

*Abstracts of the*

**Mid-Atlantic Ecology  
Conference**

**“Ecology in the Field”**

April 8-9, 2006

New Jersey School of Conservation  
Branchville, New Jersey

*Mid-Atlantic Chapter of the  
Ecological Society of America  
(MAESA)*

\* indicates presenter

BARRETT, K.R.\* (1), and M.A. McBRIEN (2)

**Chemical and biological assessment of an urban, estuarine marsh in northeastern New Jersey, USA**

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Oritani Marsh in the Hackensack Meadowlands of urbanized northeastern New Jersey USA was assessed in 2000 for vegetation, soil/sediment chemistry, abundance/diversity of benthic invertebrates, and bird and mammal usage. Vegetatively, both marsh and uplands are dominated by tall, dense *Phragmites australis*. Small patches (less than 2 ha total) dominated by *Spartina* spp. were found at the lowest elevations. Soil/sediment cores were sliced into 5 intervals and analyzed for metals, pesticides and volatile/semivolatile organic compounds. Thirteen locations had at least one chemical above Long et al.'s (1995) "Effects Range-Median" (ERM). Seven metals and nine organics exceeded ERM in at least one sample, with mercury showing the most exceedances. The surface 15 cm interval was generally more contaminated with metals than the 15 to 30 cm interval; the reverse was true for semivolatile organic compounds. Twenty taxa of benthic macroinvertebrates were collected, with each location producing from 1 to 9 taxa. Abundance ranged from 11 to 3,889 individuals/m<sup>2</sup>. Number of taxa was moderately ( $r^2$  between 0.40 and 0.70) negatively correlated with zinc, beryllium, nickel and arsenic concentrations; no other chemical's  $r^2$  was above 0.25. Diversity was moderately negatively correlated with arsenic and beryllium. These correlations were unexpected: zinc, beryllium, nickel and arsenic were not the chemicals found at the highest concentrations relative to benchmarks. Number of taxa, abundance and diversity were moderately (negatively) correlated with elevation; organic carbon was moderately (positively) correlated with abundance. All other correlations were weak ( $r^2 < 0.35$ ). Live traps captured only one mammal species, the meadow jumping mouse. Bird observations revealed 39 species, dominated by a few common species.

BAZARSKY, A.\*(1), S. TOLERICO (1), C. YURKON (1), M. STEELE (1), S. MARINO (1), J. MOORE (2), and R. SWIHART (3)

**Interactions between small mammals, oaks, and weevils: Are infested seeds dispersed?**

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(2) Duke University Marine Laboratory, Beaufort NC  
(3) Dept. of Forestry and Natural Resources, Purdue University, West Lafayette IN

Seed dispersal is a critical stage in the life history of many plant, including the oaks (*Quercus* spp.). Scatter-hoarding mammals disperse and cache acorns in sites

suitable for germination significantly influencing establishment of oaks. Such positive effects, however, are likely tempered by the activity of insect seed predators (e.g., weevils, *Curculio*). Here, we conducted a field experiment to determine how infestation by weevils affects oak dispersal by small mammals (*Sciurus carolinensis* and *Peromyscus leucopus*). Using a system of semi-permeable exclosures, we selectively provisioned mice and tree squirrels separately at five locations in three sites in northeastern Pennsylvania. At each of the 15 locations, mice and squirrels were each presented with patches of 45 infested and 135 non-infested acorns. We hypothesized that (1) non-infested acorns would be selectively dispersed and cached over those infested with weevils, and (2) that tree squirrels would disperse significantly more acorns than mice. Both hypotheses were supported; however, the decision to cache by tree squirrels was determined more by acorn crop size than infestation by weevils. Our results suggest small mammals, particularly tree squirrels, may significantly impact oak dispersal by selectively caching sound seeds, especially when oaks mast.

BELT, K.\* (1), C. SWAN (2), and R. POUYAT (1,2)

**Breakdown of leaf litter in urban and forested streams: Altered hydrology and landscape position**

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The influx of particulate organic matter (POM) to headwater streams is important to aquatic food webs in stream ecosystems. Urban catchments drainage pathways are numerous, creating a POM "gutter subsidy" and litter quality and quantity inputs are highly altered. A better understanding of how urbanization and trees interact to alter organic matter transport and cycling is needed to assess retention as well as the magnitude of carbon fluxes to the atmosphere and to downstream aquatic ecosystems. We measured breakdown rates of Sycamore and Planetree leaf litter from urban and rural landscapes in forested and suburban streams of the BES LTER. Exponential decay curves from *in situ* leaf bag experiments using eight different leaf source/landscape types were used to quantify mass loss rates. Litter from suburban and urban landscapes almost all lost mass faster than the riparian litter and were much faster than literature values. Breakdown rates in the forested stream were similar, but in the suburban stream the suburban/urban riparian litter had faster breakdown rates than the rural sites. If upland urban and suburban leaf litter generally break down faster than riparian litter, urban fluxes of organic matter (particulate and dissolved) may be substantially higher to both downstream aquatic systems and to the atmosphere (as CO<sub>2</sub>) than in forested catchments.

BERKSTRESSER, S.\* , S. P. JONES.\* , and T. J. MARET

**The effects of density, protein availability, and size variation on cannibalism, survival, and growth in larvae of the caddisfly *Ptilostomis postica***

Dept. of Biology, Shippensburg University, Shippensburg PA

*Ptilostomis postica* is a caddisfly that breeds in seasonal ponds throughout south-central Pennsylvania. Larvae grow quite large and are highly predacious on other aquatic organisms. *P. postica* larvae have also been known to engage in cannibalism. We investigated the factors that influence cannibalism and survival within this species. In one experiment, we examined the effects of protein supplementation (frozen dipteran larvae) and size variation among pairs of individuals on cannibalism. Larvae were more likely to cannibalize smaller individuals, and incidence of cannibalism was positively related to the amount of size variation between larvae. Availability of an alternative protein source did not affect the incidence of cannibalism. In another experiment, we examined the effects of supplemental protein and density on larval growth and survival. Larval survival was positively affected by supplemental protein addition and was negatively affected by increased density. Density effects were strongest early in the experiment, while protein effects were strongest late in the experiment. Although we can not rule out other causes of death, cannibalism appears to have been a major cause of mortality. Growth of larvae was positively affected by protein supplementation. These results suggest cannibalism among *P. postica* larvae may be an important cause of mortality, particularly early in the season when larval densities are high. Additionally, availability of invertebrate prey appears to affect both growth and survival of *P. postica* larvae.

BICHLER, J.\* , M.D. KUCZYNSKI, and A.J. McELRONE

**Quantifying the contribution of aquaporins to overall water transport in deep roots accessed via caves**

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Deep roots can contribute substantially to whole tree water use by accessing reliable water resources. Despite their importance, we lack knowledge of deep root physiology due to limited access for *in situ* measurements. We used a cave system on the Edward's Plateau of central Texas to investigate transport physiology in fine roots tapping a perennial stream at ~20 m depth. An ultra-low flow meter was used to measure fine root hydraulic conductivity (FRHC) and hydroxyl radicals were used to generate chemical inhibition of aquaporins (CIA) in two tree species, the evergreen *Quercus fusiformis* and the deciduous *Bumelia lanuginosa*. During the summer, FRHC was found to cycle diurnally in both species with a peak during the period of highest canopy water demand. CIA reduced FRHC by 54 and 46% during the day and 43 and 40% during the night for *Q. fusiformis* and *B. lanuginosa*, respectively. During

whole tree shade treatments repeated throughout the season, *B. lanuginosa* FRHC ceased diurnal cycling and decreased 76% during the day and 21% during the night. Furthermore, CIA decreased FRHC by 27 and 28% during the day and night, respectively. During the winter, *Q. fusiformis* maintained high FRHC values and sustained substantial CIA, while *B. lanuginosa* ceased diurnal cycling and exhibited extremely low FRHC and CIA compared to summer values. Aquaporins play an important role in overall water transport in deep roots by adjusting to varying environmental conditions. Such adjustments could reduce flow resistance in deep roots and may maintain deep water usage.

BONNEAU, L.\*, and C. LOEFFLER

### **How and when does deer browsing affect forest regeneration? Tracking seedling growth and survival rates in central PA**

Biology Dept., Dickinson College, Carlisle PA

This research project is an investigation of how excessive deer browsing affects the regeneration of forest growth in Pennsylvania and the timing of these effects. We monitored the growth and survival rates of 100 black birch (*Betula lenta* L.) and 150 red maple (*Acer rubrum* L.) seedlings in a Pennsylvania sanctuary that is heavily populated by deer. Fifty of each species were in small chicken-wire cages, 50 were exposed, and 50 of the red maple seedlings were in a 13-year-old, 6 m x 6 m enclosure. The results show that very few exposed seedlings were browsed by deer (14% of each species), suggesting that direct effects of browsing at this season are small and do not favor one species over the other. Most deaths were associated with drought. Significantly more seedlings died, due to drying, outside the 13 year enclosure (68%) compared to inside (42%). It appears that the impact of deer, during the summer months, is negative but mostly indirect. Thus the most detrimental effect of deer grazing was the alteration of the habitat which apparently lowered the seedlings' resistance to drought.

BOWDEN, R. D. (1), L. NAGEL\* (1), Z. KOTROCZÓ (2), Z. KRAKOMPERGER (2), M. PAPP (3), AND J.A. TÓTH (2)

### **Long-term change in vegetation composition and biomass in a Central European oak forest at the Sikfokut International Long-Term Ecological Research (ILTER) Site, Hungary**

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We examined long-term changes in vegetation composition and biomass in a sessile oak-turkey oak forest (*Quercetum petraea* - *Quercetum cerris*) at the Sikfokut ILTER in northeast Hungary. Since the early 1970s, widespread oak deterioration occurred; long-term data show warmer, drier conditions from 1973-2000. In 2004, we remeasured all trees (>5cm) in a one-ha plot that had been measured in 1973. In 1973, the 60 year-old forest had a medium-dense shrub layer and noticeable herb layer. Of the 817 individual trees, 84% were *Q. petraea* and 15% were *Q. cerris*. From 1973 to 2004, *Quercus petraea* declined greatly, with 68% mortality. However, mortality of the sub-Mediterranean *Q. cerris* was only 16%. The ratio of the two oaks has decreased from 5.5 in 1973 to 2.0 in 2004. Total aboveground biomass has changed little (1973: 241 MT/ha; 2004: 236 MT/ha), however, whereas in 1973, *Q. petraea* constituted 78% of total mass, by 2004, it was only 54%. *Acer campestre* has grown from the shrub layer to construct a new lower canopy tree level, however it is still a minor biomass component. Other species (*Acer tataricum*, *Cerasus avium*, *Carpinus betulus*) have also increased in abundance since 1973. Oak decline seems to have ended, and early successional maples have become increasingly important in the canopy structure. Deer browsing and feral pig rooting is extensive, likely causing the paucity of herbaceous plants and tree seedlings. Our study suggests climate change can result in rapid and drastic vegetation shifts in Central European oak forests.

BOZZOLASCO, A.\*, and J. TAYLOR

### **Understanding the ecological impacts of climate change in the Mid-Atlantic Region of the United States**

Dept. of Earth and Environmental Studies, Montclair State University, Montclair, NJ

Climate change is recognized as one of the most important factors impacting ecosystems today. The ecological impacts of climate change vary spatially and temporally, in extent and nature. As such, ecosystem changes are dependent on the surrounding environment including geographical, geological, hydrological, and human influences. Regional studies analyzing the impacts of climate change are critical in order to understand how it will impact ecosystems and their species assemblages. In this time of biological extinctions, regional ecological studies are particularly important in assisting scientists in developing management and/or mitigation strategies that can prevent future biodiversity losses. We have conducted an extensive review of the relevant literature, and have found that this region will indeed experience myriad ecosystem alterations that could have cascading ecological effects. Of particular concern in the Mid-Atlantic region is the effect of sea level rise on coastal ecological communities as well as the impacts and/or alteration to forest communities. Of course, the highly urbanized Mid-Atlantic region also faces several public safety issues, including increased flooding and the possibility of increased extreme weather events, such as hurricanes. Integrated ecological studies have yet to be performed for this region. In order to better understand the effects of climate change in the

Mid-Atlantic region, we plan on generating high resolution climate impact scenarios by downscaling the output of global climate modeling studies using a regional climate model. By producing these climate impact scenarios we anticipate being able to better understand future ecosystem structure in the Mid-Atlantic region.

BRUNKARD, J.\* (1), M. PERRY (1), J.L. MACHADO (1), C. STEFANESCU (2), and K. KITAJIMA (2,3)

**Leaf life span and effects of leaf age on photosynthetic rates in shade- vs. gap-grown seedlings of five neotropical shade-tolerant trees**

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(2) University of Florida, Gainesville FL  
(3) Smithsonian Tropical Research Institute, Panama

Changes in the photosynthetic capacity of leaves as they age were studied by measuring the carbon dioxide exchange of the leaves using LI-6400 infrared gas analyzers using a range of light regimes. Seedlings of five neotropical, shade-tolerant tree species were planted *in situ* for the study in either canopy-shaded light conditions or under gaps in the canopy. Leaves in the gap showed greater initial photosynthetic capacity and a faster rate of decline in that capacity over time than did leaves in the shade across all species studied. These results support predictions made by cost-benefit models, as the plants studied seemed able to optimize the aging of their leaves to their environment.

CARTER, C.\*, and C. LOEFFLER

**Deer herbivory and plant species diversity in two forest understories in Perry County, PA**

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The diversity and composition of forest understories was studied in two different forest sites: the Florence Jones Reineman Wildlife Sanctuary and State Game Lands 170, both in Perry County, Pennsylvania. This study compared fenced enclosure plots to control plots in three different regions of the FJR Wildlife Sanctuary, where deer are not controlled. The fenced plots were also compared to randomly selected plots of three similar regions of forest in the State Game Lands, where the deer population is controlled by hunting, to see how regeneration in fenced plots in a chronically overbrowsed area compares to understory vegetation in a forest in which deer have never been overabundant. A Shannon's diversity index was calculated for each plot, and results showed no significant differences in diversity between FJR Wildlife Sanctuary fenced plots and the State Game Lands. Diversity was however significantly lower in the control plots than in the fenced plots at FJR. Different types

of low vegetation (tree, shrub and vine, herbaceous) were either similar in abundance or significantly more abundant in the fenced FJR plots than in the comparable plots of the State Game Lands, possibly because of thinner canopy cover in the FJR plots. This study concludes that controlled deer populations probably do not negatively impact the diversity of vegetation of a forest understory, although there are interesting differences in the amount and composition of vegetation in fenced, regenerating plots in an overbrowsed area versus plots where deer have never been overabundant.

CHAPMAN, E.J.\*, and R.S. PREZANT

**Temporal molluscan community structure and diversity found in an urban New Jersey pond**

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Barbour's Pond, a 55,000 m<sup>2</sup> pond in Garrett Mountain Reservation, is located in Passaic County, northern New Jersey, one of the most densely populated urban regions in the United States. Despite its small size and the surrounding urban sprawl, the shallow waters of this pond hold 18 species of mollusc. Monthly samples from March 2004 through March 2006 found the highest diversity in December 2004, January, June, and July 2005. Total molluscan abundance was greatest in July and November 2004, possibly reflecting young from late spring and autumn. May 2004 showed the lowest diversity and abundance. Univariate statistics demonstrate that this pond has a stable and diverse malacofauna. There is also a strong correlation between frequency of occurrence and relative abundance. Using Bray-Curtis Similarity Indices, we found eight species grouped together 72% of the time. Two species of pisidiid clam were always found together and almost always in the presence of *Ammicola limosa*, at 97% similarity. These three taxa were found with *Physa acuta* 92% of the time and all four with *Helisoma anceps* and *Goniobasis virginica* over 90% of the time. *A. limosa* was found in every month except May 2004; *H. anceps* every month except February 2005. Temporal changes within the communities could reflect environmental variables. Preliminary analysis has shown little correlation of diversity with pH, dissolved oxygen, water temperature or pond size, underscoring the complexity in understanding biodiversity in small, heavily impacted urban ponds.

CHRIPCZUK, J.\* and T.J. MARET

**Predatory effect of *Notonecta irrorata* (Hemiptera: Notonectidae) on larval amphibian assemblages**

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Numerous studies have examined the role of odonate predation on the behavior, growth, morphology, and survival of larval amphibians. In temporary ponds in south-central Pennsylvania, backswimmers (*Notonecta*) are more widespread than odonates, yet little is known about the effects of predation by backswimmers on larval amphibians. Although several studies have demonstrated backswimmer predation on larval tadpoles, virtually nothing is known about the effects of backswimmer predation on larval salamanders. We conducted laboratory studies using the backswimmer *Notonecta irrorata*, larval wood frogs (*Rana sylvatica*), and spotted salamanders (*Ambystoma maculatum*) to answer the following questions: (1) Does *N. irrorata* present a predatory threat to larval amphibians? (2) Do larval amphibians modify their behavior in the presence of *N. irrorata*? (3) Since backswimmers are active predators that pursue prey from the water surface and odonates are ambush predators that inhabit the benthos, will the combined predation effects by *N. irrorata* and odonates (Libellulidae) be greater than additive? It was found that *N. irrorata* present a significant predatory threat to *R. sylvatica*, though not to *A. maculatum*. However, *N. irrorata* presence did have a significant effect on the movement and depth selection of *A. maculatum*. Additionally, *N. irrorata* had a significant effect on *R. sylvatica* depth and hiding behavior. A non-additive effect of predation by *N. irrorata* and Libellulidae was not found. This study appears to be the first to quantify *Notonecta* predation on larval amphibians. Furthermore, it demonstrates that *R. sylvatica* and *A. maculatum* alter their behavior in the presence of *N. irrorata*.

COX, K.M.\*, and G.A. LANGELLOTTO

**Urban bumblebees forage within localized habitat**

Dept. of Biological Sciences, Fordham University, Bronx NY

In New York City there are over 600 urban gardens that represent relatively small and isolated habitat patches for bumblebees and a variety of other insect taxa. By pollinating locally grown produce within gardens, bumblebees provide important ecosystem services to urban gardeners and neighborhoods. However, it is unknown whether bumblebees forage within one focal garden or if they "commute" through the urban matrix to forage in multiple nearby gardens. To determine the degree of inter-garden movement and temporal residency within individual gardens, a mark-recapture and translocation experiment was carried out on *Bombus impatiens* workers foraging in urban gardens during August and September of 2005. A total of 232 workers were marked in six gardens in the Bronx and East Harlem. The resight

rate across all gardens was high with 103 individuals (44%) recaptured. There were no exchanges of bumblebees between gardens, despite the proximity (<150 m) of some gardens. For the translocation experiment, a total of 43 individuals were captured in one garden and released in a separate garden located 357 meters away and separated by residential streets. Five individuals (12% of total translocated) moved through the urban matrix and returned to the garden of capture. No individuals were resighted in the release garden. The results of this experiment suggest that *B. impatiens* workers exhibit limited movement between urban gardens and predominantly forage within one focal garden.

CROMARTIE, W.\* (1), L. KELTOS (1), A. DWYER (1), K. MOTT (1), and F. AKERS (2)

**Determination of biological, hydrological and chemical reference sites in a New Jersey Pinelands watershed**

(1) NAMS, Richard Stockton College, Pomona NJ  
(2) Great Egg Harbor Watershed Association, P. O. Box 109, Newtonville NJ

As part of a program to assess subwatersheds in the Great Egg Harbor River, Stockton College faculty and students have been working with the Great Egg Harbor Watershed Association on a study of Gravelly Run, a stream which may be among the least disturbed HUC-14 watersheds in the GEHR basin. The chemical, physical and biological characteristics of several sites along Gravelly Run were studied in 2005-06. The first year's results indicate this watershed is suitable as a reference site for pH, specific conductance, snag-dwelling macroinvertebrates and hydrologic flow regime. We are continuing to assess additional parameters. Gravelly Run compares favorably with reference sites in the adjacent HUC-14 unit we studied from 2003-2005. Our result supports the utility of macroinvertebrates on woody debris as a target for biological assessment.

DeGENNARO, M.\* (1), E. DeLUCIA (2), O. DERMODY (2), D. EASTBURN (3), and A. McELRONE (1)

**Futuristic disease: The effect of atmospheric change on foliar soybean pathosystems**

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Since the inception of the industrial revolution, anthropomorphic emissions have been altering the atmosphere's composition. Due primarily to the combustion of fossil fuels, atmospheric concentrations of carbon dioxide (CO<sub>2</sub>) and ozone (O<sub>3</sub>) are on the rise.

Previous studies of soybeans indicate that elevated atmospheric CO<sub>2</sub> increases growth, yield, and photosynthetic activity, while elevated tropospheric O<sub>3</sub> negatively affects these same parameters. Past research has focused on climate change effects on the plant system itself and has failed to look into plant – pathogen interactions. At the SOYFACE field site located in Urbana, Illinois we examined the effect of four atmospheric treatments (ambient, elevated CO<sub>2</sub> [550ppm], elevated O<sub>3</sub> [2x ambient], and an elevated CO<sub>2</sub> and O<sub>3</sub> combination) on foliar soybean disease abundance and severity. Subsequently, these disease parameters were related to changes seen in the soybean plant chemistry, physiology, and structure. Despite the severe drought in 2005, there was a significant outbreak of Brown spot throughout SOYFACE with as much as 73% severity on some of the leaves and 77% abundance in some of the rings. While there was no significant difference between the four treatments regarding severity and abundance averaged across rings, the number of lesions per leaf varied within each treatment and correlated to the lesion size. Smaller lesions found under ambient and elevated O<sub>3</sub> treatments were more frequent, whereas fewer larger lesions were seen in the elevated CO<sub>2</sub> and combination treatments. Disease susceptibility at the leaf level may become more important in years with normal levels of precipitation.

EVANS, C.A.\*, and T.J. MARET

**The effect of consuming different leaf types on growth and survival of larval caddisflies, *Limnephilus indivisis***

Dept. of Biology, Shippensburg University, Shippensburg PA

Forests in the Mid-Atlantic region of the United States are undergoing a shift in species dominance from oak to red maple. Due to differences in leaf chemistry, this shift in species composition could potentially affect detrital processing in aquatic ecosystems. *Limnephilus indivisis* is the major leaf shredder in temporary ponds in south-central Pennsylvania. We examined the effect of leaf type on the growth and survival of *L. indivisis* by raising larvae on one of the three leaf diets: 1) red maple, *Acer rubrum*; 2) northern red oak, *Quercus rubra*, and 3) white oak, *Q. alba*. Larvae fed red maple had significantly higher growth, development and survival than did those fed red or white oak. Larval case construction was also affected by leaf type. Our results suggest that changes in forest composition from oaks to maples, by altering the survival and growth of larval caddisflies, may affect food webs and detrital processing in temporary wetlands.

EWEN-CAMPEN, B.\*(1), J. HAGELIN (1), and S. SHARBAUGH (2)

**Observations on the breeding biology, nest characteristics, and reproductive success of arctic warblers (*Phylloscopus borealis kennicotti*) in central Alaska**

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(2) Alaska Bird Observatory, Fairbanks AK

The arctic warbler (*Phylloscopus borealis kennicotti*) is listed by the U.S. Fish and Wildlife Service as a Species of Concern, and very little is understood of its breeding biology. In this study we present the results of two years of observations of breeding arctic warblers across a range of habitats along the Denali Highway in central Alaska. These observations represent the most extensive record of this species in North America (n=65 nests). Although nesting success was remarkably high (92% of nests fledged at least one chick), we observed success to vary considerably between habitat types as well as between the two years of our study. The average brood size on plots with lower nesting density (28%-33% of higher-density plots) appeared to be less affected by the effects of low rainfall during the first year of our study, suggesting that the use of these lower-quality habitats may be preserved by high annual variation in the regional climate. We also investigated the relationship between nest characteristics (nest mass and mass of moose hair lining), nest insulation quality, and reproductive success. Nest characteristics varied significantly between habitats, but these differences were not related to variation in insulation quality or reproductive success. In addition, nest insulation was not related to reproductive success. These results suggest that variation in nest construction reflects local material availability and does not strongly relate to parental quality or reproductive success, possibly because the variable local climate has strongly selected against large variations in nest insulation.

FETY, L. \* (1), K. KEELEY\* (1), B. LANTZ\* (1), R. COLLINS (2), R.A. MERZ (1), and J.L. MACHADO (1)

**The impact of white-tailed deer on tree regeneration and plant invasions in an eastern North American forest fragment**

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(2) Dept. of Botany, University of Wisconsin, Madison WI

Overabundant white-tailed deer populations (*Odocoileus virginianus*) threaten the integrity of eastern deciduous forests through reducing tree seedling recruitment, changing understory community composition, increasing erosion, and increasing dispersal of invasive species. Little is known about the extent to which deer enhance exotic species invasions. The primary focus of our study dealt with the influence of deer herbivory on exotic plant invasions and plant community structure in the Crum Woods of Swarthmore College, in southeastern Pennsylvania. Specifically, we asked

(1) does deer herbivory enhance exotic species' abilities to dominate forest communities; and if so (2) what is the nature and effects of this interaction between deer and invasive plants on native plant communities? To examine these questions, we employed a split-plot design and manipulated the presence and absence of deer (with deer-proof exclosures) and invasive plants (with manual weeding of invasive plants, primarily garlic mustard (*Alliaria petiolata*) and Japanese honeysuckle (*Lonicera japonica*). We present the initial results on plant growth, tree regeneration and shifts in community composition in this ten-year study. We will discuss our success in meeting our goals of raising local awareness of ecological threats in this suburban forest fragment, stimulating management efforts, and giving undergraduates hands-on research experience in conservation biology.

FUESNER, M.\*, T. STEELE, E. MILLER, M. NUGYEN, A. MCEUEN, and M.A. STEELE

**Effects of herbivory by a tree squirrel on seed size, quality, dispersal and establishment: Are tree squirrels agro-farming?**

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We tested the hypothesis that gray squirrels (*Sciurus carolinensis*) are agro-farming silver maples (*Acer saccharinum*) by twig clipping and thereby modifying the quality of samaras. We conducted three studies to test this hypothesis. (1) We monitored the frequency of twig-clipping and the number and biomass of terminal twigs and flowers that were clipped before seed maturation. (2) We simulated twig clipping to analyze the effect of twig-clipping on seed quality. (3) We compared dispersal, establishment, and growth of seeds and seedlings from clipped and non-clipped trees. During peak periods of twig clipping, squirrels removed an average of 170 twigs, 1500 buds, and > 5000 flowers per tree and thus exerted a significant effect on growth and reproduction. Experimental simulations of twig clipping, however, suggest an increase in seed size (up to 35%) and quality nearly 6 weeks after the peak of twig clipping. Increased seed size did not affect dispersal rates, but did improve initial establishment and growth in the first two weeks of seedling development. We argue tree squirrels are indeed increasing future nutritional gains by inducing changes in seed quality; they also may influence seedling establishment in the process.

GRAMMOND, M.\*, S. MARINO, and M.A. STEELE

**Predator-satiation and masting in oaks: The impact of acorn abundance on insect infestation and oak establishment**

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We tested the predator satiation hypothesis (PSH) by monitoring acorn production, insect infestation in acorns, and oak seedling establishment at three sites in northeastern Pennsylvania over 5 years. As predicted by the PSH, our results show a positive correlation between acorn abundance and red oak establishment. In contrast, we saw no evidence of a correlation between acorn abundance and seedling establishment for the two white oak species. Insect infestation decreased with acorn abundance in some but not all species. Based on this and related studies, we suggest that red oak species have a dispersal and establishment advantage whenever acorn production of any species occurs. In contrast, we predict white oak establishment to be rare and to occur primarily when white oaks mast independently of other oaks.

HANIFIN, R.C.\*, and B.S. PEDERSEN

**Canopy structure differences in two mixed-deciduous forests subject to different intensities of deer herbivory**

Dept. of Environmental Studies, Dickinson College, Carlisle PA

Browsing herbivores such as white-tailed deer (*Odocoileus virginianus*) can negatively impact forest ecosystems. A previous study of two ecologically-similar forests in south-central Pennsylvania concluded that deer herbivory was causing the failure of canopy-gap regeneration in the forest with an unmanaged deer population (FJRS), relative to the forest with less intense herbivory due to deer hunting (SGL). We sought differences in the vertical distribution of canopy elements due to deer herbivory. We hypothesized that at FJRS there will be fewer canopy elements near the ground due to recent herbivory and fewer canopy elements higher in the canopy due to past herbivory, relative to SGL. At both sites, we measured vertical distribution of canopy elements and calculated plant area index (PAI) by using a laser rangefinder (Leica Disto Classic3) and applying the Beer-Lambert Law. Measurements were taken at 1200 locations in each forest. Consistent with our hypothesis, PAI was significantly lower at FJRS (2.29), as compared to SGL (3.76;  $P=0.001$ , one-tailed t-test assuming unequal variances). Most of the difference in PAI was in the mid-canopy (11-19 m from the ground), which we attribute to the filling of canopy gaps by younger trees at SGL, a process prevented at FJRS by prolonged, intense herbivory. Asian stiltgrass (*Microstegium vimineum* [Trin.] Camus), a species not consumed by deer, accounted for 53% of ground vegetation at FJRS. Stiltgrass was not found at SGL; litter accounted for 63% of ground cover there. The findings have implications for the ability of these forests to absorb light energy.

HANTSCH, N.\*, W. ZHU, and J. BOHNER

### **Stream chemistry along an urban to rural watershed gradient**

Dept. of Biological Sciences, Binghamton University, Binghamton NY

Watersheds have been widely used to study large-scale environmental changes. Increases in urbanization are changing ecosystems in the immediate urban surroundings as well as those downwind through processes such as nitrogen deposition. The Binghamton project includes an urban center with a large proportion of forested headwater watersheds. The exurban area extends through Broome and Delaware Counties and reaches the rural Catskill Preserve. We sampled 28 headwater streams along this urban-rural watershed gradient (total distance of 105 km) starting in June 2005. Samples were analyzed for ammonium (NH<sub>4</sub>), nitrate (NO<sub>3</sub>), dissolved organic nitrogen (DON), soluble reactive phosphorus (SRP), and chloride (Cl). Conductivity, pH, and temperature were measured *in situ*. Ammonium concentrations were under 0.1 mg/l in nearly all streams. Nitrate concentrations were higher, averaging 0.47 mg/l in urban sites and 0.32 mg/l in rural sites. SRP, DON, and Cl<sup>-</sup> concentrations all declined from urban to rural. Stream pH averaged 7.12 in urban sites and 6.62 in rural locations, while conductivity averaged 281 μS in urban vs. 64 μS in rural streams. Nitrate and Cl<sup>-</sup> concentrations decreased from summer to winter, however, a large amount of precipitation in the fall followed a drier than normal summer, and therefore may have caused a dilution effect. DON concentrations averaged 1.29 mg/l in August, but were only 0.12 mg/l in December. These data show that urban centers have a large impact on the small headwater watersheds along this urban-to-rural gradient.

HAZURI, R.\*, and S. WEBB

### **Comparative demography of *Acer saccharum* and its invasive congener *A. platanoides* in the Drew University Forest Preserve**

Biology Dept., Drew University, Madison NJ

In order to evaluate the comparative success of the invasive *Acer platanoides* (Norway maple) with that of its native congener, *Acer saccharum* (sugar maple), the dominant species of our study area, we collected data from the 80 permanent tree and seedling plots in the Drew University forest preserve in the spring and fall of 2005. We supplemented this with preexisting data for these plots and analyzed demographic patterns of the two species. Populations of maple seedlings reflect a balance between mortality across seasons and new establishment which occurs episodically in mast years. Over time, seedling recruitment and mortality patterns have diverged for sugar and Norway maples, each displaying differences in timing of masting events and percent mortality. Despite *A. platanoides* tree removals in the study area, relative density of *A. platanoides* is high at 30.16%, due to abundant

resprouting of *A. platanoides*. This abundance of *A. platanoides* is of concern, as it demonstrates the competitive ability of an invasive species in northern New Jersey hardwood forests. Restorative work involving the removals of *A. platanoides* should be followed up with secondary removals in order to more effectively combat invasion.

JEDINY, J.\*, and F. KUSERK

### **Benthic macro-invertebrates as bio-indicators of stream quality in a rural/urban transition zone in Monocacy Creek, Northampton County, Pennsylvania**

Dept. of Biology, Moravian College, Bethlehem PA

Benthic macro-invertebrates are commonly used as bioindicators to assess the condition of stream ecosystems. The objective of this study was to assess stream quality along the Monocacy Creek (Northampton County, PA) as it transitions from a rural to an urban/suburban habitat. Benthic macro-invertebrates were collected in Fall 2005 from riffle areas in replicate 1 m<sup>2</sup> quadrats using a kick-net and along stream banks using D-frame nets at three sites. Organisms were preserved in 70% ethanol and identified to the lowest taxon using standard identification keys. The data were analyzed using a multimetric approach that included the total taxa, Ephemeroptera-Plecoptera-Trichoptera (EPT) taxa, Hilsenhoff Biotic Index (HBI), Shannon Diversity Index, and a Benthic Index of Biotic Integrity (B-IBI). Index scores were calculated and water quality ratings assigned. Results indicate that this section of the Monocacy Creek has moderately impaired water quality, with the site farthest upstream at McIlwain/Monocacy Meadows having the best and the site farthest downstream as the creek exits the Archibald Johnston Conservation Area having the poorest water quality based on EPT and Benthic Index of Biotic Integrity scores. Possible causes may be the negative impact that nutrient-rich discharges from a nearby fish hatchery and livestock feedlot have on the benthic macro-invertebrate community in this section of the stream.

JERIN, J.\*, T. BRITT, Y. AMEDUME, and T.M. HURD

### **Relative contributions of stocked trout to fish-eating birds inhabiting streams of south-central Pennsylvania**

Dept. of Biology, Shippensburg University, Shippensburg PA

Hatchery fish can contribute greatly to the diet of fish-eating birds, a pattern likely detrimental to stocking programs, and to natural food webs through introduction of PCBs. Avian diet can be determined by analyzing the isotopic carbon of bird guano and tissues (e.g. feather, claw and liver) and comparing those to dietary sources. Samples of wild and stocked fish tissue and guano were dried and analyzed for natural abundance of carbon 13 in order to determine relative predation on stocked

trout. Guano collected in mid-winter (November 2003 - February 2004) following a fall stocking on Big Spring Creek averaged 55% hatchery fish decreasing to zero by March 2005 and through spring stocking. Guano collected near Huntsdale Hatchery indicated a diet high in hatchery fish. On-going research is examining heron reliance on stocked fish following spring and fall stockings.

KELLER, J.\* (1,2), M. RICHMOND (1), and C. SMITH (1)

**An explanation of patterns of breeding bird species richness and density following clearcutting in northeastern U.S. forests**

(1) New York Cooperative Fish and Wildlife Research Unit, Dept. of Natural Resources, Cornell University, Ithaca NY  
(2) Habitat by Design, 74 Stagecoach Rd., Pipersville PA

We surveyed breeding birds for an average of 4 yrs on 23 primarily even-aged successional stands ranging from 2 to 120 years old to observe changes in species richness and density following clearcutting in central New York. An initial sharp increase in richness and density from post-cut years 2 to 6 preceded a steep decline by year 25 and a second, smaller increase and decline between years 25 and 120. The rapid initial increases in richness and density were highly correlated with leaf area which, on plots that were heavily stocked prior to cutting, returned to pre-cut levels by year 6 or 7. The decline in avian populations from years 7 to 25 accompanied canopy closure and was likely associated with the loss of foraging and nesting sites near ground level. The second, less pronounced increase in avian richness and density from years 25 to 100 was associated with 1) the redistribution of foliage to all vertical layers of the forest resulting from the increasing size and duration of canopy gaps caused by tree deaths; and 2) the increasing size and bark complexity of tree boles, which provided new foraging and nesting substrates. Overall, avian successional trends appear to be determined by the development and decline of vegetation patch types appropriate to specific guilds of birds. Management implications for early successional Neotropical migrants will be discussed.

KIGHT, S.\*, and G. COFFEY

**Termination of paternal care in giant waterbugs, *Belostoma flumineum* Say: The effects of age and season**

Dept. of Biology and Molecular Biology, Montclair State University, Montclair NJ

Animals that provide care to offspring may be expected to change the magnitude of investment as the parent ages. Specifically, as future reproductive potential diminishes, parents are expected to invest more heavily in each successive brood. We tested this hypothesis by examining age-related egg abandonment behavior in

giant waterbugs, *Belostoma flumineum* Say. Male waterbugs bear pads of eggs upon their hemelytra until hatching, but are occasionally observed discarding the pads before the eggs hatch. We predicted that the frequency of egg discarding would decrease as (a) males age or (b) males encounter environmental cues associated with diminishing reproductive opportunities. In North America, waterbugs emerge in late summer and breed prior to the onset of winter. Reproduction halts until spring, whereupon mating resumes in concert with senescence and mortality. We demonstrated that egg discarding is significantly more common in the fall breeding season than in the spring. We also demonstrated that young males are significantly less likely to discard eggs if kept at cool ambient temperatures. It may be that cooler temperatures predict the onset of winter and diminished likelihood of obtaining a replacement brood prior to the end of the fall breeding season.

KLEMOV, K. (1), B. DIBBLE\* (1), M. JOHNSTON (1), T. ORELEIN (1), J. THOMPSON (1), and M. ZUKOSKI (2)

**Online polyclave key for the plants from the Kirby Park Natural Area, Wilkes-Barre, PA**

(1) Biology Dept., Wilkes University, Wilkes-Barre PA  
(2) Dept. of Mathematics and Computer Science, Wilkes University, Wilkes-Barre PA

Online taxonomic keys can potentially serve as superior identification tools over printed field guides and technical manuals because they offer the possibility of flexible design, better graphics and enhanced search capabilities. For the past five years, an online dichotomous key for the plants from the Kirby Park Natural Area (KPNA) in Wilkes-Barre, PA has been developed. Building on the efforts of previous teams, we have developed an online polyclave key for over 100 flowering plants indigenous to the KPNA. The key was created using a .php database at Wilkes University. The key involves three parts. The first is a character entry system that creates a profile for the plant using drop-down menus linked to text and photos. In the second, the series of characters in the profile are applied against the database to search for species that fit the profile. The third is a system for displaying the plants that fit the profile back to the user. The key has been posted to the Wilkes University website at <http://mathcs.wilkes.edu/~kirbyprk>. It is being field-tested and will be on display for conference attendees to review.

KREDIET, C.\* (1,2), and M. DONAHUE (2,3)

#### **Physical and biological tradeoffs along a depth gradient in *Cancer borealis***

- (1) Dept. of Biology, Drew University, Madison NJ
- (2) Shoals Marine Laboratory, Cornell University, Ithaca NY
- (3) Dept. of Biological Sciences, Humboldt State University, Arcata CA

Different habitats offer varying conditions to the animals living there and thus force the inhabitants to either adapt to those changing conditions or move to another location. *Cancer borealis* (Stimpson) is a mobile decapod capable of moving from one habitat to another habitat depending on the presenting conditions. Following a gull exclusion experiment conducted in 2004 at Shoals Marine Laboratory, *C. borealis* was observed to migrate high into the intertidal zone at low tide where it faced high risks of predation by Great Black-backed Gulls, *Larus marinus* (Linnaeus), and Herring Gulls, *Larus argentatus* (Coues). The present study investigated possible growth/mortality tradeoffs involved in the migration of these crabs into high risk areas of the shallow subtidal and intertidal zones. These tradeoffs were examined through a food availability survey on Appledore Island of the Isle of Shoals in the Gulf of Maine, gut content analysis, and a caging experiment monitoring the growth of crabs as a result of food availability and temperature variations. The implications of subtidal predation on the distribution of *C. borealis* were also investigated. We found crabs grew significantly more in areas with increased food availability and warmer temperatures and selected prey items that were most abundant within the habitat. Increased food availability was often related to increased water temperature. From the obtained results, it appears a tradeoff between growth and risk of mortality may be in place and the benefits of areas with increased food availability may outweigh the risks of gull predation.

KUNTZ, B.\*, J. MOCZERNIUK, K. RAYMONDI and S. CODELLA

#### **Site variation in hymenopteran biodiversity in urban coniferous forest habitats**

Dept. of Biological Sciences, Kean University, Union NJ

As part of an ongoing study of the effect of site factors on biodiversity of Hymenoptera (Insecta), three assessment sites were established in conifer stands at Watchung Reservation, a 2000 acre urban forest in Union County, New Jersey. The primary collection method was yellow pan trapping, supplemented by net and hand collecting, bait and pitfall trapping, and litter sampling. During the 2002-2004 field seasons, pan traps were serviced three times weekly from May through July, with some additional collecting in August. Specimens were identified at least to family and sorted to morphospecies. The Watchung database now includes 2981 entries (approximately 70% of specimens collected during this period). At present, 159 morphospecies in 23 families are represented. Species richness is high at sites where

previous bark beetle (Coleoptera: Curculionidae: Scolytinae) activity has produced canopy gaps due to tree mortality. Across all sites, the Ichneumonidae (parasitic wasps) shows the greatest species richness, and this family comprises nearly 50% of all processed specimens and a third of all morphospecies. Formicidae (ants) are represented by 18 morphospecies in 13 genera, with *Campontous* (Formicinae) being the most speciose ant genus. Species accumulation curve analysis suggests that the ground-dwelling component of the Watchung ant fauna has been well sampled. Diapriid wasps comprise a substantial proportion of the biomass at all sites and are represented by 18 morphospecies in two subfamilies.

LAITEM, M.\*, C. PULICE, and A. PACKER

#### **Extrafloral nectaries decrease insect herbivory in *Prunus* species**

Dept. of Biology, Susquehanna University, Selinsgrove PA

Extrafloral nectaries are structurally-diverse organs that secrete nectar for purposes other than pollination. One explanation of extrafloral nectaries' function in plants is to attract natural enemies of the herbivores that attack the plant. Extrafloral nectaries have been observed in various *Prunus* species. A study was initiated to examine the relationship between extrafloral nectaries and herbivore damage in *Prunus avium* and *Prunus serotina*. Leaves were collected from both species along a hedgerow in Selinsgrove, Pennsylvania. The area of the leaves, total and area damaged by herbivores, was measured. For each leaf, the extrafloral nectaries were counted, measured, and their position on the leaf was recorded. Results showed a relationship between the number of extrafloral nectaries and the amount of herbivore damage. Leaves with high numbers of extrafloral nectaries had lower levels of herbivory in both *Prunus* species. Further, leaves on the exterior side of the tree which received more sun, were found to have higher rates of herbivore damage in both species. In *P. serotina*, the leaves on the exterior side were also found to have more extrafloral nectaries. The reverse was found in *P. avium*. We are currently conducting greenhouse experiments to explore the influence of light and nutrient availability on the development of extrafloral nectaries.

LOGOTHETIS, K.\*, and T. SIPE

#### **The effects of the herbaceous stratum on nearground windspeed and CO<sub>2</sub> profiles in a successional hardwood forest**

Dept of Biology, Franklin & Marshall College, Lancaster PA

Naturally enriched carbon dioxide levels near the ground may significantly affect plant gas exchange and growth, but little research has been conducted on forest floor windspeed or CO<sub>2</sub> profiles, including impacts of the herbaceous stratum. A controlled

field experiment was used to quantify windspeed profiles with and without herbaceous cover and relate them to CO<sub>2</sub> concentrations. Twelve circular, 1-m radius plots were established in areas dominated by *Dennstaedtia punctilobula* (hay-scented fern) in a mid-successional hardwood forest in central Massachusetts and randomly assigned to three treatments: control, fern removal to ground level, and fern removal followed by replacement with artificial ferns with similar architecture and matching leaf area index. Windspeeds were measured every second and averaged over 30-sec intervals with thermal anemometers at 5, 10, 20, and 40 cm above ground. Windspeeds showed an exponential increase with height in the exposed plots and were 2-3 times greater on average in the 10-20 cm range (0.15-0.25 m/s) compared to the more convex profiles in control and replacement plots (0.05-0.15 m/s). The results show that low-level air movement and herbaceous cover both substantially affect overall concentrations and vertical distributions of enriched CO<sub>2</sub> in the nearground environment.

MAGRINI, K.\*, J. SPOTILA, H. AVERY, and S. ANANDAN

#### **Effects of soil contamination on gene regulation in *Arabidopsis thaliana***

Dept. of Bioscience, Drexel University, Philadelphia PA

Soil contamination is a widespread problem on military installations across the country. The military utilizes millions of acres of land for activities ranging from ammunition production to combat drills. It is of interest to be able to determine the possible effects of soil contamination before any adverse effects appear in organisms in surrounding areas. This project examines the effect of contaminated soil on gene regulation in *Arabidopsis thaliana*. We collected soil from Radford Army Ammunition Plant (RAAP) and Kentland Farms (adjacent reference site), and grew *A. thaliana* in contaminated soil from RAAP, soil from Kentland Farms, and clean potting soil. We used DNA microarrays to compare differences in gene regulation among plants grown in experimental soils versus potting soil. There were statistically significant differences in growth rates of plants grown in soil highly contaminated with heavy metals and those grown in the other experimental soils. We developed a list of genes affected by metal contamination in soil and the oxidative stress associated with this type of contamination. We determined that genes most affected by heavy metal contamination are genes coding for heat shock proteins, metal transporters, and phytochelatin synthetases involved in metal sequestering. We are continuing our analysis to compare gene expression microarray profiles within and among plants grown in soil from different contamination sites. We conclude that microarray technology is an effective tool for identifying patterns of gene expression in plants exposed to contaminated soil and can give an early warning of physiological and ecological effects of such contamination.

*Abstracts of the Mid-Atlantic Ecology Conference (April 2006)*

McKONE, K. L.\*, J.M. BENSON, L.C. HOFMANN, and C.E. TANNER

#### **The role of salinity in the disease resistance of eelgrass to the wasting disease pathogen *Labyrinthula zosterae***

St. Mary's College of Maryland, St. Mary's City, MD

The temperate seagrass eelgrass (*Zostera marina*) suffered severe population declines in the 1930s worldwide, including the Chesapeake Bay. Since then, smaller more localized diebacks have been observed. Wasting disease, caused by species of the net-forming protist, *Labyrinthula* is suspected in many of these declines. In the 1930s and more recent diebacks, populations of eelgrass in low salinity areas have been observed to be less affected. The goal of our study is to understand the relationship between eelgrass wasting disease and salinity, and how eelgrass defends itself against wasting disease chemically via secondary metabolites (phenolic acids). We hypothesized that as salinity decreases the degree of infection present on eelgrass leaves will also decrease. We also hypothesized that eelgrass will respond to infection by increasing levels of phenolic acids that play roles in pathogen resistance in many higher plants. These hypotheses were tested through mesocosm experiments in which eelgrass shoots were exposed to *Labyrinthula* under different salinity treatments. Our studies have shown that there is a positive relationship between salinity and infection area ( $P < 0.01$ ). In addition preliminary analyses suggest that both infection and salinity affect the levels of some phenolic acids in eelgrass. Implications for the distribution of wasting disease in the Chesapeake Bay will be discussed.

McFARLANE, W.J.\* (1), M. POZZUTO (1), and B. JENSEN (2)

#### **Impact of the invasive Asian shore crab (*Hemigrapsus sanguineus*) on two other Northeastern intertidal crabs: the invasive European green crab (*Carcinus maenus*) and the native mud crab (*Penaeus herbstii*)**

(1) Dept. of Biology, Manhattanville College, Purchase NY

(2) Dept. of Physical and Natural Sciences, College of Saint Rose, Albany NY

Previous field studies have shown that the non-indigenous Asian shore crab (*Hemigrapsus sanguineus*) is rapidly increasing in abundance along the East coast of North America, and as a result, may be impacting long established populations of the non-indigenous European green crab (*Carcinus maenus*), and the native common mud crab (*Penaeus herbstii*). This study sought to examine the extent of the invasion of the Asian shore crab along the Northeastern coast, and to determine abundance, habitat preference, size distribution, and gender ratio at six selected sites. The competitive impact of Asian shore crabs on other crab species was assessed by examining the same variables in both green and mud crab populations. At each of six sites along the coast (from Delaware to Maine; three of which were

estuarine environments), crabs were sampled from high, medium and low intertidal zones using 1 m<sup>2</sup> quadrats. Number, size, gender, and relative tidal zone were recorded. Asian shore crab populations exhibited the greatest abundance, and appeared to be invading habitats with salinity as low as 20 parts per thousand (‰). The high reproductive potential and high larval recruitment of Asian shore crabs is likely aiding in dispersal of populations. Green crabs were also found in greatest abundance (and largest size) in areas where there was no Asian shore crabs found. In general, mud crabs were found at fewer sites than the other two species. The prevalence of the three species of crab within the intertidal zone at these six sites suggests a direct competition for both space and resources.

MEYER, E R.

### **Mid-Atlantic meltdown and the loss of diversity: How to recognize them**

Dept. of Biology, Loyola College, Baltimore MD

How can we determine how far a site has entered Mid-Atlantic meltdown? "Ecological meltdown" was Terborgh's term for conditions on particular islands that lacked large predators. To characterize field sites, I suggest we use visual search of forests, and evidence for a few mammals. The scales I suggest for Mid-Atlantic meltdown are from visual searches and disease exposures in forests: a) How much of the floor is bare, with reduced diversity of native ephemerals, and b) carpeted with exotic invasives in summer? c) Are sight distances often 30 m or more from regeneration failure, with oak seedlings and saplings few per 100 m<sup>2</sup>? d) Are canopy gaps closing slowly or not at all (Pedersen)? e) Is wildflower diversity reduced to toxic etc species that resist intensive foraging? f) Are tick species common whose adults are carried by deer and raccoons? g) Are emerging tick-borne diseases common? h) Do zoonotic diseases (rabies) seem permanent in carnivores? i) Deer-vehicle collisions common? j) Are amphibian and reptile diversities lower, some densities lower, or nest predation high? Densities of a few mammals are of course factors and drivers of meltdown: irrupting deer and a few mid-size herbivores; rodent communities (Ostfeld) simplified; irrupting mesocarnivores (Soule), especially raccoons. The documented key to Terborgh's island meltdown is absence of large predators. I suggest meltdown here stems from loss of farmers who were top predators. Where are farms in the gradients from historic diversity to Mid-Atlantic meltdown? The intellectual challenge is looking at field sites with fresh eyes.

MOSER, K.\* (1), C. AHN (1), and G. NOE (2)

### **Microtopographic influence on vegetation in mitigation wetlands in Virginia**

(1) Dept. of Environmental Science & Policy, George Mason University, Fairfax VA  
(2) U.S. Geological Survey, Reston VA

Microtopography, or topographic variation on the scale of individual plants, may influence wetland hydrology, physicochemistry, and plant community composition, but the microtopographic variation found in natural wetland settings is rarely found in created wetlands, unless it is manipulated as by diskings. This study explores the relationship between microtopography, hydrology, and plant species richness/diversity in wetlands, comparing results for two created wetlands in northern Virginia with those for beaver-engineered reference wetlands. Microtopography was measured using multiscale (0.5 m-, 1 m-, 2 m-, and 4 m-diameter) circular transects in order to determine the appropriate scale for consideration. Measurement data were used to calculate three microtopographic indices: tortuosity, limiting slope, and limiting elevation difference. Steel rod rust depth was used to assess water table depth at 80 cm transect intervals. Vegetation surveys at peak growth were used to assess weighted-average wetland indicator status and species richness/diversity, as well as to compare native/invasive and seeded/volunteer species. Results are examined with regard to wetland creation method: graded/disked, graded/undisked, and ungraded/undisked (reference), as well as in relation to scale.

NAGEL, L.\* (1), R.D. BOWDEN (1), J.A. TÓTH (2), and K. LAJTHA (3)

### **Rapid changes in soil carbon and organic matter at the Sikfokut International Long-Term Ecological Research Site, northeast Hungary**

(1) Dept. of Environmental Science, Allegheny College, Meadville PA  
(2) University of Debrecen, Dept. of Ecology, H-4032 Debrecen, Egyetem tér 1, Hungary  
(3) Dept. of Botany and Plant Pathology, Oregon State University, Corvallis OR

This study assessed short-term changes in soil chemistry due to altered litter and wood inputs and outputs in the Sikfokut Forest DIRT (Detritus Input, Removal, and Treatment) plots in northeast Hungary. The DIRT experiment assesses how plant inputs affect accumulation and dynamics of forest organic matter. Treatments include aboveground and belowground litter and wood additions or reductions. Triplicate 8 m x 8 m plots for each treatment were established in 1999. In 2005, samples were collected from DIRT plots and analyzed for C, N, S, pH and organic matter content. The pH levels generally increased as inputs increased, the O-horizon being most acidic. In the O-horizon, N was lowest in no-litter (0.6%), and highest in double-litter (0.8%). In the A-horizon, N was lowest in no-input and no-roots (0.2%), and highest in double-wood (0.3%). C content in the O-horizon was lowest in no-litter, and 50% greater in double-litter (15.0%). The A-horizon C contents were ~3.0% for no-input, no-litter, and no-roots, and ~4.0% for control, double-wood, and double-litter, suggesting that input reductions produced significant C reductions. Based on the results, C, N, and S changed little with increased inputs and sometimes decreased slightly relative to control plots, suggesting possible priming. However, large C, N, and S reductions occurred when litter was removed, possibly indicating N limitations, as well as rapid labile C loss following removal. This study suggests that soil organic

matter is processed rapidly, and that C, N, and S stocks are highly dynamic. Soil C storage processes are still not fully understood.

PEDERSEN, B.S.\*, and R.C. HANIFIN

#### **Light utilization efficiency in two mixed-deciduous forests subject to different intensities of deer herbivory**

Dept. of Environmental Studies, Dickinson College, Carlisle PA

We are studying light absorption by two mixed-deciduous forests that are subject to different intensities of herbivory by white-tailed deer (*Odocoileus virginianus*), but are otherwise ecologically similar. A previous study found a significant difference in the density of trees <20 cm dbh (diameter at breast height) at the FJRS site, as compared to the SGL site (both sites are in south-central Pennsylvania). This difference in tree communities was attributed to prolonged, high-intensity deer herbivory at FJRS. As a consequence of this community-level impact of deer herbivory, we hypothesized an associated, ecosystem-level impact: lower light utilization efficiency at FJRS than at SGL. At both sites we measured photosynthetically-active radiation (PAR) at breast height (1.3 m above the ground). During the growing season, PAR measurements were made simultaneously within the two forests and in adjacent fields where light sensors were exposed to full sun. Our horizontal profiles consisted of PAR measurements at 1200 locations within each forest, all made within 3 hours of solar noon on cloudless days. Our temporal profiles consisted of continuous measurements at 30 locations within each forest for at least two full days at each location. Based on the horizontal profile data, light utilization efficiency (PAR absorption) at FJRS (0.937) was lower than at SGL (0.968). While consistent with our hypothesis, this difference was only marginally significant ( $P=0.062$ , one-tailed t-test assuming unequal variances). Our analysis of the temporal profile data is continuing. We are also analyzing data on ground cover to determine light utilization efficiency below breast height.

PELOSI, M.\*, and M.S. PEEK

#### **Effects of sand burial on the coastal dune grass *Ammophila breviligulata***

Dept. of Biology, William Paterson University, Wayne NJ

Shoreline erosion represents a major problem for many coastal systems. American beachgrass (*Ammophila breviligulata* Fern.) acts as a natural stabilizer in this successional system. As a result, this dune vegetation is prone to severe disturbance and stress, most commonly burial by shifting sand. We monitored plant performance above and belowground throughout the summer of 2005 in response to an experimental addition of 10 cm/yr sand accretion rate, added in two increments. While

we saw no effects of burial to sand, we did measure a uniform root length and weight distribution down to 70 cm, with an average weight of  $0.39 \pm 0.027$  mg/cm<sup>3</sup> and an average length of  $2.8 \pm 0.15$  cm/cm<sup>3</sup>. Aboveground, the number of culms declined linearly from the start of the experiment, while plant height increased steadily until late August, then declined thereafter. The lack of a response to burial was not surprising as the start of the experiment was during the mid-summer, when soil moisture and temperatures were greatest and plant activity reduced. Surprisingly, however, root biomass did not change through time or in the soil profile, suggesting the importance of biomass allocation to the root system and ultimately stabilizing shifting sand.

PERRY, M.\*, K. VANNICE, M. DEFILLIPO, and J. MACHADO

#### **Testing the effectiveness of various methods to control the growth of non-indigenous Japanese knotweed (*Fallopia japonica*)**

Dept. of Biology, Swarthmore College, Swarthmore PA

The introduced species Japanese knotweed, an invasive member of the buckwheat family (Polygonaceae), has spread rapidly across the United States since its introduction from Japan in the late 1800's and poses a great threat to the integrity and diversity of native ecosystems. This plant spreads by cuttings and establish rhizomes that reproduce clonally creating large long-lived patches of single individuals. Our goal was to determine the effectiveness of different control methods that altered aboveground and belowground conditions in combination or one at a time. For four years, we employed rototilling, herbicide, and the combination of the two, nested within three light environments (full sunlight, partial shade and heavy shade) on a preexisting stand of *F. japonica* along the banks of the Little Crum Creek, Ridley Township, PA. Our results indicate that *F. japonica* growth is limited by the availability of light but light limitation alone is not an effective control method. Rototilling alone was the least effective method across all light environments. In conclusion, herbicide applications remains the most effective method but its effectiveness was increased when light was also limited. Perhaps, a combination of shading and herbicide could be recommended to limit the amount of herbicide and the number of applications necessary.

PERRY, M.\*, and J. WRIGHT

#### **World's oldest living things? Investigating the extreme age of box huckleberry (*Gaylussacia brachycera*) clones in Pennsylvania**

Dept. of Biology, Dickinson College, Carlisle PA

The box huckleberry, *Gaylussacia brachycera*, is a relatively rare colonial plant native to the eastern United States. The species has been made famous by the purported

ages of two large clones in Perry County, Pennsylvania, one alleged to be 1200 and the other 13,000 years old. Since these values were first calculated nearly a century ago, however, these age estimates have not been validated. We reviewed the literature to determine how the original age estimates were made. Then, in the field, we mapped the boundaries of one clone using GPS to compare its longest axis and area to the 1919 estimate. We also measured yearly growth as rootstock extension increments to compare with the original estimate of growth rate. The clone we mapped apparently has not expanded measurably since 1919, and the yearly growth we calculated was slower than previously supposed. Based on our revised estimates, the clone previously estimated as 13,000 years old was probably exaggerated by nearly a factor of two, but the clone originally estimated as 1200 years old may surprisingly actually be older, closer to 1600 years.

REYNARD, J.R.\* (1), G.A. POPE (1), and W.F. BIEN (2)

#### **Forest fire as a unifying soil weathering agent in differing ecosystems**

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(2) Dept. of Bioscience and Biotechnology, Drexel University, Philadelphia PA

Forest fire can impact soil in a variety of ways including alteration of the clay mineral components of the upper most soil horizons. These changes may include degradation, collapse, complete destruction of the mineral, as well as an increase in clay minerals or clay sized minerals. This study intends to ascertain if these mineral alterations are similar over broadly different ecosystems. The two study areas, the site of the 2002 Hayman, Colorado forest fire and the fire-adapted ecosystem of the Pine Barrens of New Jersey, are tied together by the feldspar component of their soils. The Colorado site is derived from a granite parent material in mountain topography while the New Jersey site is derived from sedimentary deposits of feldspathic-sands of a coastal plain. X-ray diffraction indicated that the Hayman, Colorado, soils showed slight alterations of minerals exposed to forest fire. It is expected that similar alterations will occur in the New Jersey study area and that percentages of clay will increase with more frequent or more intense fire. Accordingly, Pine Barren soils may exhibit a post-fire texture fining seen in the Hayman soils. The current New Jersey study is beginning to show implications for alteration of the clay mineral structures with forest fire. It is hoped that continued investigation will ascertain if forest fires have impacts on soil that are independent of other soil forming processes.

RICHTER, K.E.\*, and A. PACKER

#### **Differentiation of soil pathogens in agricultural and old field communities**

Dept. of Biology, Susquehanna University, Selinsgrove PA

*Abstracts of the Mid-Atlantic Ecology Conference (April 2006)*

*Pythium*, a soil pathogen classified as an oomycota, causes damping-off in the roots of many types of plants. Damping-off is often detrimental to the yield of crops and causes severe economic losses. In central Pennsylvania, soybean and corn are two crops often affected by *Pythium*. Pathogens in a soil community often differentiate depending on the identity of the host species present. This leads to the expectation that *Pythium* species may vary in soils occupied by different plants. Soil samples were taken from four locations—a cornfield, a soybean field, an old field, and a black cherry hedgerow—in the Selinsgrove, Pennsylvania area in order to characterize the *Pythium* species present. The soil was sieved, air-dried, diluted, and spread over cornmeal agar plates to allow for growth. Morphological variation in the rate of growth of *Pythium* indicates the presence of different species within the different soil samples. These early results imply that differentiation does occur and that species of *Pythium* will occupy soils that contain hosts they are better adapted to infect. This is being confirmed by inoculation experiments.

RODDY, A.B.\* (1), and S.D. WULLSCHLEGER (2)

#### **Effects of low water potentials on the growth and structure of corn roots**

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(2) Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN

The success of a plant depends on its ability to locate water and on securely anchoring in the soil. Cellular growth in roots is driven by water uptake and resulting increases in turgor pressure. Low water potentials (LWPs), characteristic of various soil conditions, slow the rate of primary root growth and induce a suite of changes in the growth zone. To better understand the effects of LWPs on the growth of primary roots, *Zea mays* seedlings were grown in different concentrations of polyethylene glycol solution. The effects of LWPs on the water content, the spatial distribution of growth, and the mechanical properties of the root throughout the growth zone were quantified. LWPs decrease the total amount of water in roots by as much as 71% and decrease the proportion of total root mass that is water by as much as 11%, indicating differential biomass allocation under LWPs. LWPs also decrease relative elemental growth rate and shift the region of maximal growth rate towards the root tip. LWPs decrease the flexural stiffness of roots, possibly due to cell wall loosening and reductions of turgor pressure, thus diminishing a root's ability to penetrate dry, hard soil. Though LWPs slow growth rate and decrease the ability to break through soil, this increased flexibility at LWPs may facilitate growth by temporarily lessening the need for water to maintain growth until more water can be found. Such a plastic response may enable plants to grow in a wider range of environments.

ROSS, K.A.\* (1), J.G. EHRENFELD (1), and M.V. PATEL (2)

**Effects of soil amendments on the nitrogen dynamics of Japanese barberry (*Berberis thunbergii*) and Japanese stiltgrass (*Microstegium vimineum*) in New Jersey forests**

(1) Dept. of Ecology, Evolution, and Natural Resources, Rutgers, The State University of New Jersey, New Brunswick NJ

(2) Dept. of Botany, University of Vermont, Burlington VT

Deciduous understory forest composition is being altered due to the invasion of two exotic, invasive species, *Berberis thunbergii* and *Microstegium vimineum*. These species have facilitated changes in soil properties leading to conditions that inhibit ecosystem resistance to further invasion. Previous research has provided evidence that both species are associated with high nitrogen soils. We hypothesize that a reduction in nitrogen availability by amending the soil will reduce the success of these exotic species, and increase the competitive ability of native vegetation. Soil amendments were added to 25 study plots, established in two national parks in New Jersey. The effects of the following soil amendments: 1) the application of aluminum sulfate to reduce soil pH, 2) the addition of woodchips to increase the soil C:N ratio, 3) the addition of a nitrification inhibitor, and 4) the removal of the surface soil to reduce N availability, were monitored. Since 2003, soil samples were collected seasonally and analyzed for moisture and organic matter content, inorganic nitrogen, nitrification rates, pH, and C:N ratio. The results of the soil analyses indicate that the removal of surface soil and the woodchip addition do alter soil N availability. Results varied among seasons, but extractable NO<sub>3</sub> was significantly reduced in the plots from which the top 5cm of soil was removed and in plots that received the woodchips when compared to controls. Findings from this study will provide scientists and managers with practical and novel methods to restore soil conditions once local ecosystems have been invaded.

SCHAUMBURG, K.\* (1), G.A. LANGELLOTTO (1), and W. M. GIULIANO (2)

**The effects of vegetation composition on avian nest site utilization and success in Connecticut tidal marshes**

(1) Louis Calder Center, Dept. of Biological Sciences, Fordham University, Bronx NY

(2) Dept. of Wildlife Ecology and Conservation, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL

The expansion of the invasive reed, *Phragmites australis*, has resulted in notable changes throughout Connecticut tidal marshes, yet few studies have quantified the impacts of these habitat changes on avian nest site utilization and success. I examined 20 Connecticut tidal marshes in the summer of 2003 to characterize habitat components (through nest monitoring, macroinvertebrate sampling, and vegetation

sampling) associated with nest sites and with nest fates. A total of 90 nests, belonging to 12 species were located with twenty-two nests belonging to tidal marsh specialists. Microhabitat characteristics did not differ between nest and other locations. However, the evaluation of microhabitat characteristics associated with nesting success revealed that successful nests were consistently located in areas with greater vertical cover. *P. australis* habitats contained the majority of nests and birds that nested there had relatively high nest success. However, no tidal marsh specialist nests were located within *P. australis* dominated habitats. These results imply that the presence of *P. australis* in tidal marshes may increase the abundance of generalist species, potentially at the expense of rarer specialists.

SCHMEDICKE, R.\*, and W.T. STARMER

**An integrative approach to community assembly in the cactus-yeast model system**

Dept. of Biology, Syracuse University, Syracuse NY

Ecological communities are often described by the abundance structure of their constituent species. The determinants of such structure have typically been explored through species interactions, as mediated by ecologically relevant traits, and more recently through evolutionary relationships, as molecular phylogenies become increasingly available. We use the ascomycetous yeast community inhabiting decaying cactus stems as a model system for developing a method of characterizing communities based on the integration of abundance relationships, trait similarities, and evolutionary history. Yeast species living in a chemically restrictive columnar subfamily of the Cactaceae show structuring consistent with the prediction of convergent evolution within the community: abundant species are physiologically more similar to each other than expected (are underdispersed), while phylogenetically more distant than expected (overdispersed). The converse is true of rare species. Species inhabiting the less restrictive *Opuntia* cacti exhibit no patterning of abundance with phylogeny and physiology. The integrative method leads to a quantitative descriptor of assembly, making possible comparisons between very disparate communities (preliminary work on North American passerines and African ungulates will also be presented) and between different scales of geographic, phylogenetic, and functional inclusion.

SCHRAMM, J.W.

**The presence of Japanese stiltgrass (*Microstegium vimineum*) as related to intermittent hydrology and forest age**

Dept. of Ecology, Evolution, and Natural Resources, Rutgers, The State University of New Jersey, New Brunswick NJ

In recent decades, Japanese stiltgrass has garnered a great deal of attention from both academic and management professionals. The species has expanded its range rapidly throughout the Mid-Atlantic states, and now dominates the herbaceous layer of many forests, where it poses a competitive threat to a wide variety of native plant species. Although many studies and anecdotal accounts indicate that the species is limited by heavy shading, and, to a lesser extent, low pH and nutrient availability, an overarching explanation for the species' distribution is still needed. Such knowledge would help both to focus control efforts and further general understanding of invasion mechanisms. Using patch-level GPS mapping, this study related the presence and abundance of stiltgrass to the locations of vernal pools and intermittent watercourses in a 1000-ha county park along the Sourland Mountains of central New Jersey. This method was designed to test the assumption that the primary abiotic seed dispersal mechanism for this annual grass is via overland water flow. In addition, the density of stiltgrass was examined in light of particular forest stand ages. Stand age presumably reflects a range of other covarying variables, such as shrub strata density and soil depth. At least at this study location and spatial scale, stiltgrass abundance does seem to be positively correlated with intermittent waterways and younger forests. Applying these findings across the scale of the entire Sourland region may be a promising method to both predict and confirm the locations of stiltgrass populations.

SCOW, S.\*, and G. WINGERT

**Reproductive adaptations of chestnut oak (*Quercus prinus*) to herbivory and cache predation**

Dept. of Environmental Studies, Dickinson College, Carlisle PA

Evolutionary success depends upon an organism's ability to produce viable offspring. However, predation decreases the probability of offspring survival, and organisms must evolve in order to overcome this threat. Chestnut oak (*Quercus prinus*) predators include herbivores and caching animals. We analyzed 1100 chestnut oak seeds were analyzed to determine reproductive strategies that it has developed in order to ensure offspring survival and dispersal. Acorns were planted and allowed to germinate until the plant body was well established. Herbivory and caching predation was simulated by breaking the plant body between the meristem and the encased cotyledon or by cutting the plant body below the meristem at the radicle-hypocotyl interface. The acorn was then replanted. Successful reproduction was determined

according to the survival of the severed plant bodies and the ability of the severed cotyledons to generate a new embryo plant. A 36% survival rate of plant bodies after being severed from the original cotyledon indicates an adaptation to direct herbivory while the 69% generation rate of a new embryo plant by the severed cotyledon indicates an adaptation to scatter caching. A germination rate of 8.5% of two plant bodies from one acorn indicates that chestnut oak acorns can produce more than one embryo plant from a single acorn.

SMITH, A., and A. B. GRIFFITH\*

**Leaf movement and leaf damage in *Cercis canadensis*: Do leaves act differently in the sun and shade?**

Dept. of Biological Sciences, University of Mary Washington, Fredericksburg VA

Past research has shown that plants growing under different light conditions (direct light, full shade, and partial shade) differ in photosynthetic rates. Two other processes, heliotropism and leaf damage, may lead to photosynthetic differences in sun and shade. Our objective was to measure leaf movement and leaf damage in different light conditions for *Cercis canadensis*. Forty plants were sampled from four sites. At each site five plants were in the sun and five in the shade. Leaf orientation (azimuth and altitude) and leaf damage were measured on ten leaves. We found differences in leaf orientation of light and shade plants. Leaves in direct light oriented in the same direction while leaves in the shade oriented randomly. The percent of leaves damaged / plant was significantly different between light environments ( $F=5.5$ ,  $P=0.026$ ) and between sites ( $F=9.0$ ,  $P\leq 0.001$ ). There was also an interaction between sites and light environment ( $F=4.4$ ,  $P=0.011$ ). The percent of damage / leaf was significantly different between light environments ( $F=31.69$ ,  $P<0.001$ ) and between sites ( $F=6.28$ ,  $P<0.001$ ). Plants growing in a shaded environment tend to have a greater amount leaf damage per plant and per leaf than those in the full sun. Our results show that leaf damage is more prevalent in cool, damp environments. It is likely that disease is more damaging to photosynthesis in these conditions than in full sun.

SNYDER, E.\*, and T. J. MARET

**Ecological correlates of rusty crayfish presence and macro-invertebrate assemblages in a stream system in south-central Pennsylvania**

Dept. of Biology, Shippensburg University, Shippensburg PA

The rusty crayfish, *Orconectes rusticus*, is a non-native crayfish that was recently introduced into aquatic ecosystems in Pennsylvania, most likely as bait for fishing. In recent years it has spread rapidly throughout stream systems in south-central

Pennsylvania. *O. rusticus* has been demonstrated to negatively affect some aquatic invertebrates and submerged vegetation in lentic ecosystems. We investigated the relationships among *O. rusticus* presence/absence, macroinvertebrate assemblages, and water quality parameters in a lotic system. We sampled a total thirteen sites within five different streams. *O. rusticus* was present at eight of the sites. Macroinvertebrate samples were taken with a 1 meter kick net. Water chemistry and physical characteristics were also determined at each site. Presence of *O. rusticus* can be predicted by stream pH or total dissolved solids (mostly CaCO<sub>3</sub>). Total invertebrate diversity was higher at locations without *O. rusticus*. Coleoptera and Trichoptera were more abundant at locations where *O. rusticus* was present, whereas Plecoptera was more abundant at sites without *O. rusticus*. However, there was a significant positive relationship between pH and density of Coleoptera and a negative relationship between pH and density of Plecoptera. We are thus unable to differentiate between the effects of *O. rusticus* and pH on these taxa. In conclusion, our data suggest that *O. rusticus* may be excluded from streams with low pH and dissolved solid concentrations. In addition, it appears that *O. rusticus* may affect freshwater stream invertebrate assemblages. A larger, more detailed study is needed to determine actual cause and effect relationships.

STRONG, A.\* (1), J.-L. MACHADO (1), and A. BARRON (2)

#### **Patterns and controls of asymbiotic nitrogen fixation in a tropical lowland forest**

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(2) Dept. of Ecology and Evolutionary Biology, Princeton University, Princeton NJ

The N input via asymbiotic N fixing bacteria in the leaf litter is often overlooked in ecosystem N budgets. As a result, the ecological controls of the rate of nitrogen fixation by asymbiotic nitrogen-fixing bacteria living on decaying leaf litter are poorly understood. We measured the nitrogenase activity of free-living bacteria in a long-term leaf litter manipulation experiment in a lowland tropical rain forest in Panama. Bacteria growing in plots with artificially doubled standing litter fixed nitrogen at a marginally higher rate than bacteria on control litter plots, indicating that the litter structure, and potentially nutrient cycles, water and microenvironments, may influence the rate of N fixation. We found substantial micro-geographic variation, however, indicating the potential for extremely localized "hot-spots" of N fixation. To investigate this, we measured nitrogenase activity of bacteria living on leaf litter of four common tree species: *Oenocarpus panamanus*, *Aspidosperma cruenta*, *Tetragastris panamensis*, and *Prioria copaifera*. N fixation by bacteria growing on *A. cruenta* leaves was an order of magnitude higher than other species. *A. cruenta* is an evergreen canopy tree with unique alkaloid compounds and extremely long-lived leaves. Elemental analysis of *A. cruenta* leaves revealed that high C:N ratio, and specifically low N levels were driving rates of N-fixation on this species of leaf. These results suggest that traditional bulk assays of mixed litter may miss "hotspots" driven

by particular combinations of leaf traits, potentially underestimating fixation at the stand level.

STROUSE, S.\*, and T. SIPE

#### **Effects of soil temperature, moisture, organic matter, and volume on respiration rates in mature hemlock and successional hardwood forests in central Massachusetts**

Dept of Biology, Franklin & Marshall College, Lancaster PA

Soil respiration plays a key role in forest carbon cycles and produces a nearground zone of enriched ambient CO<sub>2</sub> concentrations, but the factors that regulate respiration and CO<sub>2</sub> enrichment are only partially understood. Soil variables and respiration rates were measured during midsummer in 12 circular 1-m radius plots in both a mature hemlock and a mid-successional hardwood site in central Massachusetts in order to: (1) quantify respiration rates, including within-site variation; (2) relate respiration to soil temperature (5 cm), moisture (0-15 cm), organic matter concentration (0-15 cm), and unobstructed volume (upper 25 cm); (3) relate respiration to nearground CO<sub>2</sub> concentrations; and (4) compare the two sites. The successional forest showed higher mean respiration (278 mg C m<sup>-2</sup> h<sup>-1</sup>) and lower spatial variation (range=260-380) than the hemlock forest (mean=255 mg C m<sup>-2</sup> h<sup>-1</sup>, range=195-310). On average, the hardwood site had slightly higher soil temperatures (17.8 vs. 16.8 C), lower soil moisture (18.5 vs. 25.0% volumetric water content), and greater unobstructed soil volume in the upper 25 cm below respiration rings (1441 vs. 1313 cm<sup>3</sup>), which contributed to the greater soil fluxes. Results for organic matter and relationships between respiration and nearground CO<sub>2</sub> concentrations will also be presented.

TODD, N.\*, and A. POLLOCK

#### **Forest diversity on the Manhattanville College Campus: 100 years after Frederick Law Olmsted**

Dept. of Biology, Manhattanville College, Purchase NY

Manhattanville College in Purchase, New York is sited on land that was once part of a private estate, and which was intentionally planted at different times. There is a large area of undisturbed land in the northeastern corner of campus that has been the focus of this study, as part of a major habitat restoration project and development of an environmental park. The goal of this study was to examine the tree species to determine whether they might be the result of intentional planting or represent naturally occurring secondary succession, typical of northeastern hardwood forests. An estate of similar age, the Louis Calder Biological Field Station in Armonk, New

York. was used for comparison. Of 34 tree species, the two areas share only 7 in common: including Norway and sugar maple, poplar, tupelo and black ash. The Calder Center has a fairly typical oak-hickory hardwood forest with American beech, red maple, and Tulip poplar. The species unique to Manhattanville include several species of conifers (pine, spruce, cedar, and hemlock), several poplars, the largest of which is the cottonwood poplar, as well as more exotic species such as Florida silverbell, honey locust, mimosa silk tree and Carolina ash. Since the Calder Center was not extensively planted, these discrepancies suggest that the exotic species present at Manhattanville are a result of deliberate planting. Although there are a wide variety of species, sugar and Norway maple dominate, indicating gap colonization of previously disturbed areas, with the rest of the species occurring in much lower abundances.

URBAN, R.A.\*, J.E. TITUS, and W.X. ZHU

#### **Shading by an invasive macrophyte affects native isoetid growth and sediment chemistry**

Dept. of Biological Sciences, Binghamton University, Binghamton NY

The submersed macrophyte *Utricularia inflata* (inflated bladderwort) is a recent invader of Adirondack Mountain lakes (New York, USA). Previous experiments suggest that *U. inflata* may change nutrient cycling in Adirondack lake ecosystems by reducing the growth of native isoetid macrophytes, and altering key features of sediment chemistry. A 13-week greenhouse experiment was conducted to test the hypothesis that shading is the primary mechanism behind this rootless macrophyte's detrimental impact on the native short-statured species, *Eriocaulon aquaticum* (pipewort). *E. aquaticum* has an extensive root system that takes up carbon dioxide from sediment, and releases oxygen—thereby creating an oxidized sediment environment. As we increased shading by adding layers of shade cloth (1-4 layers), growth and asexual reproduction by the native species significantly declined ( $P < 0.001$ ), and the change of sediment chemistry intensified. Shading decreased *E. aquaticum*'s oxidizing effect on the sediment ( $P < 0.0001$ ) and increased the concentrations of porewater carbon dioxide ( $P < 0.0001$ ) and extractable ammonium ( $P < 0.0014$ ). There was on average an 83% light attenuation under the cover of *U. inflata*; this value was close to the light attenuation from two-layers of shade cloth (82%). The impact of *U. inflata* on the native species closely matched the impact of shade cloth with similar light attenuation. Our results suggest that the primary mechanism behind *U. inflata*'s impact on native isoetids and sediment chemistry is shading.

Abstracts of the Mid-Atlantic Ecology Conference (April 2006)

WALSH, C., and T. SIPE\*

#### **Combined effects of carbon dioxide and sunfleck characteristics on photosynthetic gas exchange and daily carbon assimilation by *Aralia nudicaulis* and *Smilacina racemosa* in the forest understory**

Dept of Biology, Franklin & Marshall College, Lancaster PA

Plants in the forest understory experience dynamic variation in both irradiance and naturally enriched  $\text{CO}_2$ . Net carbon assimilation (A), stomatal conductance (g), transpiration (E), and water use efficiency (WUE) were measured for the herbaceous species *Aralia nudicaulis* and *Smilacina racemosa* to determine the individual and combined effects of elevated  $\text{CO}_2$  and sunfleck characteristics (brightness, duration, fluence). Gas exchange was measured under steady-state conditions and in response to an array of sunflecks (0.5 to 8 minutes, 50 to 800  $\mu\text{mol m}^{-2} \text{s}^{-1}$ ) at both 400 and 500 ppm  $\text{CO}_2$ . The results were combined with field irradiance and  $\text{CO}_2$  data to estimate daily net A under four scenarios: (normal versus enriched  $\text{CO}_2$ ) x (steady-state versus sunfleck responses). All four physiological variables increased significantly in *Aralia* in response to sunfleck duration, brightness, and fluence. For *Smilacina*, A and WUE increased significantly at elevated  $\text{CO}_2$ , and A, g, E, and WUE all responded significantly to duration. Estimated daily A ranged from  $-0.0049$  to  $0.0540 \text{ mol m}^{-2} \text{ day}^{-1}$  across twelve microsites, with substantial species differences. The four estimation methods differed in the predicted order, but not significantly, when averaged across the microsites. This work confirms the importance of quantifying species-specific responses to both sunflecks and enriched  $\text{CO}_2$  across heterogeneous, dynamic understories.

YEUNG-CHEUNG, A.\*, and W. EILBACHER

#### **The inhibitory effect of bioherbicide glufosinate on *Pseudomonas putida* in nutrient broth and campus soil**

Dept. of Biology, Manhattanville College, Purchase NY

Bioherbicide glufosinate is commonly used at the lowest recommended concentration of 5.65 mM to control weeds in the field. Studies were conducted on the effect of various concentrations of glufosinate on the growth of the bacteria *Pseudomonas putida*. An inoculum of  $10^4$  CFU/ml of *P. putida* overnight culture was grown in nutrient broth containing concentrations of glufosinate ranging from 10  $\mu\text{M}$  to 10 mM. The optical density (OD 600 nm) was measured over time on broth containing *P. putida* and different concentrations of glufosinate. In another experiment, *P. putida* overnight culture was inoculated in 3 g of sieved autoclaved campus soil in a final concentration of  $10^4$  CFU/g of soil with 1 mM and 5 mM glufosinate for 96 hours. *P. putida* in soil were extracted over time and plated on selective basal salts medium agar plates. Bacteria were enumerated to determine the inhibitory growth effect of various

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glufosinate concentrations on *P. putida* in soil. In vitro results showed significant effect of 1 mM, 5 mM and 10mM glufosinate concentrations on *P. putida* growth in nutrient broth. In soil experiment, 1 mM glufosinate had a significant effect on the growth of bacteria at 48 and 72 hours, and 5 mM glufosinate had a significant effect at 18, 24, 48, and 72 hours when compared to the control. Our result demonstrated the inhibitory effect of glufosinate when over 1mM was applied to *P. putida*. This may indicate that soil microorganisms can be affected when recommended concentrations of bioherbicide are used in the field.

YEUNG-CHEUNG, A., N. TODD\*, and C. ENCARNACION

#### **Developmental changes resulting from exposure to trace amounts of pesticides in the early life stages of *Danio rerio***

Dept. of Biology, Manhattanville College, Purchase NY

Before pesticides are approved for commercial use, they undergo toxicity testing to determine lethal levels. Few studies have been done, however, which examine the effects of very small amounts of these pesticides (resulting from lawn and garden runoff) on aquatic organisms. Glufosinate ammonium (GLA) is a natural microbial toxin isolated from *Streptomyces*, and is widely used as an herbicide. Malathion is an organophosphate insecticide commonly used on lawns and gardens. As zebrafish are very similar to minnows that occur in freshwater ecosystems, they represent good proxies for study. We investigated the developmental effects of glufosinate exposure on *Danio rerio* larvae for 72 hrs under 1mM, 5mM, and 20mM concentrations. Mutations in the spinal column occurred with 5mM and 20mM GLA treatment, with a severe developmental lag occurring under the 20mM GLA concentration. A separate study sample of zebrafish eggs were exposed to four dilutions of a Malathion stock solution (1:1000, 1:750, 1:500 and 1:250). Mortality increased after 72 hours (normal hatching time), and the majority of the eggs that did survive never hatched, some remaining in the egg until 220 hours post-spawning. While the mutations are important, the long developmental lag and delay in hatching under exposure to these pesticides have major implications for aquatic food chains. Longer time in the egg will result in higher predation, and lower surviving numbers of juvenile fish, thus affecting the lower parts of the food chain. In addition, significant changes will result in adult minnow population survival and reproductive patterns.

YU, S.\*, K. ELGERSMA, T. VOR, and J.G. EHRENFELD

#### **Soil microbial community and enzyme activities responding to the leaf litter decomposition of native and invasive plants**

Dept. of Ecology, Evolution, and Natural Resources, Rutgers, The State University of New Jersey, New Brunswick NJ

Feedback between plants and soil is an important factor affecting plant ecology, and may be an important component of the success of invasive plants. Both leaf litter and roots can induce species-specific rhizosphere microbial communities, but their relative importance remains unclear. A greenhouse experiment was carried out for separating the effects of leaf litter on soil microbial community and enzyme activities from whole-plant effects. Leaf litters were collected from two native species (*Vaccinium corymbosum* and *Viburnum acerifolium*) and two invasive species (*Berberis thunbergii* and *Microstegium vimineum*), placed on field-collected (uninvaded) forest soils, and allowed to decompose. *B. thunbergii* lost 80% of dry mass after an 11-month incubation but *M. vimineum* lost 50% dry mass vs. 40% for *V. corymbosum* and 76% for *V. acerifolium*. Soil microbial biomass (SMB) was higher under *B. thunbergii* leaf litter. Surprisingly, SMB under *M. vimineum* leaf litter was lower than under the two native shrub leaf litters, measured by both the chloroform-fumigation-extraction method and the PLFA technique. We further found that microbial communities under *B. thunbergii* litter differed in bacterial and fungal components and C:N from the other species. The two native shrub leaf litters induced very similar soil microbial community structures, while soil communities under the two invasive species were clearly separated from each other and from the native shrubs based on principal component analysis. *B. thunbergii* litter reduced soil enzyme activities, including acid phosphatase, phenol oxidase and urease, whereas the two native shrubs had relative high enzyme activities specifically of nitrogen, phosphorus and carbon cycling. These studies clearly demonstrate that litters alone have significant effects on soil microbial community structure and function.

ZHU, W.-X.\*, W. WANG, and N. HANTSCH

#### **Tree species effect on soil nitrogen mineralization and nitrification in a plantation site in south-central New York**

Dept. of Biological Sciences, State University of New York, Binghamton NY

Plant species composition is important in shaping soil nitrogen (N) biogeochemistry. Dominant trees producing litter with different quantity and quality could affect N transformations, while different levels and forms of N produced affect litter production. Experiments testing this hypothesis are limited. Here we take advantage of a 60-year plantation site in south-central New York, where different trees were planted in one-acre stands on former farmland. In summer 2002, *in situ* N transformation rates were measured in duplicate stands of red oak, sugar maple, Norway spruce, red pine, and black locust (total 10 stands). Average N mineralization rates in the surface soil (0-5 cm, 0.8-2.0 µg N/g soil/d) were 3-9 times of those in the deeper soil (5-15 cm), but the differences among five species were not statistically significant. In contrast, net nitrification rates were significantly lower under red oak ( $P < 0.001$ ). Lab incubations of soils collected from the fall of 2004 and 2005 in general supports patterns of the field study. In 2004, we measured both net N transformation rates and gross rates. Data from  $^{15}\text{N}$  dilution suggested that soil  $\text{NO}_3^-$  consumption under most

trees was much smaller than  $\text{NO}_3^-$  production; however under red oaks,  $\text{NO}_3^-$  consumption matched or exceeded gross  $\text{NO}_3^-$  production. In 2005, we found microbial biomass N was higher under Norway spruce and red oaks and lower under sugar maples and red pines. Our studies suggest that different tree species lead to the differentiation of soil N biogeochemistry, affecting both N supplies and N pathways.