sap flow data that can be useful in better understanding water use in both individual species as well as whole tree stands.

62. Canopy stomatal conductance under drought, disturbance and death

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Sap-flux scaled canopy conductance (G_C) was used to evaluate the effect of drought, disturbance and mortality on three oak species in an upland oak/pine stand in the New Jersey Pine Barrens from 2005 to 2008. Since stomatal conductance controls carbon and water fluxes in forest ecosystems, its accurate characterization in land surface flux models is necessary. Canopy conductance was analyzed by performing boundary line analysis, selecting for the highest value under a given light condition. Regressing G_C with the driving force vapor pressure deficit (VPD) resulted in reference canopy conductance at 1 kPa VPD (G_{Cref}). Predictably, drought in 2006 caused G_{Cref} to decline. *Quercus prinus* was least affected, followed by *Q. coccina* with *Q. velutina* having the highest reductions. A defoliation event in 2007 caused G_{Cref} to increase due to reduced leaf area and possible increased water availability. *Q. prinus* quadrupled in G_{Cref}, doubled in *Q. velutina* and increased by 50% in *Q. coccina*. Canopy mortality in 2008 led to higher G_{Cref} in *Q. prinus* but not *Q. velutina* or *Q. coccina*. Comparing light response curves of canopy conductance (G_{Cref}) and stomatal conductance (g_S) derived from gas-exchange measurements showed marked differences in behavior. Canopy G_{Cref} failed to saturate under ambient light conditions whereas leaf level g_S saturated at 1200 µmol m^{-2} s^{-1}. The results presented here emphasize the differential responses of leaf and canopy level conductance to saturating light conditions and the effects of various disturbances (drought, defoliation and mortality) on the carbon and water balance of an oak-dominated forest.

63. Productivity and plant diversity of naturally colonized green roofs in New York City.

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The New York metropolitan area, the largest urban area in North America, could potentially benefit from widespread installation of green roofs, but adoption requires regionally-specific information for optimization. We asked the following questions: (a) what plants will naturally colonize un-planted green roofs, and (b) how does substrate depth affect productivity and colonization? To address these questions, we compared deep versus shallow green roof simulation plots on eight rooftops scattered across the five boroughs of New York City. The un-planted plots were constructed in late May 2010. In late August all plants that colonized the plots during the study period were identified to species and above ground biomass collected. About 21% of plots were colonized by at least one plant species, and deep plots were colonized 34% more often than shallow plots. Thirty-four different plant species were identified including graminoids, woody plants and forbs across all eight rooftop with each rooftop averaging 12.625 plant species. Of the species identified, 55% occurred on more than one rooftop, with *Digitaria sanguinalis*, crabgrass, found on all rooftops. *Panicum miliaceum*, millet, a grain producing grass was identified on 75% of rooftops. The maximum above ground net primary productivity (ANPP) was 630.48 g/m^2/yr while mean ANPP across all plots (deep and shallow) was 62.43 g/m^2/yr. Productivity of the deep treatment was ~35% greater than the shallow treatment. ANPP of ~600g/m^2/yr is similar to that of the Great Plains ecosystem, and demonstrates the need for further investigation into the potential of green roofs to sequester carbon.

64. Allometric relationships of *Betula populifolia* under conditions of soil metal induced stress.

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In an attempt to monetize carbon accumulation, regionalized metrics for afforestation offset projects have been developed. Such a general approach is thought to be acceptable as the allometric relationships of many forest species have been fairly well documented. However, forest carbon dynamics is not only a function of climate and edaphic conditions but also of stand history, and stress induced by abiotic filters such as disturbance, pests and soil contamination. These site-specific differences have been shown to result in corresponding growth difference. We examine allometric and mass relationships in *Betula populifolia* that occur in a urban brownfield site with a known soil metal gradient. Tree trunk taper was not found to vary by site. A positive ordinary least squared regression, pooled across sites, was identified. Site conditions did not appear to impact the mass to diameter relationship. However, the log-log standard major axis regression between branch mass and branch diameter indicates significant differences between sites. There was also considerable variability in the tree growth parameters (DBH / height and age) between the four sites. These results raise questions concerning the validity of the using regional scale metrics when justifying carbon allocation credits.

65. Marcellus Shale Gas Impacts on Pennsylvania Wetlands and Streams

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Development of widespread shale gas threatens water resources in most Pennsylvania counties. Existing laws on paper afford some protection to streams and wetlands, especially any that have been recognized as having Exceptional Value (Clean Water Act Tier 3 waters). Proactive regulation to minimize damage, however, is nonexistent at the local, State, and Federal levels. A measure of remediation can sometimes be obtained after-the-fact, but only when landowners or conservation groups take the initiative to compel compliance by permittees after having compiled baseline, pre-drilling information as the basis for lawsuits. The burden rests with the damaged parties, not those who seek to profit handsomely from gas development.

In practice, water resource protection is virtually nonexistent in Pennsylvania. The locations and characteristics of most wetlands are unknown, and there is no requirement that they be delineated or assessed during oil and gas well permit "review" or protected from unnecessary filling and draining. Actual attained uses in streams potentially affected by dewatering, spills, roads, and pipelines are almost never identified, despite existing regulations "requiring" investigation every time a permit is requested. Unknown water resources are ignored during well and infrastructure construction.

Pennsylvania's inability to protect water resources from new technology continues its non-regulation of longwall underground coal mining. After 16 years some information at last is being required as part of mine permit applications, but it is still ignored during permit review. Gas development, like that of coal, will leave to future generations an impoverished landscape.

66. Field & laboratory investigation of fire influenced chlorite weathering in an inceptisol.

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Soil was analyzed for clay mineral alteration and textural modifications following a 2009 prescribed burn of a brush pile at the Double N Farm in Warren County, New Jersey. Weathered chlorite and increased clay sized particles were observed in soils sampled underneath the burn pile 3 months post-burn at depths below 30cm, just above a restrictive lithic bedrock layer. It was suggested that alteration of chlorite was a result of changing pH, due to the input of ash, in water pooling at the restrictive layer. These results led to the development of a laboratory study to model chlorite weathering at depth under post-fire conditions. Clay alteration, texture, and pH of laboratory soil were analyzed over a 3 month period, following ash and rainwater treatment to simulate field conditions during the 2009-2010 field study period. Preliminary results indicate significant variation in mean pH values in control and ash-treated soil 1 week and 3 months post-treatment. It is expected that chlorite will exhibit increased weathering, as a result of modified pH due to ash and rain water input, corollary to previous field results.

67. Genetic diversity and population structure of *Vallisneria americana* in the Chesapeake Bay: Implications for restoration.

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Submersed aquatic macrophyte beds provide important ecosystem services, yet their distribution and extent has declined worldwide in aquatic ecosystems. Effective restoration of these habitats will require, among other factors, reintroduction of genetically diverse source material that can withstand short- and long-term environmental fluctuations in environmental conditions. We examined patterns of genetic diversity in *Vallisneria americana* because it is a cosmopolitan freshwater submersed aquatic macrophyte and is commonly used for restoring freshwater habitats. We sampled 26 naturally occurring sites of *V. americana* in the Chesapeake Bay estuary and its tributaries and found that the majority of sites are not highly inbred and have high genotypic diversity and are not highly inbred. Fourteen of the sites had high allelic and genotypic diversity and could serve as source sites for restoration material. However, substantial geographic structuring of genetic diversity suggests that caution should be used in moving propagules to locations distant from their source. In particular, we suggest that propagules at least be limited within four primary geographic areas that correspond to freshwater tidal and non-tidal, oligohaline, and seasonally mesohaline areas of the Chesapeake Bay.

68. Use of remote sensing and satellite imagery to monitor change in landscape ecology due to construction of mega dams

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Dams in general, and mega dams in particular, are controversial. Due to their considerable impact on the area in which they are built, decisions regarding the construction of such large structures generate passionate debates. The effects of dam construction are sensed by humans as well as all living creatures, including birds, animals, fish, and soil-residing microorganisms. Dam construction is impacted by competing environmental, economical, cultural, and political factors. Each and every project is different in nature but experience accumulated from the construction and operation of existing dams could be useful in designing new ones. Mega dams are constructed to serve one or more of the following functions: flood control, hydropower generation, water storage, ameliorate navigation in turbulent rivers, regulate irrigation water, or recreational activities on the artificial lake forming in the upstream side of the dam. In the early decades of the 20th century, planners and designers were concerned about the effect of the environment on the built dam rather than the effect of a dam on its surrounding environment. This view has completely reversed with further awareness and better understanding of aspects related to dam construction. This knowledge has been enhanced with the great advancements in remote sensing and satellite imagery where the change in land-cover can be observed and studied. This presentation will demonstrate these changes using examples from the sites of some of the world's largest dams such as the Three Gorges Dam in China, High Aswan Dam in Egypt, Tucurui Dam in Brazil, Tarbela Dam in Pakistan, and the Grand Coulee Dam in Washington State.

69. Developing a podcast trail guide for Nuangola Bog, Luzerne County, PA

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The development and maturation of new digital technologies have great potential to improve the public's understanding of natural history and ecology. For the past four years, faculty and students at Wilkes University in Wilkes-Barre, PA have engaged in a Podcast Trail Guide initiative. Students have created image-enhance podcast series for selected trails in northeastern Pennsylvania. This project involves creation of a podcast trail guide for Nuangola Bog, which is a cranberry bog owned by Wilkes University in central Luzerne County, immediately south of Lake Nuangola. This guide consists of fifteen episodes, each lasting 45-100 seconds, covering a diversity of topics including lake formation and ecology, plants and animals of the bog, and human impacts. Each episode consists of spoken narration and digital images pertaining to the topic under discussion, and will be linked to a station marker at the site. The podcasts are made available free of charge at Wilkes University's iTunesU website (http://itunes.wilkes.edu). We seek to develop a collaborative of podcast trail guide creators, and welcome partners.