


4-19-2016

# Student Spotlight on Research and Outreach Proceedings

SUNY College of Environmental Science and Forestry

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# **Spotlight Symposium on Student Research and Outreach Proceedings**

April 19th, 2016

Gateway Center

Syracuse, NY



**State University of New York  
College of Environmental Science and Forestry**

**Members of the Ad Hoc Committee for the Student Spotlight on Research and Outreach:**

Ms. Jessica Clemons- Chairperson

Ms. Ellen Edgerton

Ms. Theresa Kaier-May

Mr. John Wasiel

The Spotlight is organized by the Ad-Hoc Committee for Spotlight on Student Research, a sub-committee of the Academic Governance Committee on Research (COR). The Committee would like to thank the Office of Research Programs for sponsoring the refreshments during the poster session.

We would also like to express our gratitude to the graduate students, undergraduates, and faculty for contributing to this event. Without your work there would be no event!

## GRADUATE STUDENT ABSTRACTS

**Authors:** Harris, JR, Lundgren, BR, Grzeskowiak, BR, Nomura, CT. Department of Chemistry, SUNY College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, NY 13210

**Title:** A novel method for engineering recombinant *Halomonas* sp. O-1 to produce biodegradable plastics

**Abstract:** Petroleum-based plastics and the pollution they cause is one of the most serious environmental issues of this century, yet plastics have become an irreplaceable member of the lives of billions of people. The world is in desperate need of more ways to sustainably produce biodegradable plastics using renewable resources. A number of bacterial species have been found to naturally produce a class of plastic-like materials known as polyhydroxyalkanoates, or PHAs, and some can be engineered to use waste products like woody biomass and biodiesel glycerol as the carbon source for these materials. One barrier preventing industrial-scale production of PHAs is the high cost of sterilizing bacterial culture media and the dwindling supply of freshwater on the earth.

Members of the *Halomonas* genus of bacteria are characterized by their halophilic, or salt-loving nature, and certain strains are capable of producing PHAs. Emerging research shows that these organisms can be adapted to use continuously fed, non-sterile water from the ocean to create these polymers. The goal has now become the development of new molecular methodologies for engineering more efficient and higher yielding strains. *Halomonas* sp. O-1 is a natural PHA producer and the purpose of this research was to create a technique that allows for the uptake and expression of plasmid-based DNA containing genes for enhanced PHA production. Results describe a novel and reproducible method for creating electrocompetent cells and electroporation conditions cable of inducing plasmid DNA uptake and selection.

**Level of Research:** Graduate - M.S. **Department:** Chemistry **Faculty Advisor:** Dr. Christopher Nomura

**Authors:** Tyler Shields & Mark Teece, Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Identification of photosynthetic and microbial communities in freshwater microbialites of Fayetteville Green Lake using biomarker analysis.

**Abstract:** Freshwater microbialites are living carbonate structures that grow a small number of lakes throughout the world. Microbialites are composed of an outer active microbial mat that is composed of various autotrophic and heterotrophic microbial communities. These organisms precipitate carbonate to produce the skeleton of the microbialites structure. We used biomarker analysis to determine the composition of autotrophic and heterotrophic organisms within the microbialites of Fayetteville Green Lake, near Syracuse NY. Autotrophic and heterotrophic biomarkers were detected in the microbialites. Bacterial biomarkers were identified and included odd length C15 and C17 fatty acids and trace amounts of hopanoids were also identified in shallow water microbialites. Autotrophic biomarkers were identified and included all even carbon chain length fatty acids from C16-C24. Phytol which is present in chlorophyll was also detected. A wide range of steroidal compounds were identified that are typically present in photosynthetic organisms and included cholesterol and brassicasterol. The

biomarker compositions of microbialites are hypothesized to change as a function of spatial location and depth within the water column of Green Lake. We hypothesize that light is a major factor determining the composition of the heterotrophic and autotrophic communities in freshwater microbialites.

**Level of Research:** Graduate - M.S. **Department:** Chemistry **Faculty Advisor:** Mark Teece

**Authors:** Harris, JR, Lundgren, BR, Grzeskowiak, BR, Nomura, CT. Department of Chemistry, SUNY College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, NY 13210

**Title:** A novel method for engineering recombinant *Halomonas* sp. O-1 to produce biodegradable plastics

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**Level of Research:** Graduate - M.S. **Department:** Chemistry **Faculty Advisor:** Ivan Gitsov

**Authors:** Bofan Wei. Departments of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Phototransformation of Cyanobacterial Hepatotoxin Microcystin-LR by Ultraviolet Irradiation

**Abstract:** Toxic cyanobacterial blooms are a growing environmental and human health concern. The most commonly occurring toxins produced by cyanobacteria are microcystins (MCs). This toxin affects the liver by forming a permanent covalent linkage with the enzyme protein phosphatase. Among the microcystins, microcystin-LR (MC-LR) is found to be one of the most abundant and the most toxic. It is thus necessary to develop effective treatment methods to remove microcystin-LR from contaminated water. Photodegradation is a very important way to remove contaminants in natural water system. Since the defined absorption band of MC-LR in the UV range has a maximum at 238 nm, we might expect the removal of MC-LR under Xenon

light. To prove our hypothesis, we use 800MHz <sup>1</sup>H NMR to identify the structure of standard MC-LR and the product after UV irradiation. The results shows that when microcystin-LR was exposed to UV, two new compounds were identified as [4(E), 6(Z)-Adda]- and [4(Z), 6(E)-Adda] microcystin-LR and they were produced in equal amount.

**Level of Research:** Graduate - Ph.D. **Department:** Chemistry **Faculty Advisor:** Greg Boyer

**Authors:** Department of Chemistry, State University of New York-ESF

Department of Chemical and Biomedical Engineering, Syracuse University

**Title:** Synthesis and Characterization of Dumbbell-like Amphiphilic Janus Dendrimers

**Abstract:** Amphiphilic molecules are known to be able to self-assemble into nano- or microstructures in aqueous solutions. In our previous study, a family of amphiphilic Janus dendrimers has been synthesized by coupling poly(ether-ester) dendrons with Fréchet type poly(benzyl ether) dendrons through “click” chemistry. These dendrimers formed micelles and vesicles in water. In this research, a new type of dumbbell-like amphiphilic Janus dendrimers were synthesized by “inserting” an oligo(ethylene glycol) spacer between the two dendritic fragments. By changing the “rigid” linkage into the “flexible” spacer, the solution behavior of these dendrimers could be influenced dramatically. The success of synthesis was confirmed by nuclear magnetic resonance and matrix-assisted-laser-desorption-ionization mass-spectrometry. The self-assemblies from these dendrimers were studied by fluorescent spectroscopy, dynamic light scattering and transmission electron microscopy.

**Level of Research:** Graduate - Ph.D. **Department:** Chemistry **Faculty Advisor:** Dr. Gitsov

**Authors:** Derminio, D.S., Boyer, G.L. Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Effects of Nutrient limitation on the Photosynthetic Efficiency of *Microcystis Aeruginosa*

**Abstract:** *Microcystis aeruginosa*, a bloom-forming cyanobacterium, is responsible for harmful algal blooms that occur in the embayments of the Great Lakes. Nitrogen, in addition to phosphorus, may be important in controlling the growth of *Microcystis* in the western basin of Lake Erie. Traditional experiments to determine nutrient limitation in *Microcystis* involve addition of nutrients to natural cultures. The interpretation of these experiments is complicated due to *Microcystis*'s slow growth rate and the presence of other species. Nutrient-induced fluorescence transients (NIFTs) may provide a faster means to assess the nutrient status of cyanobacteria. NIFTs record the changes in the photosynthetic efficiency of a species after the addition of nutrients. *Chlorella vulgaris* and *M. aeruginosa* LE3 were grown in replete, N- and/or P-limited Z8 media. Cultures were spiked with nitrogen and/or phosphorus and their fluorescence response was measured using a PhytoPAM active fluorometer. Measurements of F<sub>v</sub>, F<sub>m</sub>, and photosynthetic yield were made 10 minutes pre- and post-addition of nutrients. Initial results suggest that changes in the fluorescent efficiency of cultures were dependent on both the species and changed with availability of nutrients. The suitability of using NIFTs as a field measurement of nutrient limitation in cyanobacteria will be discussed.

**Level of Research:** Graduate - Ph.D. **Department:** Chemistry **Faculty Advisor:** G. L. Boyer

**Authors:** Dieter Scheibel, Ivan Gitsov. Michael M. Szwarc Polymer Research Institute & Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Synthesis of Self-Assembling Amphiphilic Block Copolymers Capable of Enzyme Immobilization for Reusable Wastewater Treatments and Other Applications

**Abstract:** This study focuses on the modification and immobilization of the glycoprotein laccase via non-covalent binding for applications such as wastewater treatment. Block ABA copolymers composed of poly(ethylene glycol) as the central B block and either benzyl ether dendrons, hyperbranched poly(p-chloromethylstyrene), or linear poly(styrene) as the A segments were synthesized and used as physically immobilizing agents. By controlling the hydrophilic-hydrophobic weight ratio of the immobilizing agents, micelles and hydrogel networks capable of reusability were obtained.

Laccase modified with all amphiphilic copolymers displayed an increase in activity towards ABTS when compared with the native enzyme. Activity increases between 4% and 420% were observed, with linear-linear-linear copolymers providing the greatest increase in activity. It was observed that size of the PEG spacer in hydrogels plays a significant role in enzyme activity, with longer PEG spacers causing a significant increase in activity in contrast to shorter PEG spacers. Activity changes can be attributed to conformational changes and differences in mobility of the enzyme when modified or immobilized in micellar and hydrogel networks respectively. Immobilized laccase efficiency as a wastewater treatment catalyst was conducted by investigating the rate and reusability of the complex as a decolorizing agent for synthetic dyes. Although decolorization rate was greatest with native laccase, the reusability afforded by immobilized laccase makes the latter a more cost effective and more practical option for such wastewater treatment purposes. Effect of hydrophobic size and architecture in addition to PEG size, both of which dictate diffusion of substrate to the enzyme active site, are investigated.

**Level of Research:** Graduate - Ph.D. **Department:** Chemistry **Faculty Advisor:** Ivan Gitsov

**Authors:** Zacharias Smith<sup>1</sup> & Gregory Boyer<sup>1</sup>. <sup>1</sup>State University of New York, College of Environmental Science and Forestry, Department of Chemistry, Syracuse NY, 13210

**Title:** More than Microcystins? Analytical Methods for Paralytic Shellfish Toxins in Freshwater Systems.

**Abstract:** Most research on Harmful Algal Blooms in the US has focused on the occurrence of microcystins. However, toxin suits are known to vary significantly from region to region, and thus there may be a sizable presence of other cyanobacterial toxins. Paralytic Shellfish Toxins (PSTs) are produced by members of the genus *Anabaena* and *Lyngbya* – both common cyanobacteria in the Northeastern US. To develop a robust monitoring program for the occurrence of PSTs in the region, we examined three different methods for measurement of PSTs in New York State freshwaters. These include (1) the traditional HPLC with post-column oxidation and fluorescent detection developed by Oshima, (2) newer HILIC chromatography methods coupled with mass spectroscopy (MS or MS/MS) detection, and (3) commercially available ELISA assays for PSTs. Known PST-producing cyanobacteria were grown in laboratory culture, and water samples were collected from more than 125 lakes spread across New York.

Samples were extracted using a unified sample extraction protocol and analyzed using all three methods. A comparison of the different methods will be presented.

**Level of Research:** Graduate - Ph.D. **Department:** Chemistry **Faculty Advisor:** Gregory Boyer

**Authors:** (1) Cassandra B. Elliott, (2) Janet L. Huie, (3) Anthony J. Greenberg, (4) Thomas LaBarge, (5) Christopher M. Whipps

(1) State University of New York College of Environmental Science and Forestry (SUNY ESF), Department of Environmental and Forest Biol

**Title:** A Genomic Analysis for Markhor (*Capra falconeri heptneri*): Enhancing Captive Breeding Standards for Species Survival Plans

**Abstract:** We recently conducted genome sequencing for three markhor (*Capra falconeri heptneri*) individuals to determine the viability of single-nucleotide polymorphisms (SNP) for use in understanding the population genetics of the captive reserve population. The American and European Association of Zoos and Aquariums' (AZA, EAZA) and private wildlife preserves have been eager to incorporate genomics as a tool for breeding management in Species Survival Plans (SSP) and wild re-introduction conservation. Markhor are the largest species of wild goat whose native range in Middle East Asia is being reduced by climate change and domestic herding. Due to economic hardship in their native range, markhor are also targets of poaching for food and their large corkscrew horns. This pilot study identified ~410,699 SNPs divergent from the domestic goat (*Capra hircus*) reference genome, of which ~111,733 were polymorphic, suggestive of sufficient genetic variability at these loci to expand to additional zoo populations (North America and Europe) and wild markhor in Tajikistan. Our goals are to: (1) produce a more accurate pedigree and assign paternity where unknown within the North American population; (2) allow for more precise calculations of mean kinship, inbreeding coefficients, founder representation, genetic diversity, and heterozygosity; (3) identify potential founders to introduce into the North American population by determining if individuals from a private institution are a product of hybridization with domestic goat; (4) provide a genomic foundation for the European markhor breeding program; and (5) assess the genetic health of wild populations in comparison to captive populations.

**Level of Research:** Graduate - M.S. **Department:** EFB **Faculty Advisor:** Christopher M. Whipps

**Authors:** Augustyn, E. A. and J. M. Farrell. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Effects of perturbations on floodplain connectivity, lower trophic levels, and larval esocids

**Abstract:** Flood pulses establish connectivity between the main channel and floodplains in large river systems. Advancing flood waters allow biota (fishes) to access productive, seasonal wetland habitats and retreating flood waters facilitate the lateral movement of a diversity of aquatic invertebrates (zooplankton) into riparian areas of larger channels. The availability and diversity of prey drives larval fish recruitment during their critical period. Water level regulation by damming subdues natural fluctuation ranges and restricts water movement into fertile floodplains. In the St. Lawrence River, water level stabilization has promoted the establishment



and expansion of robust emergent species like *Typha angustifolia* and *T. x glauca*. These species fill in nearshore areas, blocking access to important spawning and nursery habitats for native northern pike (*Esox lucius*) and altering spawning distributions. Additionally litter accumulation is causing rapid marsh accretion, biogeochemical changes, and encroachment into spawning and nursery sites for muskellunge (*E. masquinongy*). Coexistence of northern pike and muskellunge results from spatial and temporal niche partitioning during spawning and larval periods and diminished floodplain access promotes greater overlap of the two species during these periods. The goal of this study is to understand prey selection of northern pike and muskellunge in floodplain and offshore habitats and to determine if offshore habitat use causes larval esocids to mismatch from high-quality, preferred food items. Results from this study will elucidate further knowledge for policy makers regarding the interface of floodplain hydrology and lower trophic level processes that support early-life stages of apex predators in a large river ecosystem.

**Level of Research:** Graduate - M.S. **Department:** EFB **Faculty Advisor:** John M. Farrell

**Authors:** Slife, CC, Paterson, G. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** The role of life history strategy on PCB bioaccumulation and biomagnification in Finger Lakes *Mysis diluviana* populations

**Abstract:** The freshwater mysid shrimp (*Mysis diluviana*) is a glacial relict species that is native throughout the Great Lakes basin. With lipid contents ranging up to 40% of dry weight and relatively large body sizes (20mm), mysids represent an important prey resource for multiple fish species. Mysid populations can have life history strategies ranging from 1 – 4 years which greatly contrasts the shorter seasonal lifespans of smaller pelagic zooplankton species. During daytime feeding, mysids will consume sediment materials which also represent the primary sink of persistent organic pollutants such as polychlorinated biphenyls (PCBs) in freshwater ecosystems. The mysid's diel vertical migration patterns then link benthic and pelagic food webs and transport these organic contaminants. PCBs are highly hydrophobic pollutants that bioaccumulate and biomagnify in the lipid fraction of biota. Mysid's high fat content, vertical migration behavior, and long life relative to other zooplankton suggest that they represent a significant source of these pollutants to higher trophic level consumers. We hypothesize that PCB bioaccumulation and biomagnification in mysid populations will be positively correlated with population life history strategy, with increased bioaccumulation and biomagnification observed in ecosystems where mysids have longer life history strategies.

**Level of Research:** Graduate - M.S. **Department:** EFB **Faculty Advisor:** Dr. Gord Paterson

**Authors:** Brannon Barr, Department of Environmental Science and Forestry, Syracuse, Ny, 13210

H. B. Underwood, Department of Environmental Science and Forestry, Syracuse, Ny, 13210

**Title:** Automated analysis of digital trail camera images for wildlife conservation studies

**Abstract:** Abstract: Modern, infrared-triggered trail cameras are very useful and widely used data collection tools in ecology. They are used to monitor individuals and populations, and to

track changes in biodiversity over time. They have advantages over physical trapping; they are non-invasive, do not require the researcher's presence to collect data, and have high detection rates of cryptic and nocturnal species. But the number of images camera traps generate is prodigious; a single camera trap can generate thousands of images over a relatively short duration, which can result in a backlog of unprocessed images. To date, there is no reliable, automated process for sorting and dispatching trail camera images. To address this problem, three research objectives are addressed: 1) Images that do not contain animals are filtered out by identifying regions of lower edge density and areas of movement. 2) Precise locations of potential targets and classification as avian or mammalian are accomplished using a machine learning based texture classification algorithm. 3) Identification of a target species is accomplished by matching three-dimensional models of the target species, projected into two-dimensions, to the targets. Error rates for mismatches are calculated at each step, and the effects of these error rates are projected into simulations of species diversity calculations using several common diversity metrics to evaluate the effects of automated detection and identification in species diversity studies.

**Level of Research:** Graduate - Ph.D. **Department:** EFB **Faculty Advisor:** Brian Underwood

**Authors:** Chang, CT., Doerr, KM., Whipps, CM. Department of Environmental and Forest Biology, 1 Forestry Drive, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210 USA

**Title:** Antibiotic treatment of zebrafish mycobacteriosis: efficacy of treatment with tigecycline and clarithromycin.

**Abstract:** Zebrafish (*Danio rerio*) are a popular model organism used in a growing number of research fields. The maintenance of healthy, disease-free laboratory fish is a primary concern. Mycobacteriosis is a chronic bacterial infection caused by *Mycobacterium* spp. and is the second most common disease found in laboratory zebrafish. Disease manifestation of mycobacteriosis is species-specific and can range from severe outbreaks with high mortality to chronic, low-level infections showing little to no signs of disease. Both scenarios are concerning as severe outbreaks result in dramatic population loss and low-level infections may go unnoticed and inadvertently affect research results. Current disease control measures recommend the removal of infected fish and in severe outbreaks, depopulation. These measures are effective but less disruptive measures should be assessed for controlling zebrafish mycobacteriosis. We recently demonstrated the effectiveness of antibiotic treatment for preventing mycobacterial growth in vitro and identified several drug candidates. In this study we tested the in vivo efficacy two drug candidates, tigecycline (1 µg/mL) and clarithromycin (4 µg/mL), in adult zebrafish that were experimentally infected with *Mycobacterium chelonae*. We assessed both short (15 day) and long-term (30 day) treatments and evaluated fecundity and pathological endpoints. Results from this study will assist in recommendations regarding the use of antibiotics for zebrafish mycobacteriosis, as well as general antibiotic use in fish.

**Level of Research:** Graduate - Ph.D. **Department:** EFB **Faculty Advisor:** Christopher M. Whipps

**Authors:** Evans, Thomas M. Department of Environment and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Using Open Population Models to Understand Larval Lamprey Movement Patterns

**Abstract:** Larval lampreys (ammocoetes) are a critical component of all lamprey species life history, but their movement patterns within streams are still poorly understood. I used Visible Implant Elastomer (VIE) tags to mark ammocoetes, because these tags were successfully retained on animals for > 1 year. Using this method, ammocoetes at three streams were tagged from 2014 to 2015 with permanent, unique marks. Tag retention was high (84%) in ammocoetes, but a handful (n = 5) of animals lost their marks and thus their identities, even though they were clearly recaptures as seen from marking scars. Some individuals were recaptured frequently, which provided important data on mortality and growth rates. However, most animals were never recaptured after being tagged, or were at most captured once, suggesting that larval lampreys may be less sedentary than predicted. The timing of these movements (in the spring and fall) was in agreement with prior work that found the drift of ammocoetes increased dramatically during high water periods, and supports the hypothesis that ammocoete movements are not entirely passive but at least partially behaviorally controlled. Better understanding the movement patterns, and the drivers of these patterns, will contribute basic knowledge about lamprey population dynamics, which in turn will aid in their management.

**Level of Research:** Graduate - Ph.D. **Department:** EFB **Faculty Advisor:** Karin Limburg

**Authors:** Ewell Hodkin, C, Limburg, K

Department of Environmental and Forest Biology  
SUNY College of Environmental Science & Forestry  
Syracuse, NY 13210

**Title:** Determining the Provenance and Life Histories of Blueback Herring in the Mohawk River

**Abstract:** Blueback herring (*Alosa aestivalis*) demonstrate a strong linkage between the Mohawk River, Hudson River, and Atlantic Ocean. Previous studies have indicated that blueback herring (1) can overwinter somewhere in the system as sub-adults, but (2) eventually all recruits to the spawning stock migrate out to sea before returning to spawn (KL, unpublished). In a collaboration between SUNY ESF and Region 4 DEC (Scott Wells), funded by the NYS Water Resources Institute at Cornell, adults were collected in 2012 and 2013, but there were no funds available to complete the work-up, leaving a dataset of morphometric characteristics, scales, otoliths, stomach contents, and 230 additional individuals preserved for analysis that have been left incomplete. We plan to complete the work-up and analyze the data set.

This work requires expansion and updating to assess both the population status, the degree of homing to the Mohawk for spawning, and the Mohawk's overall importance as a nursery habitat. We are left with four basic questions: (1) What is the relative importance of the Mohawk River nursery, relative to nurseries in the Hudson River estuary? (2) What is the provenance of blueback herring spawners in the Mohawk River? (3) What is the degree of

overwintering and within-Mohawk habitat use? (4) What are demographic characteristics of the Mohawk River spawning population?

**Level of Research:** Graduate - Ph.D. **Department:** EFB **Faculty Advisor:** Karin Limburg

**Authors:** Falkowski, TB, Diemont, SAW. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Successional Changes in Ecosystem Structure and Processes in Lacandon Maya Agroforests

**Abstract:** The Lacandon Maya of Chiapas, Mexico practice a complex form of traditional sequential swidden agroforestry, in which various crops, timber, and non-timber forest products are harvested from patches of forest in different successional stages. Given that current research has only assessed community composition and nutrient cycling in Lacandon agroforests, this work aimed to describe successional changes in vegetation structure and processes in different stages of the Lacandon agroforestry system and determine whether it could be used to effectively restore vegetation structure and ecosystem processes associated with organic matter decomposition after disturbance and extractive land use. Stand basal area, percent canopy cover, percent ground cover (bare, herbaceous, and detritus), number of leaf litter layers, and organic layer depth were measured in 4-8 plots of each successional stage. We found that Lacandon management was able to restore pre-disturbance basal area, canopy cover, ground cover, leaf litter layers, and organic layer depth in 30 years or less, but recovery was not uniform across all metrics. Regular, intermediate disturbances provided through Lacandon management may actually augment stand basal area, canopy cover, detrital ground cover, and soil organic layer depth compared to nearby undisturbed primary forest. These results demonstrate the potential value of Lacandon traditional ecological management to facilitate natural succession for the restoration of tropical moist forest in Chiapas and throughout Mesoamerica while providing ecosystem services for local people.

**Level of Research:** Graduate - Ph.D. **Department:** EFB **Faculty Advisor:** Stewart Diemont

**Authors:** Kilheffer, C. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Underwood, HB. USGS Patuxent Wildlife Research Center, 426 Illick Hall, SUNY College of Environme

**Title:** Modeling the effects of land cover and use on landscape capability for urban ungulate populations

**Abstract:** The benefits of urban greening programs on human populations have been lauded for over two decades. However, studies of urban greening on wildlife populations are just now emerging. We explored landscape capability for white-tailed deer (*Odocoileus virginianus*), a North American ungulate, in several peri-urban landscapes in upstate New York. We used count data and high-resolution digital orthoimagery to predict occurrence and abundance of deer from binomial, N-mixture models while accounting for variation in land cover composition and imperfect detection. Landscape capability was inversely proportional to percentage of impervious cover, directly proportional to percentage of tree cover, and varied dramatically

over short (1-km) spatial extents. The probability of at least one deer counted in 1-km<sup>2</sup> survey units varied between 62% and 83% for average amounts of impervious cover. Analyses implicated land use differences, particularly the presence of legacy greenspace, in observed relationships between abundance and tree cover. The extent of impervious cover dictates landscape occurrence, but the amount of tree cover sets the upper limit to population abundance. Strong associations between land cover and use drive capability for urban ungulates. Because land uses are often highly interspersed in peri-urban landscapes, conflicts with ungulates are inevitable. Consequently, we suggest that contingencies for ungulate management be developed along with plans for increasing urban tree cover through greening projects.

**Level of Research:** Graduate - Ph.D. **Department:** EFB **Faculty Advisor:** Dr. H. B. Underwood

**Authors:** Pirovano, A., Stosiek, N., Xiong, X., Newman, L. Department of Environmental Biology, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Understanding the role of *Enterobacter* sp. 638 in growth enhancement of poplar and willow trees

**Abstract:** *Enterobacter* sp. 638 (E638) is an endophytic bacterium which has been shown to significantly increase the biomass of poplar trees and some willow cultivars. E638 is incapable of the usual growth-promoting processes, such as nitrogen fixation or ACC-deaminase production, and the plant-endophyte interactions that lead to enhanced growth are widely unknown. To investigate the genetic mechanism by which endophytic bacteria increase plant growth, poplar (*Populus deltoids* x *P. nigra*) and willow (*Salix sachalinensis*) cultivars, SX64 and Fish Creek, cuttings were inoculated with E638 then grown in hydroponics under greenhouse conditions and planted at field site in Tully, New York. Plant growth was monitored by measuring growth of shoots in both greenhouse and field conditions and root length of greenhouse plants. Quantitative PCR was performed on greenhouse-grown plants after four weeks of growth and on field plant tissues after one year of growth. Preliminary results confirm growth enhancement of poplar and willow under field conditions, and increased growth of willow under greenhouse conditions. Additionally, qPCR results show upregulation of TIR1, a regulator of auxin-cytokinin crosstalk, and differential expression of other auxin-related genes in the leaves of plants inoculated with E638. Increased auxin responses may be responsible for plant growth promotion by E638. Plant-microbe interactions, such as endophytic symbiosis, may allow for more efficient growth of biofuel feedstock on marginal soils.

**Level of Research:** Graduate - Ph.D. **Department:** EFB **Faculty Advisor:** Lee Newman

**Authors:** Kara E Phelps, GPES, and Ruth D Yanai, Department of Forest and Natural Resources Management, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Nitrogen and phosphorus interactions affect foliar resorption in a northern hardwood forest

**Abstract:** The productivity of natural ecosystems is affected by human activities, such as pollution and fertilization, through their effects on nutrient cycling. We examined the effects of

fertilization with nitrogen and/or phosphorus on resorption, the process by which trees reabsorb foliar nutrients prior to leaf abscission in the fall. Previous studies attempting to link soil nutrient availability of single elements with that element's resorption in the tree have been inconclusive; other studies point to multiple element limitation driving resorption. We collected green leaves and litter of five species from northern hardwood stands in the White Mountains of New Hampshire that have been treated with a 2x2 NP factorial annually since 2011. We compared proficiency and efficiency of resorption of eleven elements. Green leaf N concentrations were lowest in the P plot (22.5 mg g<sup>-1</sup>) and highest in the N plot (27.9 mg g<sup>-1</sup>; p=0.001). Nitrogen resorption was more efficient in the NP plot (64%) compared to the control plot (55%; p=0.04), while phosphorus resorption efficiency was higher in the N plot (74%) than in the P plot (54%; p=0.05). Nitrogen proficiency was higher in the P plots (9.0 mg g<sup>-1</sup>) compared to the N plots (12.7 mg g<sup>-1</sup>; p=0.04), and phosphorus resorption was over two times more proficient in the N plots (0.28 mg g<sup>-1</sup>) than in plots with P inputs (P plot = 0.70 mg g<sup>-1</sup>; NP plot = 0.58 mg g<sup>-1</sup>; p=0.01). These results indicate a process driven by multiple elements. Sulfur concentrations were correlated with many elements, possibly due to the important and varied roles sulfur plays in tree physiological processes. A better understanding of interconnected nutrient cycles and the feedback mechanisms they affect can assist recognition of the influences of anthropogenic nutrient additions on ecosystem functions.

**Level of Research:** Graduate - M.S. **Department:** Environmental Science **Faculty Advisor:** Dr. Ruth Yanai and Dr. Dylan Parry

**Authors:** Kayla M. Smith<sup>1</sup> Karin E. Limburg<sup>1</sup> Andrea M. Feldpausch-Parker<sup>2</sup> and Alexander J. Smith<sup>3</sup>

<sup>1</sup> Department of Environmental and Forest Biology, SUNY College of Environmental Science and Forestry, Syracuse, NY

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**Title:** RECONNECTING WATERS FOR EELS AND RIVER HERRING: A MEDIATED MODELING APPROACH TO ASSESS RECEPTIVITY TO DAM REMOVAL IN THE HUDSON-MOHAWK WATERSHED

**Abstract:** Channelization of rivers via the construction of dams has been one of the most profound drivers of population declines in diadromous fishes such as river herring and the American eel. Within the Hudson River watershed there currently exist 1,968 dams, of which 481 are found in the Mohawk River (National Inventory of Dams). The objective of this study is to increase receptivity towards dam removal projects among stakeholder groups within the Hudson-Mohawk watershed through educational interventions including the co-construction of a systems dynamics model. We will be working with stakeholder groups in tributaries within the Hudson River (Quassaick Creek and Wynant's Kill) and the Mohawk River (Sauquoit Creek or Steele Creek). A set of three educational workshops will be used to assess stakeholder's attitudes toward dam removal decision making processes. These interventions will include community meeting presentations, field trip experiences and mediating model processes. A systems dynamics model will be co-created with stakeholders in small groups using STELLA, a dynamic ecosystem modeling platform, to elicit the underlying behavior and functioning of receptiveness attributed to dam removal decision making. A suite of policy scenarios will then

be tested using model products developed from each workshop. Ultimately, interventions will provide learning based outcomes that have the ability to increase consensus and trust in model findings. A summative systems model can additionally be used as a tool for managers and restoration agencies in river connectivity and dam removal project considerations.

**Level of Research:** Graduate - Ph.D. **Department:** Environmental Science **Faculty Advisor:** Karin E. Limburg

**Authors:** Lin, J. Graduate Program in Environmental Science, Environmental Monitoring and Modeling, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** The development of uncertainty estimators for urban reforestation and management models

**Abstract:** Urbanization can result in many detrimental environmental impacts including urban stream degradation, increased human exposure to air pollutants, increased temperatures, and increased material consumption and energy use. Urban reforestation and management is one way to alleviate some of these impacts, and the USDA Forest Service has developed i-Tree tools to help reforest and manage urban forests based on structure-function relationships that quantify the ecosystem services and benefits from forests. These free public domain tools have been used by hundreds of researchers, urban planners, foresters, and others around the world to advocate for the benefits of urban trees. While these tools have been extremely beneficial to the planning and management of urban trees, they have their limitations. These tools make assumptions that simplify the function of urban forests and the representation of urban landscapes. While such assumptions are often necessary to model these complex systems, they can increase the uncertainty of model output, and hinder the efficient and effective management of urban forests. This research will develop methodology to characterize the uncertainty of i-Tree model output, improving the use of this urban forest modeling tool and providing urban managers more complete information about the structure, function, and value of their forest resources. In addition, this research will explore creative and effective ways to communicate and present this uncertainty to decision makers. This research will perform demonstration project in New York City, which has had prior applications of i-Tree tools, thorough tree plot information necessary for i-Tree, and extensive environmental monitoring networks.

**Level of Research:** Graduate - Ph.D. **Department:** Environmental Science **Faculty Advisor:** Charles N. Kroll

**Authors:** Nyelele, C, Kroll, CN. Departments of Environmental Science and Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Exploring human input to tree planting decision support systems and optimization of planting locations in New York City

**Abstract:** As the global population increases, cities grow and place pressure on natural resources. Trees and green spaces are often lost along with the valuable ecosystem services

they provide. Tree planting decision support systems are being developed to aide urban tree planting initiatives being undertaken in many cities, enabling urban areas to sustain both environmental quality and human well-being. Ecosystem services such as carbon sequestration, air pollution removal, and climate regulation are critical to both environmental quality and human health. Careful thought needs to be put into considering where to plant trees, and the intended beneficiaries and management strategies to realize the maximum benefit from these trees. This study uses a mixed method approach to build on the limitation of decision support systems that do not incorporate human input into decision making when identifying priority planting locations. This study addresses this gap by identifying priority planting areas in New York City, the decision-making process by different stakeholders engaged in tree planting, community perceptions, attitudes, and preferences, and the acknowledgement that trees do not provide ubiquitous good for all. This study is expected to improve decision support systems that prioritize planting locations to maximize benefits from trees.

**Level of Research:** Graduate - Ph.D. **Department:** Environmental Science **Faculty Advisor:** Charles N. Kroll

**Authors:** Vormwald, Sean. Graduate Program in Environmental Science, State University of New York College of Environmental Science and Forestry, Syracuse, New York

**Title:** A Content Analysis of Stakeholder Engagement in New York Campus Climate Action Plans

**Abstract:** This research study consists of a content analysis of climate action plans (CAPs) developed by New York college and university signatories of the American College and University Presidents' Climate Commitment. The content analysis examines to what extent the climate action plans include behavior-based methods of reducing greenhouse gas emissions, and categorizes the CAPs' strategies of engaging stakeholders with campus emission reduction efforts. The study compares the engagement strategies employed in the CAPs with effective behavior change strategies described in the literature.

**Level of Research:** Graduate - Ph.D. **Department:** Environmental Science **Faculty Advisor:** Dr. Andrea Parker

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Adam D. Wild, State University of New York at Cobleskill, Cobleskill, NY 12043

Ruth D. Yanai, Department of Fore

**Title:** Tapping clonal sugar maple provides an opportunity to test for genetic control of mercury uptake by trees

**Abstract:** Mercury (Hg) is a neurotoxic pollutant that poses a threat to humans and other organisms exposed to elevated levels in the environment caused by emissions from anthropogenic activities. Mercury has rarely been measured in trees, and it is not known whether Hg is taken up into tree stems from the foliage or by the roots. We had an opportunity to test for genetic control of Hg cycling in trees, using a plantation of sugar maple (*Acer saccharum* Marsh.) trees that were propagated by rooted cuttings of 50 genetic individuals. The sap of sugar maple trees is easy to collect because of the unique flow of maple sap during the



dormant season. We measured mercury concentrations in the sap of xx trees using thermal decomposition, catalytic conversion, amalgamation, and atomic absorption spectrophotometry (USEPA Method 7473). Mercury concentrations differed by clone ( $p = 0.03$ ), with a high of 6.8 ng L<sup>-1</sup> and a low of 3.6 ng L<sup>-1</sup>. These concentrations are extremely low; even concentrated as maple syrup, the concentrations would be only 7 ng g<sup>-1</sup>, compared to the safe level in food of 500 ng g<sup>-1</sup>. Clones differed in sap sweetness ( $p < 0.001$ ), and trees with sweeter sap also had higher Hg concentrations ( $p = 0.08$  for a test across all the trees sampled). This is the first report of Hg in the sap of a hardwood species. More research is needed to determine whether Hg differs among clones due to uptake by roots or leaves or mobilization within the tree.

**Level of Research:** Graduate - Ph.D. **Department:** Environmental Science **Faculty Advisor:** Ruth D. Yanai

**Authors:** Endres, A, Alyssa. Department of Environmental Resource Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Evaluation of Hotspots Using Global MODIS Surface Temperature and Biodiversity Data

**Abstract:** During the 20th century, the Earth's average temperature has risen about one degree Fahrenheit. While this might not seem significant, it has caused enormous changes in the environment. Shrinking glaciers, accelerated sea level rise, and longer, more intense heat waves are examples of phenomena that have a direct effect on biodiversity in those areas. Species richness, defined as the count of species in a biological community, is an important biodiversity indicator. Biodiversity hotspots are biogeographical regions that are a significant reservoir of biodiversity and are threatened with destruction. By calculating trends in a select number of indicator species which provide insight on the health of an ecosystem, and looking at past temperature data, hotspots can be prioritized based on which areas that have undergone the most drastic changes. MODIS MOD11C3 V006 data from February 2000 through February 2016 will be used to calculate monthly and annual surface temperature trends for both average day and nighttime temperatures. Biodiversity data will be collected from the Global Biodiversity Information Facility. By better understanding the changes that are occurring, specific conservation plans targeting these areas can be established.

**Level of Research:** Graduate - M.S. **Department:** ERE **Faculty Advisor:** Giorgos Mountrakis

**Authors:** John Bisgrove\* Department of Environmental Resources Engineering, Dr. Gregory L. Boyer and Michael Satchwell Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Communicating Water Quality Parameters Through Maps

**Abstract:** Describing scientific work with community and policy implications can be simplified by judicious usage of visualization. Watershed Associations and similar community organizations involved in water quality issues are strongly invested in their local resource, but scientific and issue literacy in such groups is highly variable. Spatial components to limnological studies are common and not all community members enjoy knowledge of an entire basin.

Geographic Information Systems extend the usage of graphical tools into the realm of spatial variance. In support of watershed research and its presentation to community members in various formats, mapping elements and spatial data presentation are explored using transect data obtained from Greg Boyer at the Department of Chemistry, SUNY–ESF using a Turner Designs C6 sonde as part of a project to look at the fine scale distribution of cyanobacteria in lakes and nearshore waters.

**Level of Research:** Graduate - M.S. **Department:** ERE **Faculty Advisor:** Lindi J. Quackenbush

**Authors:** Namrata Shenoy, Chuck Kroll, Department of Environmental Resources Engineering , State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Carbon Pricing

**Abstract:** Against the background of critique on the negative social and environmental implications of globalization, multinational enterprises have become active in reporting on activities undertaken to prevent these “externalities” of international trade and production. [1] The number of corporations disclosing they use an internal price on carbon has tripled since last year. Corporations use internal carbon pricing to offset the costs and risks of greenhouse gas production, and to finance the transition to secure sources of low carbon energy. This dramatic increase demonstrates the ongoing mainstreaming of carbon pricing as a high priority for business and an essential component of the corporate strategy toolkit. [2] Carbon Pricing is a complex model designed around the concept in which a polluter pays for the pollution created by the business or institution. They begin to capture what are known as the external costs of carbon emissions – costs that the public pays for in other ways, such as damage to crops and health care costs from heat waves and droughts or to property from flooding and sea level rise – and tie them to their sources through a price on carbon.

A price on carbon helps shift the burden for the damage back to those who are responsible for it, and who can reduce it. Instead of dictating who should reduce emissions where and how, a carbon price gives an economic signal and polluters decide for themselves whether to discontinue their polluting activity, reduce emissions, or continue polluting and pay for it. In this way, the overall environmental goal is achieved in the most flexible and least-cost way to society. The carbon price also stimulates clean technology and market innovation, fuelling new, low-carbon drivers of economic growth. [3]

**Level of Research:** Graduate - M.S. **Department:** ERE **Faculty Advisor:** CHUCK KROLL

**Authors:** Ng, N.; Shaw, S.B. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Spatiotemporal variations in baseflow generation in the eastern United States

**Abstract:** Baseflow has long been assumed to be generated uniformly across an entire watershed. However, recent studies suggest spatial variability in baseflow sources. Despite its importance, there has been a knowledge gap on the controls that affect heterogeneity in baseflow generation and a lack of hydrologic models that sufficiently represent these heterogeneities. This study investigates the spatial and temporal variations in baseflow at three

research watersheds in the Appalachian Highlands in the eastern United States (Yellow Barn Catchment in NY, Fernow Experimental Forest in WV, and Sleepers River Research Watershed in VT). Different from many watershed studies, all three watersheds have multiple, small gaged subcatchments, allowing continuous comparison of baseflow contributions at a small spatial scale. Comparison of subcatchment flows versus watershed outlet flow reveals distinct flow behaviors from each subcatchments with the fractional flow contribution from different subcatchments changing dynamically in time. A parallel linear reservoir model reproduces observed recession curves and flow contributions. This work presents a novel interpretation of baseflow generation which can improve discharge estimation during low flow periods and provide insight into spatial variations in flow in headwater streams.

**Level of Research:** Graduate - M.S. **Department:** ERE **Faculty Advisor:** Stephen B. Shaw

**Authors:** Saeta Farinha, J, Kroll, CN. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

**Title:** The Recent Drought in the Metropolitan Region of São Paulo, Brazil

**Abstract:** Sao Paulo, Brazil's biggest and economically most important city is undergoing a historic drought. The reservoir systems that supply water to the city and its metropolitan region are running out of storage, and approximately 22 million people, as well as industry, commerce, agriculture, and a multitude of other sectors, are being directly or indirectly affected. This project's main objective is to present a general overview of the recent drought in the Metropolitan Region of São Paulo (RMSP), Brazil, studying its causes, consequences and possible future actions to assure appropriate supply for the population. Scientific literature, articles from the press, and official data were used as the main sources of information. To achieve the proposed goals, an overview of the system was developed to put the recent drought in context, examining water resource availability in São Paulo and a comparison between historic and recent precipitation events. This was followed by an analysis of the climate drivers that led to the extended dry period that caused the current drought. Finally, the responses from decision makers in dealing with the drought were chronologically cited and analyzed. The conclusion was that the drought was a consequence of a multitude of factors, including a gradual decrease in precipitation in the region that started in 2011 and reached its peak during austral summers of 2013-2014 and 2014-2015. In addition, increasing demand and the lack of strategic planning were also important factors creating water stress in the system.

**Level of Research:** Graduate - M.S. **Department:** ERE **Faculty Advisor:** Charles N. Kroll

**Authors:** Stagnitta, T, Kroll, CN. Departments of Environmental Science and Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Low Streamflow Estimation from Spot Measurements

**Abstract:** Low streamflow prediction at ungauged river sites is problematic, most models of low streamflow statistics create estimators with large errors. Often this is because hydrogeologic characteristics have a strong impact on low streamflow, which are hard to characterize. A potential solution is to take a small number of streamflow measurements at an ungauged river

site to either estimate improved hydrogeologic indices or correlate with concurrent streamflow measurements at a nearby site. Past results have indicated that baseflow correlation performs better than regional regression when 4 or more streamflow measurements are available, even when the regional regression models are augmented by improved hydrogeologic indices. Here we revisit this issue within the 19,800 square mile Apalachicola-Chattahoochee-Flint watershed, a USGS WaterSMART region spanning Georgia, southeastern Alabama, and northwestern Florida. This study area is of particular interest because numerous watershed modeling analyses have previously been performed using gauged river sites within this basin. Initial results indicate that baseflow correlation can produce improved estimators when spot-measurements are available, but selection of an appropriate donor site is problematic, especially in regions with a small number of gauged river sites. Estimation of hydrogeologic indices do improve regional regression models, but these models are generally outperformed by baseflow correlation.

**Level of Research:** Graduate - M.S. **Department:** ERE **Faculty Advisor:** Chuck Kroll

**Authors:** Heydari, S. S., Mountrakis, G. DEpartment of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Study of land cover classifiers' performance utilizing big datasets and deep neural networks

**Abstract:** Accurate land cover / land use classification based on aerial and satellite imagery has been an important issue from the beginning of remote sensing era and still is. Advancements in vehicle, sensor, and communication technologies provide newer opportunities to gather and structure data.

We study different classification algorithms' performance and their comparison using a set of Landsat images and associated ground-truth information. Our concentration will be mostly on Neural Networks and specifically deep NNs, but other important algorithms such as Support Vector Machines (SVM), maximum likelihood, decision trees, and random forests will be considered and compared.

Our early findings on single and multilayer neural networks classifier did not show significant performance increase by expanding number of nodes over 10 to 20 or adding multiple hidden layers, and rare classes are effectively masked by presence of dominant classes in data set. But as it highly depends on training strategy, this possibility should be investigated using different sampling methods and varying tuning parameters. The idea of feature extraction is also of core interest in multilayer (deep) networks when dealing with big data volumes available nowadays, which is an understudied research area especially considering the size of the Landsat image archive or very high resolution drone-derived data.

**Level of Research:** Graduate - Ph.D. **Department:** ERE **Faculty Advisor:** Mountrakis, G.

**Authors:** Khatami, R, Mountrakis, G, Stehman, S.V. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, NY, United States

**Title:** Per-pixel accuracy estimation of classified remote sensing images

**Abstract:** The accuracy of land-cover maps constructed through classification of satellite images is of great importance for interdisciplinary model development and applications. The traditional approach of map accuracy assessment based on an error matrix does not depict spatial variation in classification accuracy. The majority of previous work for local or per-pixel map quality assessment has concentrated on quantification of classification certainty based on training outputs. However, classification accuracy cannot be replaced by classification certainty as it is calculated from training outputs and not from a comparison with true ground values. In this research we examine several interpolation methods for producing per-pixel classification accuracy estimators. The factors affecting the performance of interpolations include explanatory feature spaces (spatial vs spectral), interpolation functions (e.g. linear vs Gaussian), incorporation of class information (i.e., interpolating each class separately or grouping them together), and sample size. The census ground truth data of 26 case studies of this research are used to quantify performance of interpolations. The area under receiver operating characteristic (AUC) is used as the measure of predictive power to evaluate interpolation models. Results show that interpolations should be done separately for each class. Interpolations should be done in spectral domain rather than spatial domain unless test data density is exceptionally high. Larger sample sizes improve the accuracy estimations, however, sample size is of higher importance for spatial interpolation than spectral interpolation. The function used for interpolation had the smallest effect on performance of estimations among all factors examined.

**Level of Research:** Graduate - Ph.D. **Department:** ERE **Faculty Advisor:** Dr. Giorgos Mountrakis

**Authors:** Pede, T, Mountrakis, G. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** A Comprehensive Review and Comparison of Cloud Interpolation Techniques for Satellite-Derived Land Surface Temperature (LST) Images

**Abstract:** A significant limitation of satellite-derived land surface temperature (LST) images is lack of data due to cloud obstruction, which results in numerous invalid pixels in LST products. To overcome this issue, several researchers have derived methods for interpolating missing LST values. Although several algorithms have been proposed, there has been virtually no comparison or rigorous validation. This poster will present a comprehensive summary of cloud interpolation methods that have previously been applied to LST images from NASA's Moderate-Resolution Imaging Spectrometer (MODIS) sensor. A case study will also be proposed, in which the accuracy of these methods will be assessed under a range of climatic conditions. Validation will be performed by predicting the LST of valid pixels and comparing interpolated LST values to actual surface temperatures recorded at US Climate Reference Network (USCRN) stations. Discrepancies between actual and predicted values will be quantified using the linear coefficient of determination ( $R^2$ ), root mean square error (RMSE), and mean absolute error (MAE).

**Level of Research:** Graduate - Ph.D. **Department:** ERE **Faculty Advisor:** Giorgos Mountrakis

**Authors:** Reza Abdi, Departments of Environmental Resources Engineering, SUNY ESF, Syracuse, New York, USA, 13210

Theodore A. Endreny, Departments of Environmental Resources Engineering, SUNY ESF, Syracuse, New York, USA, 13210

**Title:** The Sensitivity of Urban Air Temperature Predictions to the Heat Storage Parameters of Impervious, Short Vegetation, and Tree Land Cover

**Abstract:** Estimates of how tree planting can lower urban air temperature are needed to help communities with climate change mitigation. This research performs verification tests and sensitivity tests with the algorithms developed for i-Tree Air, a new urban air temperature model based on a coupled water and energy balance. Air temperature is derived from a reference station based on adjustments to the energy balance between stations, where the energy balance is sum of net radiation and anthropogenic heating equal to the sum of sensible and latent heat and heat storage. Each energy term is affected by a local value of water availability, albedo, emissivity, and roughness heights, which in turn are determined by land cover. Two contrasting land cover types are tested in this research, one dominated by impervious cover and another by tree cover (e.g., National Land Cover Data NLCD classes 22 and 24). While conversion of impervious to tree cover generally cools air temperature, verification tests have identified cases where the change from impervious to tree cover increased both the air temperature, which was not expected from the model. This research demonstrates how the heat storage differs between two contrasting land cover configurations during a series of diurnal cycles, and explores how the energy balance terms are sensitive to model parameters.

**Level of Research:** Graduate - Ph.D. **Department:** ERE **Faculty Advisor:** Theodore A. Endreny

**Authors:** Riehle, K, Kroll, CN. Department of Environmental Resource Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Salmon River Recreational Release Schedule Improvements

**Abstract:** The Salmon River, near Pulaski, NY, provides ecosystem services to the surrounding community including sport fishing, whitewater recreation, and hydro-electric power generation. The stream flows on the Salmon River are regulated by releases from the Lighthouse Hill powerhouse, on the Lower Salmon Reservoir. The current release schedule allocates 120,000 cfs-hours of water for whitewater recreation, stipulates 2 week gaps between releases, and divides this water into 5 release weekends. The current schedule makes inefficient use of the allocated water by not achieving the maximum recreational benefit; for example, 2 of the 5 releases are not useful because either low water levels or they occurred during salmon fishing season. An improved release schedules should be considered. Two options are proposed. One adheres to the 120,000 cfs-hours water limitation with 2 week gaps; it shows that the number of useful whitewater recreational release weekends can be increased from 3 to 6. The second option shows that, if the water release could be increased to 214,500 cfs-hours, 11 release weekends could be achieved. These plans would increase recreational opportunity, increase commercial rafting and drift-boat fishing, and create opportunities to establish a local rafting company, kayaking school, and retail store.

**Level of Research:** Graduate - Ph.D. **Department:** ERE **Faculty Advisor:** Kroll, CN

**Authors:** Yang, S, Mountrakis, G. Department of Environmental Resources and Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Forest dynamics in the conterminous U.S. indicate disproportionate attrition in western forests, rural areas and public lands

**Abstract:** Forests are experiencing significant changes; studying geographic patterns in forests is critical in understanding the impact of forest dynamics to biodiversity, soil erosion, water chemistry and climate. Numerous geographic indicators have been proposed but none supports multi-temporal comparisons at various spatial scales independent of study boundaries while allowing intuitive understanding by non-experts. Few studies have examined forest geographic patterns other than fragmentation; however, other spatial processes of forest dynamics are of equal importance. Here, we study proximity to forest in the continental U.S. over ten years as an indicator of forest landscape transformation. Our findings reveal that within that period the average distance to nearest forest increased by 14%. Furthermore, forest attrition - the complete removal of forest patches - is considerably higher in the western United States, in rural areas and in public lands. Our mathematical model supports estimation of attrition for a given forest cover. We anticipate that our study will serve as a starting point for future studies on deforestation patterns and it will facilitate changes in forest management policy from local to national scales.

**Level of Research:** Graduate - Ph.D. **Department:** ERE **Faculty Advisor:** Giorgos Mountrakis

**Authors:** Maren F. King, Director, Center for Community Design Research at State University of New York, College of Environmental Science and Forestry; Natalie M. Spinola, Master of Landscape Architecture student and research assistant for CCDR at State University

**Title:** Auburn Parks Master Plan Process

**Abstract:** The Department of Landscape Architecture at the SUNY College of Environmental Science and Forestry was contacted by The City of Auburn's Planning and Economic Development Department to assist in the development of the City of Auburn's Park Master Plan. Organized and managed by the Center of Community Design Research, director Maren King and students developed a framework for the parks system as a whole and designs for individual parks through community engagement and additional research during the design process.

**Level of Research:** Graduate - M.S. **Department:** LA **Faculty Advisor:** Maren F. King

**Authors:** Chengyan Jing, Kuo-Ting Wang, Biljana Bujanovic

**Title:** Lignin Determination in Biomass Before and After Hot-Water Extraction

**Abstract:** Along with cellulose and hemicelluloses, lignin is a structural constituent of lignocellulosic biomass. Lignin may be defined as an amorphous, polyphenolic material arising from an enzyme-mediated dehydrogenative polymerization of three cinnamyl alcohols: p-coumaryl, coniferyl, and sinapyl alcohols. By far the most commonly used method for

determining lignin content is the Klason or acid hydrolysis procedure which is a gravimetric method (a two-step H<sub>2</sub>SO<sub>4</sub> treatment of pre-extracted biomass). In this method, however, compounds such as proteins and unhydrolyzed polysaccharides can interfere with measurements and result in an overestimation of the lignin content. On the other hand, this method includes a UV spectral analysis of the soluble lignin using an absorption coefficient (Beer's Law) which varies depending on the type of biomass. Johnson developed a method based on lignin solubilization in acetyl bromide and acetic acid and determination of its UV-absorbance at 280nm. This method is simpler and less time consuming than the Klason method. However, a critical parameter in this method is an accurately measured lignin absorption coefficient.

In this research, the acetyl bromide spectrophotometric method was compared with the Klason lignin method in a series of experiments using sugar maple, willow and Miscanthus before and after hot-water extraction which is suggested as a hydrothermal pretreatment of xylan-rich lignocellulosics. The milled wood lignin was isolated to represent lignin in-situ and to obtain the correct absorbance values for quantifying lignin in samples. The results of these studies are expected to help quantifying lignin in raw and hot-water extracted biomass and also clarifying lignin modifications during hot-water extraction.

**Level of Research:** Graduate - M.S. **Department:** PBE **Faculty Advisor:** Dr. Biljana Bujanovic

**Authors:** Kuo-Ting Wang, Chengyan Jing, Sean Hohm, Cristopher Wood, and Biljana Bujanovic. Departments of Paper and Bioprocess Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Studies of Miscanthus Use in Biorefinery: Scaling Up of Hot-Water Extraction

**Abstract:** Miscanthus (*Miscanthus* spp., MS) is a lignocellulosic biomass suggested as a candidate biofuel crop, especially in North America and Europe. MS is studied in this work to evaluate its potential for use in lignocellulosic biorefinery and feasibility for industrial and commercial utilization. Hot water extraction (HWE; 160°C, 2h), which assists in removing the easily accessible hemicelluloses, was performed in a Parr Reactor, M/K Digester, and Pilot Plant 65ft<sup>3</sup>-Digester. MS was comminuted to the particle size appropriate for each digester type and used for HWE. The effects of liquor-to-biomass ratio and particle size were explored by the analysis of chemical composition of Miscanthus before and after hot water extraction (MS and EMS), including lignin, cellulose, and extractives contents (analytical methods, Klason lignin, Seifert cellulose, and Soxhlet extraction, respectively). The dissolved lignin in the hydrolysate was recovered by precipitation after acidification of the extract to pH 2. By the mass balance, the removed cellulose and lignin in the hydrolysate, lignin recovery rate, degree of delignification could be estimated. These results indicate that the particle size and liquor-to-biomass ratio affect the HWE results and while bench-scale experiments may provide a rough estimate of these effects, Pilot Plant scale experiments should be performed to adequately assess the HWE of Miscanthus and provide necessary data for industrial development

**Level of Research:** Graduate - Ph.D. **Department:** PBE **Faculty Advisor:** Dr. Biljana Bujanovic



**Authors:** Nagardeolekar, A, Bujanovic, B. Department of Paper and Bioprocess Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

**Title:** Isolation of extracts of Chaga mushroom (*Inonotus obliquus*) and analysis of their antioxidizing activity and free phenolic hydroxyl group content

**Abstract:** Chaga mushroom (*Inonotus obliquus*) is a higher basidiomycota fungus found in cold regions of boreal forests, mainly in Russia and Siberia, that grows parasitically on sources rich in betulinic acid, such as birch trees. It is reported to contain polyphenolic compounds, terpenoids and polysaccharides and has been used traditionally in folk medicine for its anti-inflammatory, immunomodulatory, hepatoprotective and anticancer effects. Finely ground Chaga mushroom obtained from white birch (*Betula papyrifera*) and yellow birch (*Betula alleghaniensis*) trees from Southern Tier region of New York state was subjected to extraction with solvents in the increasing order of their polarity. Extraction was also done with water under different conditions (e.g. cold water with ultrasonication, hot water at atmospheric pressure and hot water under higher pressure in a Parr reactor). The water extracts were treated further to isolate compounds of interest. Selected extracts were then analyzed for their total free phenolic hydroxyl groups using two different methods, viz. Folin Ciocalteu and UV absorbance method and for their radical quenching capacity using the DPPH method and these values were compared with established antioxidants. These results can provide an indication of potential biological activity of Chaga extracts.

**Level of Research:** Graduate - Ph.D. **Department:** PBE **Faculty Advisor:** Dr. B. Bujanovic

## UNDERGRADUTE STUDENT ABSTRACTS

**Authors:** Michael X. Wang. Department of Chemistry, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

Zaara Sarwar. Department of Chemistry, State University of New York College of Environmental Science and Forestry, Syr

**Title:** Identification of Amino Acid Residues Required for Biological Activity of MifS, an  $\alpha$ -Ketoglutarate Sensing Histidine Kinase, in *Pseudomonas aeruginosa* PAO1

**Abstract:** *Pseudomonas aeruginosa* is an opportunistic pathogen that is able to efficiently adapt to new environments by utilizing a variety of carbon and energy sources. In prokaryotes, two-component signal transduction systems (TCS) are comprised of a sensor histidine kinase (HK) and a response regulator that link environmental changes with adaptive cell responses. The MifS/MifR TCS of *P. aeruginosa* PAO1 regulates the uptake of  $\alpha$ -ketoglutarate ( $\alpha$ -KG). This dicarboxylic acid is a common nutrient and may be a preferred carbon source for a number of bacteria. Using site-directed mutagenesis and  $\beta$ -galactosidase assays, we have identified several amino acid residues that are essential for the biological activity of the  $\alpha$ -KG sensing histidine kinase MifS. These include residues that are most likely involved in ligand interaction, i.e., hydrogen bonding, hydrophobic interactions, and steric effects. Importantly, we have potentially identified a residue that allows MifS to recognize other substrates. Protein modeling and ligand docking computations suggest a proposed binding pocket for the protein-ligand interactions between MifS and  $\alpha$ -KG. The results of this study provide crucial insight for the further characterization of MifS and similar histidine kinases involved in dicarboxylate sensing.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Christopher T. Nomura

**Authors:** Michael V. Zarbo. Department of Chemistry, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** CAPTURING TRULY DISSOLVED AND DISSOLVED ORGANIC MATTER-BOUND HYDROPHOBIC ORGANIC COMPOUNDS FROM NATURAL WATER SAMPLES

**Abstract:** Hydrophobic organic compounds (HOCs) can have devastating effects on natural systems. Most dissolved organic matter (DOM) is naturally occurring matter found in varying concentrations in natural waters. HOCs have been observed to bind with DOM, making them unextractable by conventional extraction techniques such as hydrophobic resins. DOM is comprised of poly-valent anions, making anion exchange resins ideal for its capture. A series of hydrophobic and anion exchange resins can increase HOC recovery by capturing both the truly dissolved, and DOM bound fractions. Naturally present inorganic anions compete with DOM for exchange sites on the anion exchange resin. This competition may reduce the volume of water which can be extracted prior to exchange site saturation, lowering the systems utility. Water samples were taken from Onondaga Lake in Syracuse, NY. Due to its divalent charge and concentration in Onondaga Lake, sulfate was identified as the major competitor with DOM for exchange sites. Filtered samples will be dosed with the hydrophobic organic dye Sudan-II and passed through XAD-2, a hydrophobic resin, and then A-21, an anion exchange resin. Recovery

rates and break through points for the dye will be monitored using Ultra Violet/Visible Spectrometry and Gas Chromatography-Mass Spectrometry. Sulfate concentrations in the effluent will be monitored using a Turbidimetric method. This experiment will explore the differences in affinity of the anion exchange resin for DOM and sulfate. Higher affinity for DOM than for sulfate will allow for larger volumes of water to pass through the system before DOM breakthrough, increasing the recovery of trace organic compounds and lowering the detection limit.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** John P. Hassett

**Authors:** Alame El Din, S, Kunz, J, Milano, A, Donaghy, K. Department of Chemistry, State University of New York, College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, New York, 13210

**Title:** From sludge to silver: creating value-added materials from teaching laboratory waste

**Abstract:** Waste materials from chemistry teaching labs contain precious metal ions such as silver, copper and gold. Silver chloride and silver nitrate are found in the waste material from the Analytical Chemistry 1 Laboratory (FCH 380) Experiment 8A, B. Precipitation & Titration of Chloride Ion at SUNY ESF. Aqueous silver ions and suspended silver chloride are reduced to silver metal nanoparticles using sodium borohydride, isolation of the silver ions from the solution via vacuum filtration produces metal nanoparticles that can be used in the production of precious metal clays (PMC). PMC's, made from castoff metals from the electronics industry are marketed to jewelry artists as an alternative to using molten metal to form intricate shapes. PMC's were made by combining various amounts of wheat flour binder, oil, water and a dispersing agent poly-vinylalcohol with silver nanoparticles from laboratory waste, brass particles recovered from metal machining, as well as silver purchased from Sigma-Aldrich. Once PMC's were prepared, they were fired in a kiln. Brass clays were fired twice: once at low-temperature to burn off the organic binder and the second firing, in graphite. This second firing, called sintering, allows the metal atoms to close holes and create a homogenous metallic structure. Silver is fired once as it does not oxidize at high temperatures and does not require graphite immersion binder and sintering can be done in one firing. A scanning electron microscope (SEM) was used to compare particle size of the metal nanoparticles and the fired metal surfaces.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Kelley Donaghy

**Authors:** Sosa, M, Pinto, A, Nomura, CT. Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Redefining PhaG: Expression and Purification of Recombinant Proteins for the Biochemical Characterization of the Putative Thioesterase PhaG

**Abstract:** Polyhydroxyalkanoates (PHAs) are biodegradable polymers biosynthesized from fatty acids by a host of microorganisms, both naturally occurring and genetically modified. In the genus *Pseudomonas*, one important link between fatty acids and PHA biosynthesis is the protein PhaG. This protein was reported to function as a 3-hydroxyacyl-ACP:CoA transferase. However, recent studies have challenged this notion leading us to hypothesize that PhaG

functions instead as a 3-hydroxyacyl-ACP thioesterase to produce intracellular 3-hydroxy fatty acids. In order to test our hypothesis, the gene phaG (PP1408) from *Pseudomonas putida* was cloned into the pET-21c(+) and pMBP-Parallel1 vectors for protein expression in *Escherichia coli* BL21(DE3) in attempts to obtain soluble protein. The pET-21c(+)/phaG vector, dubbed pJGG003, was also co-expressed with the pG-KJE8 plasmid for expression of chaperone proteins. Refolding experiments were also performed on denatured protein in an attempt to obtain native PhaG. Once functional PhaG is obtained, biochemical assays will be conducted to clarify PhaG's role in the biosynthesis of PHAs.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Chris Nomura

**Authors:** McKenney, Seamus C., Lundgren, Benjamin R., Nomura, Christopher T. Department of Chemistry, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Adaptation of recombinant *Escherichia coli* LSBJ for PHA production in a bioreactor

**Abstract:** Polyhydroxyalkanoates (PHAs) are plastic biopolymers produced by bacteria as an energy reserve under stressful conditions. PHAs are biodegradable and can be made to exhibit similar properties to petroleum-based plastics, which makes mass production of them highly desirable. In this study, we adapted *E. coli* LSBJ for high biomass production in a 2.2 L New Brunswick Scientific BioFlo 310 bioreactor and began studies toward high PHA polymer production in this setting. The LSBJ strain of *E. coli* was modified with several genetic manipulations ( $\Delta$ aas,  $\Delta$ arcA,  $\Delta$ dld, crp\*) to assist in PHA polymer production in the bioreactor, and a method was developed for high biomass production of this bacterial strain in the bioreactor. This method has consistently achieved optical densities at 600 nm in the range of 30-50 and cell dry weights above 15 g/L, which is several-fold higher than shake flask procedures with the LSBJ strain have achieved, as evidenced by typical cell dry weights achieved in shake flasks (0.8-3.4 g/L). With this method fully developed for the 2.2 L bioreactor, PHA production at high biomass achieved using this method can be investigated further, and scale-up procedures to larger vessel volumes, such as a 6 L bioreactor, can then be started.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Dr. Christopher Nomura

**Authors:** Cassandra Beaulieu, Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse NY 13210

Rebecca S. Robinson, Graduate School of Oceanography, University of Rhode Island, Narragansett, RI

**Title:** Method Development for Evaluating the Ammonium Nitrogen Isotopic Composition of Point Source Nutrient Inputs to Narragansett Bay

**Abstract:** In much of the marine environment nitrogen is the limiting nutrient for primary production. However, when nitrogen inputs increase significantly, it can stimulate potentially harmful results including harmful algal blooms and decreased dissolved oxygen due to enhanced respiration. In the Narragansett Bay watershed, wastewater treatment facilities (WWTFs) are the largest source of anthropogenic nitrogen to the estuary system. WWTFs

output nitrogen in the forms of ammonium ( $\text{NH}_4^+$ ) and nitrate ( $\text{NO}_3^-$ ), both of which are suitable for use by primary producers. In this study the aim was to refine a method for measuring the nitrogen isotopic composition of ammonium. The method needed to meet three main requirements. It must be able to separate ammonium from nitrate and dissolved organic nitrogen in the water samples. This separation must be done quantitatively in order to prevent fractionation of the isotopic composition in the samples. These first two requirements were met by ensuring that diffusion took place through a gas permeable membrane and by extending the diffusion period and therefore improving yield. Thirdly, the blank must be less than 10% of the sample size in order for it not to contribute significantly to the measured isotope value. I determined the origin of the blank contribution (magnesium oxide and vial caps) and made changes in the method to minimize it. Finally, the isotopic composition of WWTF samples was measured to see if they behaved like standards. A previous study completed the nitrate budget within the watershed. Quantification of the full isotope budget of DIN (ammonium and nitrate) allows study of the larger picture of nitrogen cycling within the Narragansett Bay watershed.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Robin Kimmerer

**Authors:** John R. Swartzfager and Kelley J. Donaghy

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**Title:** Progress Toward The Synthesis of Polyhedral Borane End-capped Macromolecules for Boron Neutron Capture Therapy

**Abstract:** Boron polyhedra have been investigated for use as Boron Neutron Capture Therapy, a cancer therapy employing the high cross section of boron for capturing neutrons and expelling alpha particles and lithium. The relative insolubility of these boranes in water, the need for a large number of boron-10 atoms to be localized in a tumor cell, coupled with their inability to be targeted directly to a tumor site, has prohibited the adoption of these compounds as drugs. To address these problems, we propose to synthesize a tri-functional dendrimer. One part of the dendrimer would be end-capped with polyhedral boranes, the second would have water soluble groups and the third would be tumor directing. The synthesis requires the formation of a core branch structure which was created through the reaction of isopropylidene-2,2-bis(methoxy)propionic acid with benzyl-2,2-bis(methylol)propionate in the presence of N,N-dicyclohexylcarbodiimide and 4-(dimethylamino)pyridinium p-toluenesulfonate. With the dendritic branch formed, the acetonide group will be converted to hydroxide functional groups which will then be converted into azides. The conversion of the hydroxide functionality to an azide will be carried out by replacement of the alcohol with iodine followed by displacement of the iodide by sodium azide. The future steps to be carried out would involve the reaction of the azide functionality and acetylene functionalized dicarborane through a "click" chemistry reaction. This would allow the incorporation of multiple carborane polyhedra onto the dendritic branch.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Kelley Donaghy

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Gregory L. Boyer (Advising Professor) Department of Chemistry, State University of New York- College of Environ

**Title:** Concentration of Protein-Bound and Unbound BMAA in Cyanobacteria

**Abstract:** Abstract:  $\beta$ -N-methylamino-L-alanine (BMAA) is a neurotoxin that has been associated with amyotrophic lateral sclerosis, Alzheimer's disease, and Parkinson's disease. The Chamorro people of Guam have a high incident rate of ALS/PDC, believed to be caused by bioaccumulation of BMAA in their diet. BMAA was found in the brain tissue of deceased Chamorro people who had ALS/PDC, but not in the brain tissue of those who did not. In Guam, Nostoc (a species of cyanobacteria) was the source of BMAA. This suggests that BMAA could be found in cyanobacteria, and could be a source of human exposure to BMAA. The aim of this paper is to examine BMAA levels, both protein-bound and unbound, in cyanobacteria collected from Lake Erie. Three different extraction techniques are used (80% MeOH, 20% MeOH, and 10%TCA), followed by LC-MS/MS analysis of their supernatant to determine unbound BMAA levels. The cyanobacteria pellets were then hydrolyzed (10M HCl at 110 °C for 18 hours) in order to analyze for levels of protein-bound BMAA. The results of this reasearch are currently ongoing and will be presented.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Dr. Gregory L. Boyer

**Authors:** James Capanegro<sup>1</sup>, Ryan A. Scheel<sup>1</sup>, Christopher T. Nomura<sup>1</sup>

<sup>1</sup>Department of Chemistry, State University of New York (SUNY) College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Synthesizing Biodegradable Plastic from Genetically Modified Strains of Escherichia coli using Paper Mill Waste Products

**Abstract:** Petroleum based plastics are a large problem around the world, due to their inability to readily breakdown, contributing to pollution of our land, rivers, and oceans. This incites the necessity of Biodegradable plastics such as poly(3-hydroxybutyrate) to prevent such pollution. In an effort to improve the renewability of our system we sought to use paper mill waste products, which can be broken down into a 66:33 ratio of glucose to xylose, as a carbon source for polymer production. Several strains of E.coli were transformed with a plasmid which converts glucose and xylose sugars into PHB plastics. After gas chromatography analysis it was concluded that the introduction of xylose produced the most PHB, an interesting conclusion since glucose is the preferred carbon source in E.Coli. This may be because the presence of glucose will actually reduce the efficiency of transcription of the proteins dependent on a Lac promoter by reducing cAMP levels and subsequently the level of transcriptional activator CRP-cAMP. Further experimentation using an E. coli strain containing a mutated CRP able to bind to promoter elements independent of cAMP may result in higher PHB production while utilizing glucose.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Dr. Christopher Nomura

**Authors:** Jordan A. Pitt(1), Ken G. Drouillard(2), Gordon Paterson(1)

(1)State University of New York, College of Environmental Science and Forestry, Syracuse New York, USA 13210; (2)Great Lakes Institute for Environmental Research, University of Windsor, Windsor,

**Title:** Polychlorinated biphenyl bioaccumulation patterns among Lake Erie lower trophic level consumers reflect species ecologies

**Abstract:** Polychlorinated biphenyl (PCB) concentrations were quantified in lower trophic level consumers of the Lake Erie western basin food web to assess the capacity of PCBs to discriminate among trophically similar species inhabiting different compartments of the same ecosystem. Zooplankton were characterized by higher proportions of less chlorinated and hydrophobic homologs relative to zebra mussel, mayfly and emerald shiner samples. PCB biomagnification factors (BMF) were positively correlated for emerald shiner, zebra mussel and mayfly samples with emerald shiners exhibiting the greatest degree of biomagnification relative to zooplankton prey. Principal components analysis of sample PCB profiles reflected the contrasting benthic and pelagic habitats occupied by filter-feeding zooplankton and zebra mussel samples, respectively. Benthic mayfly PCB profiles were characterized by increasingly hydrophobic ( $\log K_{OW} \geq 6.7$ ) congeners with more variable emerald shiner profiles reflecting the greater mobility and extent of spatial habitat integration achieved by this secondary consumer. These results contribute to growing evidence for the use of PCBs as ecological tracers in aquatic ecosystems.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Dr. Gordon Paterson

**Authors:** Schwid, C, Abraham. Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

**Title:** Fate of Mercury In The Atmosphere

**Abstract:** Mercury is a heavy metal and a neurotoxin, which can harm human health and the health of ecosystems. The atmosphere distributes mercury emissions all over the planet. 90% of the mercury in the atmosphere exists as Hg(0). Hg(0) is not readily removed from the atmosphere but, oxidized mercury (generally Hg(II)) is readily removed from the atmosphere and deposited to the Earth's surface. However, the mechanisms of Hg(0) oxidation in the atmosphere are not well known. Field work indicates that atomic bromine (Br) was a major initiator of oxidation through the reaction  $\text{Br} \bullet + \text{Hg} \rightarrow \text{BrHg} \bullet$ . The atmospheric fate of  $\text{BrHg} \bullet$  is unknown. One possible fate of  $\text{BrHg} \bullet$  is addition to alkenes in the manner of other radicals, e.g.:  $\text{BrHg} \bullet + \text{CH}_2=\text{CH}_2 \rightarrow \text{BrHgCH}_2\text{CH}_2 \bullet$ .

To determine if this reaction is relevant to the fate of  $\text{BrHg} \bullet$ , we have used quantum chemistry to investigate the thermodynamics and kinetics of this reaction and the reverse reaction. The reaction is only slightly exothermic, meaning the  $\text{BrHg}-\text{CH}_2\text{CH}_2$  bond is quite weak. This strongly suggests that this reaction is unimportant, and probably that the addition to alkenes, generally, is unimportant.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Dr. Dibble

**Authors:** Eric J. Benderski, Joseph M. Shoytush, Benjamin R. Lundgren, Christopher T. Noumra. Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY, 13210; SUNY Center of Applied Microbiology

**Title:** Determining the Genes Responsible for the Uptake of Acidic Amino Acids in *Pseudomonas aeruginosa*.

**Abstract:** Cystic fibrosis is a genetic disorder caused by mutations in the gene which codes for the cystic fibrosis transmembrane conductance regulator (CFTR) protein. CFTR is a regulator protein which controls the production of sweat, mucus and digestive fluids in the body. Patients with cystic fibrosis are vulnerable to pulmonary abnormalities due to mucus buildup in the lungs. Increased mucus accumulation in the lungs elicits favorable conditions for bacteria to thrive which causes infection. *Pseudomonas aeruginosa* is one strain of bacteria associated with this occurrence. *Pseudomonas aeruginosa* PA01 is a gram negative bacteria which can thrive in various environments due to its ability to uptake and metabolize a multitude of carbon and nitrogen sources. Similar bacteria (i.e. *Pseudomonas putida*) have been studied and are known to use a two-component signal transduction system (TCS) which regulates uptake and metabolism of acidic amino acids [1]. The TCS consists of sensory protein (AauS) which is found in the lipid bilayer of the inner membrane and a cytoplasmic response regulator protein (AauR). Upon detection of acidic amino acids by AauS, a signaling cascade activates AauR, leading to the uptake of acidic amino acids. This uptake is achieved by a transport protein cluster, AatJMQP, which allows acidic amino acids into the cell via active transport. Determining if *Pseudomonas aeruginosa* utilizes the TCS system and understanding the intracellular mechanisms which allow this bacterium to uptake and metabolize nutrients may lead to medical advances to treat bacterial related symptoms of cystic fibrosis.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Christopher T. Nomura

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Boyer, G. PhD. Professor of Chemistry, State University of New York, College of Environmental Science and Forestry, Syra

**Title:** Peptide Profiles in Toxic Cyanobacteria

**Abstract:** Cyanobacteria, or blue-green algae, are genetically diverse prokaryotic organisms that obtain energy through photosynthesis. Some cyanobacteria produce a number of bioactive metabolites during algal blooms that can impact other organisms. We are interested in knowing if cellular profiles generated through mass spectroscopy change between species and with growth conditions within a species. To investigate this growth, the cyanobacterium *Microcystis aeruginosa* LE-3 was grown under replete, low phosphorus, and low nitrogen conditions; and the bioactive peptides were analyzed using HPLC coupled with mass spectroscopy, and by MALDI-TOF mass spectroscopy. The LE-3 culture grew much better in replete media when compared to low nitrogen or phosphorus conditions. The LE-3 culture produced a series of toxins including Microcystin LR, de-methylated Microcystin LR, and Aeruginosin 98A among



others. A detailed comparison between the peptide expression profiles under different nutrient conditions will be presented.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Gregory L. Boyer

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Yuting, Zhu. Department of Chemistry, State University of New York, College of Environmental Science and

**Title:** Dark reversibility of sunlight-photolyzed organic matter fluorescence in Cape Fear and Delaware Estuary Water

**Abstract:** The fluorescence of dissolved organic matter decreases when exposed to sunlight, primarily by ultraviolet light. However, this process is partially reversible in the dark, as reported by Kouassi and Zika in 1990 (Neth. J. Sea Res. 27: 25-32), but this phenomenon has been overlooked in recent studies. The purpose of this study is to test Kouassi and Zika's fluorescence photo-reversibility hypothesis. To test this hypothesis, filter-sterilized Cape Fear (NC) and Delaware Estuary water samples were irradiated with a UVA lamp at wavelengths between 300 and 400nm. These samples were then left in the dark at room temperature for various intervals to determine recovery of the fluorescence. Significant loss of the dissolved organic matter fluorescence was observed after short-term irradiations. The Cape Fear water samples showed dark recovery of fluorescence after 2 h of irradiation and a short 30 min dark incubation, and further recovery was not observed for as long as 2 h. The Delaware Estuary water samples, also irradiated for 2 h, showed increasing fluorescence intensity for as short as 10 min intervals, and a significant dark recovery for a total 130 min. This means that studies of fluorescence losses due to exposure of natural organic matter to sunlight will be dependent on how long samples are kept in the dark prior to analysis.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Dr. Kieber

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Gregory, L, Boyer, Biochemistry Professor, State University of New York, College of Environmental Science and Forestry,

**Title:** Cyanobacteria identification using protein Expression Profiles

**Abstract:** Cyanobacteria Identification Using Protein Expression Profiles

Chris Japinga

Greg Boyer

Department of Chemistry

Toxic cyanobacterial blooms are serious public health issues, and are becoming increasingly widespread. These blooms are often a mixture of toxic and non-toxic species. Typically morphological characteristics of cyanobacterial strains have been used for identification. These natural variations are often difficult to observe under a typical compound microscope, often morphological differences are often not associated with toxic formation. Recently, protein expression profiles have been used to differentiate between closely related bacteria in a clinical

setting. Here we investigate the use of a similiar for differentiation of cyanobacteria species. Protein expression profiles of bacterial protein extracts generated using MALDI-TOF mass spectrometer. Two common bacteria, Escherichia coli and Bacillus subtilis were included as controls. Ribosomal peptides between 3000 and 16,000 dalton were identified in the MALDI spectra. Current efforts are focused on how to analyze that data using different proteomics software packages.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Greg Boyer

**Authors:** Jason R. Pauldine, Ryan A. Scheel, Christopher T. Nomura

Department of Chemistry, State University College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Endotoxin Assessment of PHA's for Potential Stem Cell Scaffold Materials

**Abstract:** Current regenerative technologies use collagen as a scaffold for autologous stem cells however adequate structural integrity of the scaffold remains a concern.

Polyhydroxyalkanoates (PHAs) generated from engineered Escherichia coli are capable of filling the role of a bio-absorbable scaffold, without many of the disadvantages associated with collagen. As a Gram-negative organism, our engineered strain of E. coli, contains endotoxins, which elicit a powerful immunogenic response in mammals. We seek to evaluate the levels of these endotoxins both in crude and methanol purified samples of PHAs grown from three E. coli strains (E. coli LSBJ, E. coli RSCO2, and E. coli ClearColi® utilizing a limulus ameocyte lysate (LAL) endotoxin detection assay. We hypothesize that the endotoxin levels of post methanol purified PHAs will be shown to be negligible. This would assure that scaffolds made from these materials would fall below the threshold of human endotoxin limits as established by the FDA. Should the hypothesis hold, immediate work can begin to formulate suitable stem cell scaffold materials from PHAs.

**Level of Research:** Undergraduate **Department:** Chemistry **Faculty Advisor:** Christopher T. Nomura

**Authors:** Artruc, E.G.\*, Ivany, L.C. Department of Earth Sciences, Syracuse University, Syracuse NY, 13210, \*SUNY College of Environmental Science and Forestry, Department of Environmental and Forest Biology, Syracuse NY, 13210

**Title:** Growth Rate and Ecology of the Giant Heteromorph Ammonite *Diplomoceras maximum* Using Stable Isotopes of Accretionary Shell Carbonate

**Abstract:** *Diplomoceras maximum* is a large, hamitcone heteromorph ammonite with a shell that resembles a giant paperclip. A 1.5 meter long specimen representing more than 3 meters of linear shell growth from the late Cretaceous Lopez de Bertodano Formation of Seymour Island, Antarctica, now resides at the Paleontological Research Institution (PRI) in Ithaca, NY. Its growth rate and ecology have been the subject of much discussion but are completely unknown. Stable carbon and oxygen isotope analysis of serially sampled shell material can provide insight into the growth and habitat of these peculiar cephalopods. A roughly half-meter section of shell containing a hook and both adjoining portions of shafts, with aperture diameter ~15 cm, was sampled at a resolution of 5 samples per sculptural rib on the shell (total of 145

analyses).  $\delta^{18}\text{O}$  values vary between +1.9 to -1.7‰, roughly the same range expressed by co-occurring benthic mollusks. A 15-point moving average defines a broad sinusoid that likely reflects ~1.5 years of shell growth. If so, and if accretion were constant, the PRI animal would have been about 9 years old at death. Superimposed on this sinusoid is regular variation of up to 2‰ that corresponds to sculptural ribs and covaries with  $\delta^{13}\text{C}$ , suggesting the potential for disequilibrium effects during precipitation of ribs or, potentially, repeated vertical migrations through the water column. Carbon isotope values overlap those of typical benthic mollusks and other ammonites, but also include extremely negative values (+1.7 to -30‰). Values are low between ribs and higher on them; regular swings to low values become significantly more extreme in the hook than they are in the shafts. If related to disequilibrium and/or incorporation of metabolic  $\text{CO}_2$ , this suggests more rapid growth in the hook section. Exceedingly negative  $\delta^{13}\text{C}$  values may also reflect precipitation in the presence of methane, as suggested in the literature by unusual carbonate precipitates, chemosymbiotic cold-seep bivalve taxa, and very low  $\delta^{13}\text{C}$  values of cemented burrow fills. Taken together, our data suggest a pelagic habit near the bottom, with a vertically oriented shell, closely associated with cold methane seeps. Shell growth is fast, consistent with living coleoids, and large individuals are likely less than 10 years old at death.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Linda Ivany

**Authors:** Ashley Adler\*, Carolyn T. Chang, Christopher M. Whipps

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**Title:** Investigating transmission of *Mycobacterium* spp. from experimentally infected zebrafish (*Danio rerio*) to tank biofilms

**Abstract:** Zebrafish (*Danio rerio*) are a popular model organism used in research.

Mycobacteriosis is a common, chronic bacterial infection that is found in this laboratory fish.

Several species and strains of *Mycobacterium* have been identified to infect zebrafish.

*Mycobacterium* species are facultative pathogens that can survive both within the host organism, but also in the environment, persisting in surface biofilms. Due to this biofilm

presence, we can not only detect *Mycobacterium* species within the zebrafish, but also in tank biofilms. In fact, biofilm sampling is a common surveillance method used to detect

mycobacteria in facilities. The relationship between mycobacterial-infected zebrafish and tank biofilm communities remains elusive and little is known regarding the transmission of

*Mycobacterium* species. between zebrafish host and tank biofilm. In this study, fish were

infected with *Mycobacterium saopaulense* and given four weeks to develop infection before being placed in sterilized tanks. We monitored tank biofilm community through weekly

sampling and monitored for the presence of *M. saopaulense*. Given these conditions, and in comparison to mycobacterial surveillance data from zebrafish facilities, we hypothesized that

*M. saopaulense* will be detected in tank biofilms by six weeks. To date, eight weeks following the addition of infected fish we have still not detected this strain in tank biofilms, suggesting

that additional outside factors may affect the rate of transmission between fish and tank

biofilms. Future work should look into this transmission, as results will help to inform disease management and husbandry procedures in zebrafish laboratories.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Dr. Christopher Whipps

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<sup>1</sup>SUNY Environmental Science and

**Title:** Putting Plasmids in Pigs Produces Powerful Pulmonary Pumps: Reduction of ARDS Mortality by Electroporation Mediated Delivery of Na<sup>+</sup>,K<sup>+</sup>-ATPase

**Abstract:** Background: The Acute Respiratory Distress Syndrome (ARDS) has a 40% mortality rate and results in roughly 80,000 annual deaths. It occurs in patients afflicted by sepsis or trauma and diseases like pneumonia, which initiate an inflammatory cascade. The resulting vasodilation, increased cardiac output and endothelial permeability ultimately produce alveolar edema, which contributes to reduced gas exchange at the alveolar-capillary interface and contributes to patient mortality. We applied gene therapy techniques in a clinically translational porcine ARDS model and delivered genes for membrane-bound pumps to the alveolar cells. We hypothesized this would decrease mortality by reducing edema and improving oxygenation.

Methods: ARDS was induced in ten anesthetized pigs (34-36kg) using a “two-hit” ischemia/reperfusion (I/R) and fecal clot (FC) model. Animals were connected to physiologic monitors and mechanically ventilated. The superior mesenteric artery was clamped for 30 minutes and released to create I/R injury and FC was placed in the abdomen to induce sepsis. Plasmids were delivered to the lung via bronchoscopy and electroporated (100V/cm). Following injury, animals were randomized to either Treatment (Na<sup>+</sup>,K<sup>+</sup>-ATPase/ENaC plasmid, n=5) or Control (Empty plasmid, n=5) groups. The study end-point was death or T=48 hours.

Results: The treatment group had significantly lower Wet/Dry ratios and histopathology scores and increased Surfactant Protein-B concentrations. Mortality was 20% lower in the treatment group.

Conclusion: Gene delivery improved lung function and reduced mortality due to ARDS. Current research lies in determining if transfer of Na<sup>+</sup>,K<sup>+</sup>-ATPase alone will preserve lung function, and in identifying the most advantageous time for plasmid delivery.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Dr. Lee Newman

**Authors:** McGee, GG, Kiernan, DH, Departments of Environmental and Forest Biology and Forest and Natural Resources Management, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Variation in sugar maple (*Acer saccharum* Marshall) bark characteristics: implications for epiphytic bryophyte communities

**Abstract:** Several studies have reported succession of epiphytic bryophytes and lichens on trees of progressively larger diameters, suggesting the existence of temporal resource gradients associated with aging/growing phorophyte hosts. The objective of this study was to identify possible resource gradients associated with aging sugar maple (*Acer saccharum* Marshall) trees in Adirondack Park, New York, USA. A single bark sample (12.6 cm<sup>2</sup>) was extracted from each of 103 sugar maples (diameter range: 11-84 cm dbh) from twelve northern hardwood forest

stands, and analyzed in the laboratory for moisture holding capacity, moisture availability, drying rates, and nutrient content. Bark mass per unit surface area ( $\text{g cm}^{-2}$ ) was positively correlated with tree diameter, reflecting the development of mature, thick bark characteristics. Bark moisture holding capacity ( $\text{H}_2\text{O}$  as % dry mass) was independent of tree diameter, but moisture availability ( $\text{g H}_2\text{O cm}^{-2}$  bark) increased with diameter as a result of thickening bark. Bark drying rates were negatively correlated with bark mass (thickness). Cation ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ) concentrations in bark leachate were all positively correlated with tree diameter (and bark mass). Nitrate concentrations in leachate were typically below detection limits, and  $\text{NH}_4^+$  and total nitrogen concentrations varied independently of tree diameter. The results of this study are consistent with prevailing hypotheses that increased moisture and nutrient availability, and slower drying rates of bark on large-diameter trees (in this case, sugar maples) could account for increasing total cover and species richness of bryophytes, and increasing dominance of mesophytic and calciphilic bryophytes on larger trees.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Gregory G. McGee

**Authors:** Corinne Michaud, Jacqueline L. Frair, Christopher M. Whipps.

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Department of Environmental and Forest Biology, 1 Forestry Drive, Syracuse, NY 13210 USA

**Title:** Evaluating Effectiveness of Field Identification of Predator Scat through DNA Amplification

**Abstract:** In this study, we compared the field identifications of carnivore scat samples to the DNA sequence identifications to evaluate the accuracy of species assignment based on field identification. Feces, or scat, are commonly used to study elusive wildlife. Scats can be used to determine species distribution, spatial and temporal movements, diet, and disease status. However, misidentification of scat based on physical criteria, even from seasoned biologists, can lead to inaccurate or biased inference. Identification of scat samples based on morphology can be confounded by such factors as diet and the presence of similarly sized species within the same area. Over the past three years in Fort Drum, New York, scat samples have been collected and presumptively identified as red fox (*Vulpes vulpes*; scat diameter  $< 2$  cm) or coyote (*Canis latrans*; scat diameter  $\geq 2$  cm). Using polymerase chain reaction we amplified and sequenced part of the cytochrome b (cytb) gene, and compared to known cytb sequences in GenBank for species identification. We obtained species identification for 96% of the scat samples ( $n = 94$ ). Species identified were *C. latrans*, *V. vulpes*, and gray fox (*Urocyon cinereogentus*). Comparison of field identification to genetic identification indicated 62% overall agreement. Of the 57 putative *C. latrans* samples, 89% were verified as *C. latrans* genetically. For putative *V. vulpes* samples ( $n=37$ ), only 14% were verified as *V. vulpes* whereas 51% were verified as *C. latrans*, 24% as *U. cinereogentus*, and 4 samples could not be identified genetically using sequencing. Whereas field researchers may be confident that scats  $\geq 2$  cm are most likely from coyote, they are also likely to miss a large fraction of coyote scats that they presume to belong to red fox, and completely miss species like grey fox. Such biased sampling likely will have implications for mapping species occurrence, habitat use and diets from scats lacking DNA verification to species.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Christopher M. Whipps

**Authors:** Forte, Madalyn F. The State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210. Lockhart, Kathy B. The School For Field Studies, Center For Marine Resource Studies, South Caicos

**Title:** An Assessment of a Marine Protected Area in Proximity to South Caicos, and its Capacity to Protect the Biodiversity of Finfish on the Caicos Bank

**Abstract:** Marine Protected Areas (MPAs) are often established without frequent assessment, and these MPA's ability to achieve their conservation goals is questionable. To assess the effectiveness of the Admiral Cockburn Land and Sea National Park (the closest no-take MPA to the town of Cockburn Harbour in the South Caicos) for preserving biodiversity, underwater visual surveys were conducted, both inside and outside the MPA. Biodiversity assessed with log<sub>10</sub> categories, and the Shannon-Wiener Index. There was no significant difference in diversity between sites inside and outside the MPA, based on either technique. The lack of significance in diversity may be due to it being set up without consideration of baseline data. A median test showed that the sites with the highest biodiversity changes depending on the assessment technique. Based on the results from this study, it is not recommended to use the log<sub>10</sub> category method for MPA establishment, without Shannon-Wiener Index values for comparison. With the use of only log<sub>10</sub> categories one would miss high Shannon-Wiener Index valued sites, and thus may not consider those as important of a site when evaluating and potentially reconfiguring the MPAs in the South Caicos area.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Jame Gibbs

**Authors:** Cappelli, L. Department of Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** The effects of acidic soils on the age structure and age at sexual maturity of eastern red-backed salamanders (*Plethodon cinereus*) in hardwood forests of New Hampshire and Vermont

**Abstract:** Acid deposition due to increased pollutant emissions has negatively impacted the hardwood forests of the northeastern United States. Highly acidic soils between a pH of 2.5 and 3.0 were considered lethal to eastern red-backed salamanders (*Plethodon cinereus*), but recent studies have found that these salamanders are abundant in low soil pH. I predicted that high acidity would negatively impact eastern red-backed salamander age distribution, growth rate, and age at sexual maturity. I analyzed data of four *P. cinereus* populations that were collected at two sites in the White Mountain National Forest in New Hampshire (pH 3.30 & 3.89) and two sites in the Green Mountain National Forest in Vermont (pH 2.73 & 3.68) (Bondi et al. 2015). Ages of each red-backed salamander were determined using skeletochronology and growth curves were calculated using the von Bertalanffy equation and Chapman's method. The most acidic site had a high abundance of young juveniles and few adults, which may indicate that limited juveniles survive to adulthood in these stressful conditions. The mean age of sexually mature individuals was significantly higher at the most acidic site compared to least acidic site, but was not significantly higher compared to the other sites (ANOVA,  $p = 0.04$ ). It is possible that eastern red-backed salamanders can locally adapt to soils of high acidity. Future research on the effects of high acidity on *P. cinereus* populations is crucial because they

comprise a large portion of terrestrial vertebrate biomass and play an important ecological role in nutrient cycling.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Dr. Colin Beier

**Authors:** Jay Palumbo, Kean Clifford, and Donald Stewart. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Morphological Variation Among Bowfin (*Amia*) Populations from South Carolina and the Laurentian Great Lakes: Taxonomic and Conservation Implications

**Abstract:** The genus *Amia* has been considered monotypic since 1896, when 12 nominal species were synonymized with *A. calva* without analysis or rationale. To test that monotypy hypothesis, we analyzed morphological variation between two regions, focusing on newly collected topotypical specimens: 1) South Carolina (type localities of *A. calva*, *A. lentiginosa* and *A. cinerea*) and 2) Great Lakes (type localities of *A. ocellicauda*, *A. occidentalis*, and *A. canina*). We also examined all available type materials for *Amia* spp. Results revealed significant morphological differences among these populations; we reject the 120-year-old monotypy hypothesis. Several characters distinguish South Carolina bowfins from those in lakes Erie and Huron, including: 1) More lateral-line scales; 2) More dorsal fin-rays; 3) Pelvic and pectoral fins relatively shorter in South Carolina; and 4) Posterior nostril diameter relatively smaller in South Carolina. Bowfins from Lakes Huron and Erie also differed, with L. Huron fishes having: 1) More pelvic fin-rays; 2) Longer caudal peduncle; and 3) Narrower head width. The second Bowfin species to be described was *A. ocellicauda* from L. Huron; it seems likely that nominal taxon may need to be reconsidered. Distinction of the L. Erie population also suggests further taxonomic complexity needing analysis. Discovery of a second bowfin species raises conservation concerns, given the developing bowfin caviar fishery.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Donald Stewart

**Authors:** Juliann Marie Schneider, Dr. Lee Newman, contributions by Susie Tran

**Title:** Development of a Plant Care Guide for the Veterans Hospital Horticultural Therapy Program

**Abstract:** The goal of this project is to provide a resource for both staff and patients at the Syracuse Veteran's Affairs Medical Center to learn to care for the collection of plants in the therapeutic horticulture program and to also learn about their history and uses. This program is designed to enhance the in-patient activities during short and long-term hospital stays for patients suffering from spinal cord disabilities or disease, and for those patients in long-term residential care. The program has been active for three years, but until now, there was no information available to the patients regarding what plants were being grown in the patient rooms, common areas, or outside nor any guidance for care. During the academic years, students from ESF guide the patients in plant care, but outside that time, hospital staff generously tends to the plants. This project compiled information about all plants, outside garden plants, seed grown edibles and houseplants, into one living document, that would be both educational and entertaining. Each species is clearly detailed with care instructions,

images, and some interesting information about history and uses. Additional copies of the pages for each plant are available if patients wish to take their plants home with them; thus having the resources they need to bring therapeutic horticulture into their own home. This project involved considerable research into over 50 plant species, including ideal growing conditions, history, and uses. It also incorporated interpretive design, compiling these facts into a digestible and approachable form for any reader.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Dr. Lee Newman

**Authors:** Wierzbicki, B, Piedmonte, NP, Fierke, MK, Shaw, SB. Departments of Environmental and Forest Biology and Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Habitat Associations of *Ixodes scapularis* (Acari: Ixodidae) in Syracuse, New York

**Abstract:** Habitat associations of *Ixodes scapularis* Say were described at six public-use sites across Syracuse, New York. Tick abundance was determined in October and November 2015 by flagging for questing adult *I. scapularis* along two 264-m transects at each site, each within a distinct forest patch. We examined the association of basal area, leaf litter depth, and percent understory cover with tick abundance using negative binomial regression models. Our models indicated tick abundance was positively associated with percent cover of understory species. Tick abundance did not appear to be associated with particular canopy and understory species. These results may assist park-goers and land managers in considering local risk factors for exposure to *Ixodes scapularis* and the diseases vectored by this host species.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Dr. Melissa Fierke

**Authors:** Poje, C. Department of Environmental Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse NY 13210 and The School for Field Studies, Center for Rainforest Studies Yungaburra, QLD 4884

**Title:** Calling Behaviour in the Northern Queensland Subpopulation of *Petaurus australis*

**Abstract:** Vocalizations are a common form of inter- and intraspecific communication for mammals. Yellow-bellied Gliders, *Petaurus australis*, are the most vocal of the Australian Gliders emitting low frequency calls at high intensities. I explored the frequency of calls in relation to season, temperature and humidity as well as the behavioral context in which the calls were emitted. Along with my field crew, I observed current feed and den trees for gliders during dusk, their most active time. Observations were performed over the course of two years during the wet and dry season for a total of four observation seasons. I found a significantly higher mean call frequency during the dry season than the wet season. I determined that temperature has no apparent relationship to call frequency; however, humidity is positively correlated with call frequency. One call type was distinguished during this study, the full call. It was determined to be used for a number of purposes by the gliders including cohesive group traveling and to defend food resources of a home range from gliders of other species. This study suggests that with an understanding of glider vocalizations they can be used as a time and energy efficient method to monitor and survey populations.



**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Dr. William Shields (ESF) and Dr. Sigrid Heise-Pavlov (SFS)

**Authors:** Sarah Lynch, Lena Rogovin

Department of Environmental and Forest Biology, SUNY College of Environmental Science and Forestry, Syracuse, NY, USA 13210

Mitrani Centre for Desert Ecology, Ben-Gurion University of the Negev, Be'er Sheva, Israel, 84105

**Title:** Lichen Water Absorbance in the Namib Desert

**Abstract:** The Namib desert is a coastal desert that experiences frequent coastal fog. Lichens use the fog to collect moisture required for photosynthesis. This experiment focused on analyzing water absorbance and retention rates in various lichen species collected in Namibian lichen fields. Water gain and loss was measured by using photo analysis with ImageJ. Water mass loss was measured over 20 minute intervals. Results found a correlation between lichen life forms and water absorbance and retention rates. Closer examination at species specific morphology shows adaptations that aided in either rapid water absorbance or prolonged water retention. Further research at the molecular level will give more insight into the desiccation tolerant abilities of lichen species adapted to hyper-arid desert environments.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Scott Turner

**Authors:** Zarha Dillon-Zuppelli, Geoffrey Griffiths, Greg McGee, Department of Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Dynamic Modeling of White Trillium Restoration

**Abstract:** Native forest wildflower communities experienced substantial declines across the Northeast following widespread conversion of forests to agricultural land uses. With agricultural abandonment at the turn of the 20th century forest cover has increased, but understory wildflower community reassembly has not kept pace. Restoration efforts are currently being implemented to return several wildflower species to regional forests, but there is still some uncertainty about which management practices would maximize restoration success. Dynamic modeling tools could potentially be used to help assess which edaphic factors, biological interactions and restoration strategies have the greatest impacts on wildflower population growth rates. For this project, I attempted to use white trillium (*Trillium grandiflorum* Mich.) as an example of how a modeling program could be implemented to inform management decisions. To do this, I used the STELLA program to model how white trillium population growth varied based on light levels, herbivory levels, and restoration efforts. The model indicated that herbivory is the greatest limiting factor for trillium populations, which suggests that deer control is critically important for successful trillium restoration. Although limited, this model was useful for conceptualizing the limits on trillium populations. I would suggest using dynamic modeling in the future to assist in both restoration and education efforts.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Greg McGee

**Authors:** Allison Smith (1), Michael L. Schummer (1), Richard M. Kaminski (2), Kevin Hunt (3), and Houston Havens (4)

(1) State University of New York College of Environmental Science and Forestry, Department of Environmental and Forest Biology, 1 Forestry Drive,

**Title:** Influence of Achievement-oriented Factors on Hunt Quality in Mississippi

**Abstract:** Waterfowl hunters participate in hunting for appreciative, affiliative, and achievement oriented reasons. Understanding how achievement-oriented factors influence perceived hunt quality can help guide future management efforts to increase hunter participation and retain hunters from previous years. To investigate the influence of achievement-oriented factors on hunt quality, from 2009-2015 waterfowl hunters at four Mississippi Wildlife Management Areas (WMAs) responded to a six-question survey immediately following their hunt (n=8,399). Questions were related to achievement-oriented factors and were used to calculate a hunt quality score for each participant. Surveys also included each hunter's harvest composition and hunt party size. I tested a suite of competing models to determine whether variation in hunt quality was best explained by total number of ducks harvested, number of mallards harvested, total bag weight, or rank as table fare of ducks harvested. I detected a single model with overwhelming support explaining variation in hunt quality ( $\omega_i=1.0$ ). The model included a quadratic relationship for total number of ducks harvested, total number of mallards harvested, and hunt frequency ( $>$  hunt quality score on areas hunted 2 than 4 days per week), and included number of other non-duck species harvested as a covariate. Hunt quality score varied positively with number of ducks harvested up to six ducks (i.e., the daily allowable bag), and number of mallards up to three mallards. Results indicate that achievement-oriented factors are important influences on hunt quality at Mississippi WMAs.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Dr. Michael Schummer

**Authors:** Ian E. Newcomb, Christopher J. Foelker, Melissa K. Fierke

**Title:** Cost Effective Wood Borer Trapping (Hymenoptera: Siricidae & Coleoptera: Cerambycidae) in New York State

**Abstract:** As international trade increases, potential for insect introductions outside of their native ranges dramatically increases. Introduction of *Sirex noctilio* (Hymenoptera: Siricidae) into North America has raised cause for serious concern. In New York State, we tested efficacy of readily available and inexpensive lures (split billets of *P. resinosa*, *P. sylvestris*, EtOH and Turpentine+EtOH) for woodboring insects in New York State, specifically *S. noctilio* and *Monochamus* spp. From Jun to Sept 2015, woodborers were sampled in five locations. To maximize catches, sites were chosen based on prior success catching siricids. In total, seven *S. noctilio* were caught (72% *P. sylvestris*) and 319 *Monochamus* spp. (47% Turpentine + EtOH, 24% *P. sylvestris*). Sampling periods were likely not long enough to yield significant results despite capturing 5 X greater numbers of *S. noctilio* with intercept traps lured with *P. sylvestris*. Our results are consistent with similar studies conducted with the same lure trapping native *S. nigricornis*. Ultimately, our results indicate there is some potential for the use of inexpensive

lures, such as split billets of *P. sylvestris* and turpentine mix, to make widespread monitoring much more efficient. Further experimentation will be required to determine if volatile emission from *Amylostereum aerolatum* elicits a significant response.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Melissa Fierke

**Authors:** Gregory, G., McGee, PhD. Environmental Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY, 13210

**Title:** Northern Hardwood Forest Impacts Fifty-Five Years Following an American beech Treatment with Sodium Arsenite in Huntington Wildlife Forest, New York

**Abstract:** The prolific root spouting behavior of American beech (*Fagus grandifolia* Ehrh.) is disruptive to northern hardwood forest structure. Numerous herbicides have been used to control beech over the years; however, few studies have described the long-term impacts of those herbicides on beech control. In 1960-1961 in an experimental stand at Huntington Wildlife Forest, Newcomb, New York, sodium arsenite was applied in spaced axe cuts at waist height to all beech stems 0.5"-12" dbh. By 1961, all treated beech stems had died or were in decline and by 1964 stocking of sugar maple and yellow birch had increased. Fifty-five years later, we examine the long-term success of the sodium arsenite treatment. In 2015, all living stems 4.6"-12.5" dbh were tallied, American beech was the most abundant species, comprising 82% and 83% of all stems in the treated and untreated areas, respectively. Sugar maple density was 1.9% in the treated and 8.7% in the untreated areas and yellow birch density was 4.2% in treated and 1.4% in the untreated areas. There were no differences between treated and untreated areas in densities by any size classes any species, except for American beech 10.6"-11.5" dbh and sugar maple 8.6"-9.5" dbh, both of which were more abundant in the untreated areas ( $p < 0.05$ ). The results indicate that, although initially effective, the sodium arsenite treatment did not decrease beech density or improve regeneration desirable hardwoods over the long term. This study highlights the possible need for repeated chemical treatments to control American beech, and the importance of monitoring outcomes of chemical control experiments over longer periods than those currently reported in the literature.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Gregory G. McGee

**Authors:** KIM SAVIDES. State University of New York College of Environmental Science and Forestry, Department of Environmental and Forest Biology, Syracuse, NY, USA

NICOLE KRAUSS. Washington State University, School of Biological Sciences, Pullman, WA, USA

MICHAEL

**Title:** Relationship between Extra-Pair Paternity and Proximity of Nests to Territory Edges in the Black-throated Blue Warbler (*Setophaga caerulescens*)

**Abstract:** Socially monogamous songbirds often engage in extra-pair copulations (EPC) with individuals beyond their social mates in attempt to raise their fitness. Male efforts combatting and eliciting EPCs have been well studied; however female contributions including circumventing males and nest placement are often overlooked. Here I investigated female nest site selection relative to male territory boundaries in the black-throated blue warbler (*Setophaga caerulescens*) to determine if female nest placement influenced proportions of

extra-pair young (EPY) within the nest. Male territories were mapped using 95% kernel density isopleths from singing male locations in Hubbard Brook Experimental Forest, NH. Distances between nests and territory edges were measured and normalized against territory sizes (n=20). Using collected blood samples, extra-pair paternity (EPP) was determined through established microsatellite loci analyses. Preliminary results suggest EPP varied greatly with nest distance from territory boundaries. Using a linear model, I plotted proportional EPP against proportional nest distance ( $R^2=0.109$ ). I found little support for a relationship between EPP and nest distance relative to its territory. These results may suggest EPCs do not happen in relation to nest position within a territory, but rather elsewhere either in a neighboring male territory or interterritorial spaces. Greater investigation is needed to determine if females actively seek EPCs outside of the social males' territory or extra-pair males enter social male territories to seek EPCs.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Dr. Shannon L. Farrell

**Authors:** Protus, A, Cohen, J. Department of Environmental Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Avoiding Predation: Is There a Critical Period? Temporal and Seasonal Variation of Piping Plover Nest Predators

**Abstract:** A great deal of resources have been spent attempting to manage predators of the piping plover. Nest predators are active throughout the day and night, while monitoring staff that might deter predators are usually present only during select hours of the day. Monitoring efforts are also uniform throughout the nesting season, while predator activity may not be. The purpose of this study was to identify potential critical periods throughout the 24-hour cycle and the breeding season of the piping plover to allow for more targeted allocation of resources for monitoring nest predators. Camera traps were installed near enclosed piping plover nests (N=16) at Jones Beach State Park, New York during egg incubation. Predators were identified and visit frequencies were summarized by time and seasonal period. Red fox (n=12) were most prevalent from 3 to 6 am, while raccoon (n=8) visited primarily between 12 and 3 am. Avian predators (n=17) including gulls, American crow, and American oystercatcher visited nests mainly from 6 am to 6 pm. Visit frequency of mammals and oystercatcher did not vary seasonally, however crows (n=13) only visited between 14 June and 5 July. Different predator species visited plover nests throughout the 24-hour cycle, with the exception of the early evening hours (6pm to 12 am), which seemed to have reduced predator visits. However, given that red fox may compromise enclosures and avian predators may attack newly-hatched chicks as they exit from enclosures, providing additional monitoring in the pre-dawn and daylight hours could improve reproductive success.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Jonathan Cohen

**Authors:** Charlotte A. Rozanski 1, Stacy A. McNulty 2, and Gregory McGee 3

1, 3 Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

2 Adirondack Ecological Center, State U

**Title:** Beavers as ecosystem engineers: Influence of wetland class and vegetation structure on avian species richness

**Abstract:** Beavers (*Castor canadensis*) are high-level ecosystem engineers that greatly impact wetland habitat. I compared vegetation composition and structure for four National Wetland Inventory (NWI) wetland classes and related site variables to bird species richness. I conducted bird point counts at 11 sites on ESF's Huntington Wildlife Forest in Newcomb, NY. Line transects were conducted with six, 1 m<sup>2</sup> plots/ 80 m transect for plant species and vertical structure complexity (VSC). The forested wetland class had the greatest plant diversity ( $D_s = 0.697$ ) and second highest bird species richness. Multivariate analysis using non-metric multidimensional scaling (NMS) demonstrated that bird richness, plant richness, and VSC were not statistically correlated with NWI class ( $r^2 < 0.15$ ). Yet I found a positive relationship between bird and plant species richness across sites, although species assemblages were not statistically correlated. Bird assemblages were correlated with VSC and certain plant species. These results indicate the importance of habitat complexity to wetland and edge birds. The NWI classification scheme was an unreliable way to categorize wetlands in terms of current vegetation and bird communities. Management that conserves a variety of vegetal structure at beaver-influenced wetlands will provide a diversity of habitat for birds.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Stacy A. McNulty

**Authors:** Carpentier J.E., Jones M.I., Fierke M. Department of Environmental and Forest Biology, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210.

**Title:** Detection of Emerald Ash Borer and Associated Biological Control Parasitoids on Insecticide Treated Trees vs. Untreated Control Trees: A Case Study in Syracuse, NY

**Abstract:** Emerald ash borer (EAB) is an invasive forest pest of ash trees. First detected in 2002 near Detroit, MI., EAB has now been found in 25 states, including New York. Several management strategies are being used to control EAB and mitigate ecological effects, two of which include insecticide treatment and the use of introduced parasitoid wasps for biological control. The systemic insecticide emamectin benzoate, which is injected into infested trees, has been successful in saving individual high value trees, but it was unknown if EAB avoids those trees or if they oviposit on them, but the larva are unsuccessful. Our research objectives were to document if EAB, or its parasitoids, are attracted to insecticide treated ash trees. We deployed purple prism traps (for EAB) and yellow pan traps (for parasitoids) on insecticide treated ash trees and untreated (control) trees. Results were significantly more EAB were caught on control trees, 67, as compared to 2 on treated. However, no parasitoids were captures in YPT's. The second may be more attributable to it being the first year of parasitoid release and so it is suggested to continue this study another year to ascertain whether or not treated trees are avoided by parasitoids.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Melissa Fierke

**Authors:** Kristen M. Doerr\*, Carolyn T. Chang, Christopher M. Whipps  
Department of Environment and Forest Biology, State University of New York College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse NY, 13210

**Title:** Investigating tolerance, growth, and fecundity of laboratory zebrafish (*Danio rerio*) clarithromycin and tigecycline antibiotics.

**Abstract:** The zebrafish (*Danio rerio*) has revolutionized the research community as an ideal model organism. Easy husbandry, large clutch sizes, and a transparent embryo make it popular in many studies. *Mycobacterium* spp. are common pathogens in zebrafish research facilities and have zoonotic potential. While some mycobacteriosis outbreaks are severe, causing mortalities, other outbreaks are subclinical, showing sometimes no clinical signs of illness. Subclinical infections are a major concern as they may confound research results. Current disease control measures emphasize prevention, as established outbreaks require intensive measures such as depopulation. Alternatives, such as antibiotic treatment, remain to be investigated. Little is known about the effects of antibiotic treatment on zebrafish health. In this study, we investigated, in vivo, the health effects of short- and long-term clarithromycin and tigecycline treatment on growth, reproductive yield, and 24-hour embryo mortality on uninfected adult zebrafish. Clarithromycin and tigecycline were chosen due to their effectiveness against *Mycobacterium* spp. in previous studies. Treatments were administered using a medicated gelatin feed. Control (unmedicated) feeds were used for comparison. Results indicated no significant difference between antibiotic and control treatments on reproductive yield or 24-hour egg mortality. A significant increase in growth was observed for long-term tigecycline treatment compared to clarithromycin and control treatments. Because we did not observe any negative health effects, future studies investigating the efficacy of this treatment on fish with mycobacteriosis are warranted. Together the results from both this study and subsequent efficacy investigations will inform the zebrafish community regarding the potential for antibiotic treatment of mycobacteriosis.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Christopher Whipps

**Authors:** Kristen M. Doerr\*, Carolyn T. Chang, Christopher M. Whipps

Department of Environment and Forest Biology, State University of New York College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse NY, 13210

**Title:** Investigating tolerance, growth, and fecundity of laboratory zebrafish (*Danio rerio*) clarithromycin and tigecycline antibiotics.

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**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Christopher Whipps

**Authors:** Hemanth Ramachandran, SUNY ESF

Meghan Rousseau, Ben-Gurion University of the Negev

**Title:** Effects of Temperature and Solar Radiation in Walking Speed of Namib Desert Ants

**Abstract:** Temperature is an important determining factor of the metabolic rate and energetics of desert ants in Namibia. The metabolic rate (walking speed) of ants are predominantly reliant of different heat sources during the day: direct solar radiation or shortwave radiation in early morning and terrestrial thermal radiation or longwave radiation later in the morning. Since ants are some of the tiniest, yet very important members of the Namib ecosystem, it is important to understand how these fluctuations affect their walking speed as foraging is critical for survival. We predicted that the temperature will have a positive effect on the walking speed of ants. Ants will be less reliant on direct solar radiation later in the morning compared to earlier in the morning because of the availability of terrestrial long wave radiation. We measured walking speed under direct sunlight and artificial shade; and operative temperature and solar radiation for each shade/sun events. We found that the ant walking is positively affected by its operative temperature with a Q10 value of 1.90. The metabolic activity increases 1.90-fold for every 10°C increment in the operative temperature. However, the walking speed difference in shade and sun during earlier in the morning versus later in the morning was not significantly different.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Scott Turner

**Authors:** Sean Cromwell, SUNY ESF

Monja Gerber, University of the Northwest (Potchefstroom), South Africa

**Title:** !Nara (*Anthanosicyos horridus*) niche construction through manipulation of the biophysical environment.

**Abstract:** Organisms adapt to their ever changing environments, but is it possible that some organisms manipulate their environment and therefore “adapts” the environment to the organism? !Nara, a C3 cucurbit endemic to the Namib Desert (situated in southwest coast of Africa), shows various adaptations to this hyper-arid environment. !Nara forms hummocks through certain morphological traits that help trap sand and windblown organic litter in their spiny thicket. There is however little information on the effect of hummock formation on the biophysical aspects of their environment. The purpose of this study was to determine how hummock construction influences certain biophysical factors by measuring, along the hummock’s gradient, wind velocity with a hot-wire anemometer, the change in operative

temperature, and the fog cultivation of the plant. This study reveals that !Nara initiates the hummock formation within its thicket by lowering wind velocity causing particles to fall out of suspension. This hummock formation also leads to decreased operative temperature on the topmost point of the gradient caused by an increase in heat loss through convection. Furthermore, the morphological traits of !Nara also allow fog capture. Water accumulates on the grooved stem and runs down to fall upon the sand. This allows the sand on the hummock to become more compact and moist, creating a microenvironment for microorganisms, such as nematodes, which the plant can benefit from. These factors can be taken into account when studying the cultivation capacity of the !Nara plant which benefits the local community.

**Level of Research:** Undergraduate **Department:** EFB **Faculty Advisor:** Scott Turner

**Authors:** Lindsay, Alana. Department of Environmental Science, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** "The Economics Behind Mass Residential Solar PV Energy Adoption in the US."

**Abstract:** The New York state average price of electricity for a residential home is about 20.07 cents per kilowatt hour (kWh) while the national average cost of solar electricity can be as high as 30 cents per kilowatt hour. There are currently no statistics for the average price of solar energy in NYS alone. I will be using the National Renewable Energy Lab (NREL) "PV Watts Calculator" to model the average cost of supplying electricity to residential homes in Central New York State with solar energy. Federal and State tax credits, grants, and financing options will be included to see how much money it would take, to make solar energy just as feasible an option as coal and gas powered energy. The initiatives of the Central New York Regional Planning and Development Board, to streamline solar energy for Central New York will also be evaluated.

**Level of Research:** Undergraduate **Department:** Environmental Science **Faculty Advisor:** Tim Volk

**Authors:** Vaccare, J. Department of Environmental Science, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

York, J. School of Marine Science and Policy, University of Delaware, Newark, DE 19716

**Title:** The Forms and Sources of Nitrogen Used by Phytoplankton in Guinea Creek, DE (USA)

**Abstract:** The health of the Delaware inland bays is of interest due to their commercial value, importance as nursery grounds for fish and shellfish, and as sites of recreation. To study a site of eutrophication, mesocosms with pore water additions, connections to the substrate (seeps) and controls were designed to test the response of phytoplankton to different nitrogen sources. We analyzed concentrations of nitrate, ammonium, phosphate and chlorophyll a, along with the  $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$  values of nitrate, and the  $\delta^{13}\text{C}$  values of phytoplankton in mesocosms with various treatments in Guinea Creek, DE. Nutrient concentrations in the groundwater (for the seeps) and in the pore water (for the pore water mesocosms) differed markedly; the average nitrate concentration for the pore water ( $295 \pm 3.6 \mu\text{mol/L}$ ) was higher than the ground water ( $83 \pm 33.8 \mu\text{mol/L}$ ); while the average ammonium concentration for the pore water ( $4 \pm 0.2 \mu\text{mol/L}$ ) was less than the groundwater ( $48 \pm 5.6 \mu\text{mol/L}$ ). The seeps saw



the highest level of chlorophyll a over the sampling period compared to the other treatments, and particulate matter in the seeps had the lowest  $\delta^{13}\text{C}$  values. This could indicate that the resuspension of benthic algae may have increased phytoplankton biomass in the seeps. The close proximity of the estuary to a golf course, residential homes with lawns, and agricultural areas that utilize chicken manure for fertilizer, could explain why the nitrate isotope values reflected the presence of fertilizer and manure in the groundwater as the source of nitrate to the estuary.

**Level of Research:** Undergraduate **Department:** Environmental Science **Faculty Advisor:** Dr. Mark Teece

**Authors:** Harbordt, N. Department of Environmental Science, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Presence of PPCPs in Soil Irrigated with Municipal Wastewater in North Carolina

**Abstract:** Pharmaceuticals and personal care products (PPCPs) are largely produced, consumed, and detected readily in wastewater effluent. Municipal wastewater land application to managed forests is an important treatment and disposal practice globally, with 86 municipal facilities located in North Carolina. However, the concentrations and transport of PPCPs and their potential impacts in these systems are largely unknown. The objective of this study was to assess PPCPs in forested soils at a municipal land application site in North Carolina, U.S.A. Soil cores were hand-augured at the surface (0-10 cm) and at depth (50-60 cm) along two transects within the wastewater irrigation area and at a reference site outside of the irrigation area. Thirty-three PPCP analytes were targeted through solid-phase extraction (SPE) and concentration, and separated and quantified via LC-MS/MS. Relationships between PPCP analyte concentrations and soil characteristics (e.g. soil depth, soil texture, carbon concentration, humic matter content, cation exchange capacity, and pH), were evaluated. From this study, 25 of the 33 targeted PPCP analytes were detected in the soil at very low concentrations (ng/g of soil), indicating leaching and potentially some mitigation by the forest system. Generally, PPCPs were present at higher concentrations in the surface soil. No significant correlations were observed between soil characteristics and the presence and concentration of PPCPs; however, cation exchange capacity and carbon content did positively correlate with the concentration of carbamazepine, a rather persistent chemical detected at every site in only the surface horizon.

**Level of Research:** Undergraduate **Department:** Environmental Science **Faculty Advisor:** Dr. Russell Briggs

**Authors:** Michael Persson (1), Charley Driscoll (2), Mario Montesdeoca (2), Amy Shaw (2) & Mariah Taylor (2) State University of New York College of Environmental Science and Forestry (1), & Syracuse University (2)

**Title:** Comparison of Fish Mercury Concentrations among Sample Preparation Methods

**Abstract:** Currently there are three generally accepted methods of sample preparation to analyze fish muscle tissue for total mercury analysis in New York State (NYS): plugs, standard filets, and Department of Environmental Conservation (DEC) filets. Literature has shown that

there is a similarity among plug and standard filet results. A comparison study between the plug and DEC filet methods was then completed to obtain data in order to evaluate a correction between the data sets. Graphically, results indicate that plugs from each fish sample have higher mean concentrations of mercury compared to the DEC filets, and that a correction factor to utilize DEC filet data as plug data is possible. However, statistical testing revealed variable results ( $\alpha=0.05$ ). Differences observed between these two preparation methods may be dependent on a host of factors like size, species, or lake-specific fish length-Hg relationships. The benefits of utilizing the plug method include overall reduced time processing, increased freezer storage, energy spent on homogenization, and is a potentially humane alternative. Additionally, this information can support future research to investigate correlations among lakes with varying chemical properties and other target species, utilize archived data sets, and promote tagging and recapture. Finally, the study is inclusive of thirteen different lakes, seven different species of fish, and with a 241 sample size.

**Level of Research:** Undergraduate **Department:** Environmental Science **Faculty Advisor:** Lee Newman

**Authors:** Stanley, Kolosovskiy. Departments of Environmental Science, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Designing an optimized indoor aquaponic system.

**Abstract:** Aquaponics combines aquaculture and growing plants in a soilless media in a recirculating system. The effluent from the fish provides the nutrients required by plants to grow. The uptake of nutrients from the water purifies the water for the fish allowing the system to produce fish and vegetables while generating no waste effluent. This experiment seeks to optimize the design of a compact home aquaponics system by utilizing current advances in technology to create a low maintenance, semi-automated working prototype. This design has multiple features: Firstly, custom LED grow lights were built to maximize plant growth while minimizing electricity usage. Secondly, electronic monitoring systems were designed to record crucial water quality data to ensure smooth operation of the system. Lastly, amphipods were introduced to have in situ mineralization of organic solids in the system.

**Level of Research:** Undergraduate **Department:** Environmental Science **Faculty Advisor:** Neil Ringler

**Authors:** Ohnesorge, M. Department of Environmental Science, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** A Sensitivity Analysis on Oil and Gas Prices and How This Affects Sustainable Energy Implementation

**Abstract:** Following a preceding paper a sensitivity analysis was performed on oil and gas prices to see how this affects the Net Present Value of the economic analysis and in turn how this would affect sustainable energy technology implementation suggestions made based off the analysis. From an average of 25 years of data a sensitivity range was formed around the current fuel prices plus/minus one and two standard deviations. This created a range of five fuel prices in which the economic analysis, specifically Net Present Value, was re-performed. The results

showed that most of the sustainable energy technologies that were suggested had Net Present Values that increased in worth with an increase of at least one, if not two standard deviations above the current oil prices. This increase in price is consistent with data from the U.S. Energy Information Administration showing a general increase in fuel and gas prices over the years. Once this trend in prices is taken into consideration it makes sustainable energy technologies more favorable to implement. In some cases, specifically a geothermal heat pump that was suggested in the previous paper, this increase in fuel and gas prices increased the Net Present Value to become positive thus making the investment profitable. This sensitivity analysis reduces investment risk and incorporates the increasing trend in oil and gas prices when performing an economic analysis, in turn making sustainable energy technologies more favorable to implement.

**Level of Research:** Undergraduate **Department:** Environmental Science **Faculty Advisor:** Michael Kelleher

**Authors:** Hanz, R, Xue, L, Zhu, Y, Kieber, D. Division of Environmental Science and Department of Chemistry, State University of New York College of Environmental Science and Forestry, Syracuse NY 13210

**Title:** Organic Carbon Surface Microlayer Enrichments in Cranberry Lake, New York

**Abstract:** In aquatic systems, the air and water are separated by a thin but distinct layer called the surface microlayer (SML). The SML is important because it affects the physical, chemical, and biological environment at and below the interface, which will impact various processes at the SML such as gas exchange. The SML is operationally defined, with a typical thickness from 50 to 200  $\mu\text{m}$ , depending on the sampling technique. Unlike oceans very little work has been done to examine organic enrichments in the SML in freshwater. Lakes differ from oceans in that they contain more organic matter which can affect the degree of enrichment in the surface microlayer.

The SML was sampled using a glass plate, which collects an approximately 50  $\mu\text{m}$  thick layer, and analyzed for total (TOC) and dissolved organic carbon (DOC) content, chromophoric dissolved organic matter (CDOM) and chlorophyll a (Chl a); parallel samples were collected from approximately 20 cm below the surface. The goal of this project was to determine whether TOC, DOC and CDOM were enriched in a lake's SML compared to the underlying water. We hypothesized that TOC, DOC and CDOM would be enriched in the SML. Indeed, all fractions of organic matter (DOC, TOC and CDOM) were enriched in the SML compared to the underlying water, with median enrichments of 3, 3 and 2%, respectively. In contrast, Chl a had a median depletion in the SML of 47%.

**Level of Research:** Undergraduate **Department:** Environmental Science **Faculty Advisor:** David Kieber

**Authors:** Shaw, B, Steven, PhD. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** An Evaluation of General Circulation Models in Relation to the North Atlantic Oscillation

**Abstract:** A basic exploration of CMIP5 general circulation models (GCMs) was conducted in order to compare and validate their ability to reproduce the North Atlantic Oscillation (NAO) index. The investigation involves 12 GCMs, their historical runs, and also simulations based on an atmospheric increase of carbon dioxide (CO<sub>2</sub>) concentrations at an rcp60 level. The time period being evaluated is from 1900-2005 historically and 1900-2100 for simulations. The historical model runs are compared to the standardized NAO station based index provided by the National Center for Atmospheric Research (NCAR). All models, both historical and perturbed, were able to show the pressure dipole present between the subtropical Bermuda-Azores High and subpolar Icelandic low. Though the models generally were not capable of reproducing multi-year variability in the signal, the models for the most part were able to generate decadal trends similar to that of the control. Earlier generations of GCMs (i.e. prior to CMIP 5) have shown an inability to replicate the dipole, seasonal variability, and decadal trends in the NAO (Stephenson et. al., 2006). The results here show improvements in the most recent generation of models' behavior but the current generation of models still have sizable limitations. As there is increased interest in explaining regional changes in future climate, the ability of GCMs to reproduce such climate patterns as the NAO becomes increasingly important.

**Level of Research:** Undergraduate **Department:** ERE **Faculty Advisor:** Steven Shaw

**Authors:** Grace Belisle, Undergraduate of the Department of Environmental Resources Engineering. Kristina Macro, Undergraduate of the Department of Environmental Resources Engineering. Mark Tepper, Undergraduate of the Department of Landscape Architecture. Denali T

**Title:** Ready, Set, GROW

**Abstract:** The work of the Biomimicry Global Design Challenge combines science with design, engineering with natural phenomena and food system challenges with the obstacles of successful product design. The challenge asks that the problems encountered in modern day anthropogenic food systems be solved by considering how nature operates efficiently and successfully. Our group created a personal compost container that exceeds the capabilities of those already on the market by widening the scope of its usage and functionality. The project's functionality is unique as the container itself is enhanced to provide ideal conditions and mechanisms for optimal composting. The scope of the project's usage is widened through the container's life cycle. Once filled, as a normal compost container would be, it can simply be brought outside to serve as a small garden planter. Over the course of filling more and more containers, the individual containers can be pieced together to make a larger, raised garden bed made of fully biodegradable material great for a schoolyard, residential backyard, or city balcony.

Our design submission to Biomimicry Global Design Challenge is "GROW" standing for "Gateway to Rethinking Organic Waste". The goal of GROW beyond its physical functionality is to spark interest and increase knowledge about composting, sustainability and food waste, whether in the classroom, in an urban development, or where food waste is located, which is everywhere.

**Level of Research:** Undergraduate **Department:** ERE **Faculty Advisor:** Bill Shields

**Authors:** Jessica Alli Straub, Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Ecological Engineering for Improve Water Quality in Red River Delta, Vietnam

**Abstract:** The Red River Delta (RRD) of northern Vietnam is one of the largest river deltas in the world. Near 20 million inhabitants rely on the river delta for irrigation drinking water and other every-day uses. However, developmental stressors, such as industrial runoff and deforestation, has contributed to significant pollution of the river basin. Due to the amount of people dependent on this water source, it is vital to understand how to mediate the current water crisis.

In an effort to support the health of the RRD, this paper explores the use of constructed wetlands a low capital and maintenance solution for water quality improvement. Evaluations of varying constructed wetland configurations were conducted to assess each respective wetland's ability to restore ecological services and improve overall water quality. To identify the optimal locations for the implementation of constructed wetlands, this study created an algorithm for the production of a hydraulic model of the RRD using local remote sensing data and spatial analysis methodology.

The study concluded by combing the optimal wetland types and locations with an implementation policy for long term sustainability through interdisciplinary collaboration.

**Level of Research:** Undergraduate **Department:** ERE **Faculty Advisor:** Dr. Neil Murphy, Dr. Malmshemer

**Authors:** Jennifer Gienau. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Using object-based segmentation to identify invasive species in Onondaga County, NY

**Abstract:** The impact invasive species have on native habitats can be devastating in that they can reduce plant biodiversity, decrease wildlife habitat, and change ecological function of an area. *Lythrum salicaria* (purple loosestrife), *Fallopia japonica* (Japanese knotweed), and *Phragmites australis* (phragmites AKA common reed) are three significant invasive species located in Onondaga County, New York and were the focus of this study. This study aimed to test the feasibility of using readily available oblique imagery to identify the presence of these invasive species. Imagery used in the study came from Google Earth Street View imagery matched to the coordinates of locations reported to have dense populations of phragmites, Japanese knotweed, or purple loosestrife. Images were first loaded into ERDAS Imagine 2015 where unsupervised object-based classifications were performed. ArcGIS was used to create features and calculate texture of the image. MATLAB was used to further classify the segmented images using a classification tree based off of the spectral bands, length to area ratio of the objects, and average texture of the objects. Results largely show images classified by these means have an overall accuracy of about 85% correct classification. To improve this methodology, spatial resolution and capture time of photos should be optimized. Future research should include reference photos with confirmed species identification, better quality

images, and ground validation. This research is an important step towards improving invasive species management efforts.

**Level of Research:** Undergraduate **Department:** ERE **Faculty Advisor:** Lindi Quackenbush

**Authors:** Jeremy Driscoll<sup>1</sup>, M.M Khachan<sup>2</sup>, S.K. Bhatia<sup>3</sup>

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<sup>2</sup>Doc

**Title:** Comparison of 1-D and 2-D Dewatering Tests in Geotextile Application

**Abstract:** Geotextile tubes are used in many remediation projects throughout the world to dewater contaminated sediment. This process allows for easier transport and storage of contaminated sediment, while allowing clean water to return to its source. However, as sediment type varies in size and composition, each project requires experimental testing to determine the dewatering rate. One-dimensional tests are commonly used in the laboratory to determine dewatering rate and analyze filter cake properties. However, these tests do not accurately assess the properties, as geotextile tubes dewater from all sides.

In this study, two one-dimensional tests (with flow only vertically) through a Pressure Filtration Test and a novel Suction Filtration Test were compared to determine variability in the results of one-dimensional flow due to different pressure applications. In addition, an innovative Two-Dimensional Filtration Apparatus (with flow both vertically and radially through the sides of the geotextile) was developed in order to determine the effect of radial flow on the results. This apparatus will more accurately imitate the real-life dewatering application of geotextile tubes. Unlike on-site “hanging bag” and “pouch” tests, this laboratory apparatus was designed in a form that will facilitate the studying of dewatering rate laterally and radially separately. These results will be of great in the laboratory, as it will provide for more accurate dewatering rate and filter cake property analysis. It will also be used by mathematicians, as its geometric form will be more conducive to analysis of dewatering. This will aid in the creation of a simple and fast mathematical model to determine geotextile dewatering rate, which will reduce the need and cost of experimental testing during construction/remediation projects.

**Level of Research:** Undergraduate **Department:** ERE **Faculty Advisor:** Dr. Shobha Bhatia

**Authors:** Sean Matus. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Dr. Wendong Tao, Associate Professor. Department of Environmental Resources Engineering, State U

**Title:** Review of macrophyte and bacteria nutrient removal performance in constructed wetlands

**Abstract:** In constructed wetlands, macrophytes and bacteria are considered drivers of nutrient removal from water. Understanding how well macrophytes and bacteria remove nutrients, nitrogen in particular, under specific conditions can be used as a design consideration for the improvement of these systems. This study investigated the nitrogen removal through uptake by

Cyperus alternifolius and Typha angustifolia in constructed wetlands to see the role different macrophytes play in improving water quality. Weekly water quality monitoring and determination of plant biomass growth showed that macrophytes did not play a major role in the total inorganic nitrogen (TIN) removal in the constructed wetlands, especially when they were stressed by high concentrations of ammonia. With a nitrogen removal approximately 2.9% – 15.9% of the total removal under slightly stressed conditions, Cyperus alternifolius and Typha angustifolia contributed minimally to the nutrient uptake that occurred. This study also examined multiple years of trials to see if there is an optimal constructed wetland configuration and operating conditions for the implementation of anammox bacteria.

**Level of Research:** Undergraduate **Department:** ERE **Faculty Advisor:** Dr. Wendong Tao

**Authors:** Dr. Paul Hirsch. Department of Environmental Studies, College of Environmental Science and Forestry, Syracuse, NY 13210

Dr. Whitney Lash Marshall. Department of Environmental Studies, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Exploring Opportunities for Undergraduates in Interdisciplinary Research

**Abstract:** While there are many interdisciplinary research (IDR) opportunities available to undergraduates, they may not expose students to the full IDR process. This researcher aims to characterize the undergraduate research experience within the SUNY system in order to identify the level of exposure undergraduates have to the research process, and the skills they gain. Interviews have been conducted with faculty, students, and administrators at both SUNY ESF and SUNY University at Buffalo (UB) in order to explore multiple perspectives on the subject. Resulting data will be used to make recommendations on how to improve or establish research experiences that better prepare undergraduates for IDR collaborations.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Paul Hirsch

**Authors:** Luis Mendez, Onondaga County Department of Law

Travis Glazier, Onondaga County Office of the Environment

David Sonnenfeld, SUNY ESF Department of Environmental Studies

**Title:** Onondaga County Department of Law Internship

**Abstract:** For the Environmental Studies Senior Synthesis Project my goal was to acquire an internship that would further my knowledge of environmental law. I then received and completed a summer internship at the Onondaga County Department of Law. I proposed this internship to my advisor and Senior Synthesis supervisor, David Sonnenfeld, at the end of the Spring 2015 semester. My proposal was approved and I began my internship in May and completed it in July.

I worked with Senior Deputy County Attorney Luis Mendez, who handles the majority of the County's environmental cases, and the Director of the Department of the Environment for the County, Travis Glazier. Under their guidance, I drafted a 20 plus page proposal requesting the Natural Resource Damages Trustees for approximately \$16 million to implement natural resource damages projects surrounding Onondaga Lake. The proposal was well received by the

NRD Trustees and is awaiting further action. I have completed my Senior Synthesis and final report on this internship.

I was able to apply my coursework from 3 ½ years at SUNY-ESF to the project and what I had learned in my writing, biology and environmental law and policy classes significantly helped me draft the proposal. The internship experience taught me how to be a professional and exposed me to new types of writing. If this proposal is accepted by the NRD Trustees, Onondaga County will be awarded the funding requested to complete various resource remediation and trail implementation projects around Onondaga Lake.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** David Sonnenfeld

**Authors:** Chris Rothery, Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Drought Discourse in 3 Los Angeles County Communities

**Abstract:** Faced with another year of historic drought in the West, discovering the most effective communication strategies for decreasing water use on an individual and societal scale have become increasingly needed to craft effective conservation strategies. This study attempts to discover a relationship between communicative strategies and water conservation through an analysis of drought discourse in three Los Angeles County communities. Comparisons of the frequency of newspaper and twitter responses to the drought to state water conservation reporting numbers creates a method for comparing the public spheres in each study area. A frame analysis of the newspaper and twitter content provide context for the frequency of articles data. The results show a clear divide in water conservation along class lines between each study area, with frequency of newspaper articles mentioning the drought playing an important role in shaping each community's attentiveness to its water conservation efforts.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Dr Andrea Parker

**Authors:** Courtney Pitman, Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** A Semester With SEQRA

State Environmental Quality Review Act

**Abstract:** My senior synthesis project consists of an internship with NYS Parks. Duties include: assisting with the State Environmental Quality Review (SEQR) process, communicating between various NYS Parks staff, using GIS/mapping skills, and lending a hand to the planning, engineering, and environmental management departments when needed which may include written/graphic presentations, database input, office organizing, filing, occasional field work, and surveying areas i.e. future playground sites.

Upon completion of the internship as a "FORCES Park Planning and Data Management Steward", I will write a ten page paper as required. I currently have a journal to keep track of new skills and lessons I have learned throughout the professional experience. I plan to describe the SEQR process on my poster by using diagrams such as flow charts, bullet points, and computer image snapshots to pique viewer interest and understanding of the review. My goal is to promote SEQR, describe how the process preserves the natural, cultural and historical



resources of NYS, and demonstrate the importance of SEQR as a whole. I would also like to promote the FORCES Club (Friends of Recreation, Conservation, & Environmental Stewardship) which is closely connected with NYS Parks and has given me this great opportunity as an intern.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** David Sonnenfeld

**Authors:** John F. Flood Jr., Dr. Paul D. Hirsch. Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Analyzing the Complexities of the Long Island Pine Barrens and the Decision Making Process

**Abstract:** The Long Island Pine Barrens Region is an environmental sensitive area that is protected by ECL (Environmental Conservation Law) Section 57-0105. It states:

“The legislature further finds that a portion of the system known as the Central Pine Barrens area requires the preparation and implementation of a state supported regional comprehensive land use plan that will provide for the preservation of the core preservation area, protection of the Central Pine Barrens area and for the designation of compatible growth areas to accommodate appropriate patterns of development and regional growth with recognition of the rights of private land owners and the purpose of preservation of the core area.”

Although this law was created with the environments best interests, shortcuts have been taken to degrade the protection of this open space and lead to a complexity of issues. Issues include water protection, development, the evasive Southern Pine Beetle, wildfires, and so on. All these issues have created tensions between the community, municipalities, and environmentalists which have developed biocentric and anthropocentric views. The idea that nature has intrinsic value and has a right to grow and thrive is being combated by individuals who seek to develop and/or undue the preservation of this region.

These complex issues are not being well addressed and some of the solutions have negatively impacted both the environment and human health. Through looking at these issues, a multi-criteria decision matrix will be generated showing all these complexities are interlinked and that their is no easy to solution to solving the entire problem.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Dr. Paul D. Hirsch

**Authors:** David Sonnenfeld Department of Environmental Studies: Biological System Applications, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Brooker Engineering Internship: Civil Engineer

**Abstract:** This past summer has presented a plethora of opportunities for me to expand my experience within the field of Environmental Studies focusing on Biological Applications. I have been able to work with agencies within the federal, state, regional, and private sectors. My main responsibilities were with Brooker Engineering a private engineering firm in Rockland County, NY. Brooker Engineering provides their clients with a wide range of services designed to follow project development from feasibility studies, conceptual design, surveying, final project design, permitting, and ultimately through construction. The firm also offers engineering design for a wide range of projects, including residential, commercial and municipal. The firm’s

projects are mostly in the tri-state area and New York City. As a result of the internship I had the opportunity to take this past summer, I have a newfound confidence in the knowledge, and the tools that I have gained from studying Environmental Studies at SUNY ESF. This newfound confidence guided me in the path to SUNY ESF classes that will further help me in the professional world.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Valerie Luzadis

**Authors:** Brendan Ingargiola. Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** The Washington Experience

**Abstract:** During the fall of 2014, the first semester of my junior year at SUNY-ESF, I was privileged enough to accept a professional and educational internship at the Environmental and Energy Study Institute in Washington, DC. I wanted an internship in Washington DC so I could explore potential career options and to see if I could picture myself working in this environment. While interning four days a week on the policy, communication and development teams at EESI, I also participated in two courses with professors from SUNY Brockport that introduced me to various political players around DC and helped to improve my research writing skills. My internship coordinator also allowed me to attend councils, panels and other events in DC all pertaining to the environment and clean energy. I gained valuable knowledge into not only how the legislative process works in our country but also how environmental politics and ideas are intertwined in that process. Since coming back to campus, I have realigned my academic path to better serve my career interests and goals, which have shifted as a result of my experience in DC.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** David Sonnenfeld

**Authors:** Colette S McDonald. Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** The Public Health Risk of Formaldehyde in Brazilian Keratin Hair Treatments

**Abstract:** As the "Science and Policy" Intern of the Environmental Protection Bureau (EPB) of the NYS Office of the Attorney General, I conducted research to determine which Brazilian Keratin Hair Treatment (BKT) products contain harmful levels of the carcinogenic substance, Formaldehyde. All products are being pursued for further research on account of deceitful practice. These companies claim their products are formaldehyde-free when they contain levels above .2% or they pose formaldehyde as a safe, harmless substance when in reality it is a known human carcinogen.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Dr. Paul Hirsch

**Authors:** Linda Poon

**Title:** How Million Trees NYC Enhances Resiliency

**Abstract:** Rising sea levels, increasing natural disasters, and shifting weather patterns make major cities located by the coast, such as New York City, exposed to many challenges. Hurricane

Sandy and Irene are examples of recent disasters that have prompted the city to become more resilient. I defined resiliency as the ability to respond back to unpredictable or predictable events, and adapting to these changes. NYC needs to be resilient against many environmental factors including climate change, air pollution, and heavy storms, and social factors like crime and health problems. One of the ways to enhance resiliency is to plant trees, as they offer numerous environmental benefits in face of climate change including carbon sequestration, stormwater management, enhancing biodiversity, and reducing urban heat island effect. In terms of social benefits, tree plantings increase connection in the community through stewardship, enhance aesthetics and feeling of safeness, and improve human health. Tree plantings are not an easy fix, as they also have their own challenges such as expensive cost, potential to fall down during natural disasters, and early death due to harsh urban conditions. NYC Parks has addressed some of the challenges through careful planning and selection of trees and increasing public outreach. Despite the struggles planting trees are, they still provide environmental and social resiliency against climate change and improve community texture. To not plant trees because of fear can eliminate the overall long-term benefits.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Sharon D. Moran

**Authors:** Starr, R, Nicholas. Department of Environmental Studies, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Rogers Environmental Education Center Internship

**Abstract:** My senior synthesis presentation revolves around my internship at Rogers Environmental Education Center over the summer of 2015. During this internship, I helped run a day summer camp for kids aged 6-12. I was able to incorporate many of the skills I had learned during my time at ESF. Environmental writing, public speaking, project planning, teamwork, and science interpretation are a few of those skills. Additionally, I was able to experience the day-to-day operations of an environmental center, work with all ages of people, and teach individuals about multiple aspects of the environment. With the time and commitment that I gave Rogers, I was able to help produce a variety of new camp program ideas along with additional material for their newsletters. Overall, the internship was a great learning experience and a helpful tool for professional growth. It helped strengthen my goal of finding employment.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Dr. Andrea Parker

**Authors:** Steve Ricker, Director of Conservation and Wildlife Management, Westmoreland Sanctuary, Mt. Kisco, NY 10549

**Title:** Summer Internship at Westmoreland Sanctuary

**Abstract:** For my senior capstone project I interned with the Director of Conservation and Wildlife Management at Westmoreland Sanctuary in Mt Kisco, New York. I conducted this internship during the Summer of 2015, and I chose this option for my Senior Synthesis Project because I wanted more hands on experience as an environmental educator and a conservationist. Although my major is Environmental Policy, Planning, and Law, this internship made me a much more well-rounded individual, and has given me the opportunity to have a

future career in a wide range of environmental areas. Throughout my summer at Westmoreland Sanctuary, I learned priceless information that will enhance my attributes in the environmental professional field. I learned so many things about myself, and environmental education and conservation that I will remember throughout my life. This internship helped me refine the direction in which I want to take my Policy, Planning, and Law degree. As an environmental educator, I learned how to communicate science in a way that a range of age groups would understand and become interested in. In addition, as a conservationist, I realized for the first time how much of a positive impact I can have on the environment. I am truly grateful for the opportunity I had last summer and I want to thank Steve Ricker and the entire Westmoreland staff for the incredible opportunity they have given me.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** David Sonnenfeld

**Authors:** Alexis Richter

**Title:** Broome County Health Department Internship Experience

**Abstract:** I had the opportunity to intern with the Broome County Health Department (BCHP) in the city of Binghamton, New York. I primarily interned with The Environmental Health Services Division. This division carries out different programs that provide not only information but also the necessary enforcement of state and local health laws, codes and standards that apply to various facilities and homes throughout the county.

I shadowed the head of the Lead Poisoning Primary Prevention Program, Barbara West, who oversees this program. This program aims to end lead poisoning and to create lead free housing throughout Broome County. The staff goes to many homes throughout the county to identify lead hazards in these homes and provides residents resources and enforcement to correct the hazards in a lead safe way.

Another program that I was able to work with was the Healthy Neighborhoods Program. The HNP provides free home safety surveys along with free supplies with product demonstrations for residents that will prevent or reduce any environmental health or safety issues. For each survey we went to residents' homes and completed a visual inspection of the unit. I went through a checklist with the resident of each health safety issue that the program addresses and related it to their home.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Dr. Andrea Parker

**Authors:** Rojek, A. Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** The Fight for Health and Justice: An Internship with the Clean Air Coalition of Western New York

**Abstract:** The Clean Air Coalition is a non-profit organization that seeks to mobilize community residents against various environmental and social impacts across Western New York. Over the summer of 2015 I logged over 240 hours with the organization and worked directly on five campaigns. I created a Good Neighbor Agreement between residents and a facility looking to build on a Brownfield site. I helped educate residents about the upcoming Peace Bridge expansion and how it will affect their health. I organized a community event and aided with the

decision-making process of where Participatory Budgeting money should go to in the City of Buffalo. I canvassed local neighborhoods and helped register 60 new voters in Erie County. I also assisted with the creation of a conference for the coalition for a Just Transition. All of these campaigns, combined with the work that I did in the local office allowed me to explore just how useful my future degree in Environmental Studies can be in the real world. As a result I finally realized the career path that I wanted to seek from my major; working, and ultimately leading a non-profit organization.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Jack Manno

**Authors:** Bethani McCarthy. Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Beaver Lake Nature Center Internship

**Abstract:** Over the summer of 2015 I did an internship at Beaver Lake Nature Center which is located in Baldwinsville, New York. During my internship I got to work with two of my passions, nature and children. At the center I served as a naturalist and trail-guide and helped to design and lead various children's programs. I lead school tours, gave educational talks, helped with the center's summer camp, and lead workshops and other fun and educational activities. Not only was I able to work in and around nature, I was also able to work with and communicate to people of all ages and help them learn about the natural world. My experience at Beaver Lake was not only fun and educational but also very meaningful to me because I was able to follow in my Grandparent's footsteps. They have been volunteer naturalists at the center since I was young and are a big reason why I developed a passion for the environment. My internship was extremely rewarding. I now have the knowledge and experience to communicate with people of all ages and help them learn in a fun way. I also now have experience designing environmental programs and activities and implementing them at an educational level. This internship was a great stepping stone to my future career.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Dr. Andrea Parker

**Authors:** Bhattacharya, Shomita. Department of Environmental Studies, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Concepts and Principles of Sustainable Development: An Overview

**Abstract:** My poster is an overview of "EST 626: Concepts and Principles of Sustainable Development", which I took as an Advanced Course work for my Environment Studies Senior Synthesis. It briefly highlights the basic concepts and topics learned and discussed in the class. The poster focuses on the two major projects assigned for the class: making a profile interviewing a professional working/have previously worked in the field of Sustainable Development and formulating a policy to achieve the goal of Sustainable Development through increasing human well-being and reducing environmental throughput. For the profile, I interviewed my father, who is back in India, and has always worked in the field of Sustainable Development. My policy was focused on minimizing plastic going to landfills and incineration plants generated specifically from packaging waste. The poster displays the results and learning from the profile that I created, and the propositions made for the policy being suggested.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Dr. Jack P. Manno

**Authors:** Joellen Lampman- Cornell Cooperative Extension

Quinton Hasak- Doubleday Field Groundskeeper

**Title:** Cornell Cooperative Extension Internship in Partnership with Doubleday Field

**Abstract:** I have been focusing on the no-pesticide agreement Cooperstown's Doubleday Field has adopted as a senior synthesis project. This is the 1st major league field to refrain from pesticide use, so it's important to communicate the pros and cons of this no-pesticide pest management approach. I am in the process of designing a website and generating signage/displays for the field in order to communicate to visitors as well as other fields/municipalities looking for information on this topic.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Andrea Parker

**Authors:** Bailey, Mike; Kaplan, Isabella; Kroll, Edward; Jaramillo, Diana; Walsh, Brian affiliated with EST 427/627 Environmental and Energy Auditing, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Utilizing Building Energy Models to Analyze their Accuracy and Determine Variables that Impact Building Energy Consumption

**Abstract:** Buildings are responsible for half of the world's greenhouse gas production. To be a sustainable campus, SUNY-ESF needs to improve its building's energy use. Building energy modeling is a tool that can be used to analyze a building's energy use and run different scenarios to identify opportunities for energy conservation. We developed six simplistic energy models of ESF's academic buildings using Autodesk Formit 360. By evaluating the different models through sensitivity analysis, we noted the range of predicted energy use of each building and the specific variables that had the greatest impact on each building's energy consumption. We then compared empirical data of building energy consumption, provided by ESF Sustainability Office, to the model data to see if the models accurately predicted the energy consumption of the current campus buildings. Without the complete architectural blueprints of the buildings, the results of this study showed our models did not accurately reflect the area, nor the electricity and heating energy consumption of the building each was modeled after. Despite this, the simplistic models still provided valuable information about which variables had the greatest impact on predicted energy use and how to inform a detailed modeling process. Overall, this study is important as it illustrates how simplistic models can be used to identify specific variables that impact energy consumption, raise awareness of building sciences, provide predictions on building behaviors and pave a path for more detailed models. This will allow for more precise building initiatives that will increase ESF's sustainability.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Justin Heavey

**Authors:** Jillian Buono. Baltimore Woods Nature Center, Marcellus, New York.

**Title:** Evaluating the Effects of Nature in the City on 5th grade Students' Scientific Knowledge and Opinions in the Syracuse City School District

**Abstract:** Baltimore Woods Nature Center's Nature in the City school programs provides K-6 students in the Syracuse City School District with hands-on learning experiences that connect them with their environment. To improve the quality of the NITC program, as well as assess changes in 5th grade students' scientific knowledge and opinions, assessments were conducted in all participatory schools. Assessments were given before and after NITC programs in each 5th grade classroom. Pre- and post-assessments scores were calculated for each student, and these scores were used to compute statistics for individual schools and the overall district. Paired t-tests were run at a 95% level of confidence ( $\alpha = 0.05$ ). Following data analysis it was found that the overall district showed a significant increase from pre- to post-scores (percent change of 46.32%). 10 out of the 12 schools in this report showed an individual significant increase. Results from Delaware and Porter implicate there is room for improvement in the program. Responses to opinion questions were initially positive (> 40% answered "yes" or "I already do"), this did increase by a small margin (1-3%) from pre- to post-scores. The overall findings of this report implicate that the Nature in the City program is effective at increasing participants' scientific knowledge and influencing students' environmental opinions. This positive change in opinions about the environment and the significant increase of scientific knowledge, will equip students with the tools they will need to make environmentally conscious decisions and act in its favor.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Valerie Luzadis / Richard Beal

**Authors:** Erika Mincarelli, Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY, 13210

**Title:** Water Policy, International Collaboration, and Development in Jordan

**Abstract:** The country of Jordan lives in a state of extreme water scarcity, receiving about 170 m<sup>3</sup> per capita per year (Abdulla & Al-Sareef, 2009). Jordanians have managed and conserved their water resources since the 1980s, however a recent influx of Syrian refugees has increased the water supply demands to accommodate an additional 600,000 people (Tapped Out, 2014). On average, Jordanians have been able to live off 80 L/d of water but now receive below 30 L/d due to rapid population increases, further exasperated by refugees who are unaccustomed to habits of water conservation (Tapped Out, 2014). This has increased the resentment by Jordanians for both Syrian refugees, and Palestinian refugees who fled to Baqa in the 2000s (Tapped Out, 2014). The 1994 peace treaty between Jordan and Israel, which specifically recognized that water resources were insufficient (Mohsen, 2007), was thought to be the beginning of many peacemaking opportunities. On the contrary, the repeated influx of refugees has transformed water policy in the region, thwarting development and increasing political tensions. There have been efforts to stabilize the country's water resources so that both Jordanians and refugees have an adequate amount of potable water, through privatization and general reallocation, methods which will no longer suffice. International collaboration is needed now more than ever to improve relations, promote development, and resolve water conflict around the Jordan Rift Valley.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Sharon Moran

**Authors:** Tessa A. Janicke Department of Environmental Studies SUNY ESF Syracuse, NY

**Title:** A Summer of Environmental Education, Nature Appreciation, and Stewardship at NYS DEC Camp Colby

**Abstract:** For my Environmental Studies Senior Synthesis Project, I chose to do an internship. I completed my internship during the summer of 2015. I worked at the NYS DEC Camp Colby in Saranac Lake 24 hours a day, 6 days a week, for 7 weeks. I worked as an environmental educator, camp counselor, and trip leader. For my internship paper and poster, I will be focusing on my job as an environmental educator.

As an environmental educator I taught groups of 12 children ranging from ages 11 to 13. I taught ecology lessons, outdoor skills, and human impacts. The goal of my internship was to inspire interest in the environment, and to provide the information and tools to be a steward of the natural environment.

My job as environmental educator and counselor was to create a safe, fun, and educational learning environment in an outdoor camp setting. The base of all lessons was the acronym EDCICAC. This acronym stands for energy flow, cycle, diversity, community, interactions, change adaptation, and caring. These basic concepts were included in every lesson. From my experience at Camp Colby I learned a lot about environmental and outdoor education. I hope to continue with my goal of inspiring stewardship in young children in the future.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** David Sonnenfeld

**Authors:** Grace Frenzel

**Title:** Superfund's Failure to the Onondaga Nation

**Abstract:** The relationship between Indigenous people and the Euro-American descendants of those who colonized their land is fraught with complications, and despite the "melting pot" that is modern day America, there is a clear divide between the Indigenous and non-Indigenous communities, physically, culturally, politically. In my paper, I examine the discrepancies between the Superfund cleanup of Onondaga Lake in Syracuse, NY, with the vision for the cleanup by the Onondaga Nation. Since 1970, the City of Syracuse and State of New York have attempted to repair the damage done by companies like Honeywell and Clark Concrete Company to this once sacred space for the Onondaga Nation. Through CERCLA (Comprehensive Environmental Response, Compensation and Liability Act of 1980), the cleanup was given federal aid and the responsible parties were sued for the costs to do so. However, to the Onondaga Nation, for whom the lake and its tributaries are the lifeblood of their historical territory, their version of the cleanup was lacking. The failure of the DEC and Federal Government to adequately address the concerns of the Onondaga Nation in regards to the cleanup of this highly polluted area is a reflection on the wider relationships between the US Government and the sovereign tribes in North America. If we examine Onondaga Lake's botched cleanup through the lens of Native and Non-native relations, it shows that a radical change is needed for Environmental Policy in order to effectively protect and aid Native Americans and their land.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** David Sonnenfeld



**Authors:** Emily Badway

**Title:** Scientific Cafés: A Creative Project (Fall 2016)

**Abstract:** This poster describes a creative project that will be completed in the Fall 2016 semester, and focuses on Scientific Cafés as a method of public engagement. These cafés represent an informal method of engaging a conversational dialogue between a presenter scientists and the public in that might not happen otherwise. Held at a local café or bar, the informality of location removes the intimidation factors that an academic setting might foster in the public's view. This project will ask the question, "what makes scientific cafés effective as a method of public engagement," and will be supported by public engagement theoretical frameworks. Survey feedback from both the public and scientists will inform this research question further. As the details of who, what topics, where, and when are still being sorted, this poster serves as a sort of proposal for what is to come.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Andrea Feldpausch-Parker

**Authors:** Diana Jagde

**Title:** The Young Naturalist Program

**Abstract:** The Young Naturalist Program was an educational experience created during the summer of 2015 for students entering grades 5 through 8. Working in collaboration with the Izaak Walton League, and the Manlius Library, local teacher Don Gates and his assistant field coordinator Diana Jagde (me!) led an exploration of the local ecology of Manlius, New York.

This program extended over a 6-week period with 1 hour long sessions once a week. Funding was provided through an IWLA Creek Freaks \$400 grant. The grant money provided the program with a comfortable budget to acquire the materials needed.

I had a range of responsibilities in this internship, including writing out lesson plans, creating the class materials, and leading different segments of the program. Together Don and I would brainstorm ideas as to what topics and activities we would present to the students and how these topics would better connect them to their community and the environment.

In the future we hope to expand this program and have it run through a network of libraries. There will soon be an established lesson plan that will have activities, suggestions, and step by step processes. It is planned to make this program something easy to understand and adapt to different locations - that way your average individual can become an "expert" on the topic. The Young Naturalist Program is a fun and impactful opportunity to teach kids about water, its importance to us and the environment, and a little something about their community.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Andrea Parker

**Authors:** Savannah Betkowski

**Title:** A New Way of Thinking, Communicating, and Understanding Materials

**Abstract:** A synthesis credit was completed through a professional internship at SUNY-ESF's Office of Energy and Sustainability. The majority of this internship focused on how to better understand how ESF's campus facilitated materials management through campus initiatives and programs, policies, and outreach. This internship focused on ESF's campus boundaries but extended to incorporate the Syracuse community. This internship linked together a variety of

tasks that involved materials management, public outreach in various forms, and participating in events that promoted sustainability across the ESF campus and the Syracuse community. Each situation was complex and allowed for critical development in my comprehension and communication skills. I learned to be ever adapting to the situations I find myself within.

**Level of Research:** Undergraduate **Department:** ES **Faculty Advisor:** Mark Lichtenstein

**Authors:** Morley M.S.1., Wild A.D.2., Yanai R.D.3. Departments of 1,Environmental Forest Biology and 3,Forest and Natural Resources Management, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210 2,Department of Animal and

**Title:** Snapchat for Science: Comparing Leaf Retention on Nitrogen- and Phosphorus-Fertilized Birch and Maple Trees

**Abstract:** The scientific community has the potential to exploit the use of hand-held internet devices to improve data collection, for example, capturing images to quantify whether nutrient additions change the timing of leaf fall in autumn. There are plots in the White Mountains of New Hampshire which have received nitrogen, phosphorous, and nitrogen-phosphorous treatments since 2011. On October 24th and 25th, 2015, photos were taken of four randomly selected maple (*Acer rubrum* and *Acer saccharum*) and four birch (*Betula papyrifera* and *Betula alleghaniensis*) trees in each of the four treatment plots from five stands using the social media app, Snapchat. Thirteen impartial observers were asked to rank the photos by the extent of leaf loss. The average ranking for each tree was used to test the effects of treatment on leaf loss using a randomized complete-block analysis of variance. Birch trees had lost more leaves in the nitrogen-treated plots, while they retained more leaves in the control and phosphorus-treated plots. For maple, there was no significant difference in leaf retention across the treatments. Results from this study demonstrate that the popular social media app, Snapchat, is a practical tool for scientific research as it allows photos to be labeled immediately after capturing the image.

**Level of Research:** Undergraduate **Department:** FNRM **Faculty Advisor:** Ruth D Yanai

**Authors:** Morris, Alden, Landscape Architecture Department, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

**Title:** Elevating Erie International Design Competition

**Abstract:** The Erie Canal, a once prosperous entrepot for New York, now remains as a strip-mall centered boulevard. Vehicle centered and disconnected from the community there is large potential for restructuring the space to better accommodate current economic and societal needs. This poster looks to revitalize the boulevard into a multi-modal greenspace to connect communities, grow business/industry and alleviate environmental degradation. The boulevard is broken into seven sections, each one having a distinct area of focus dependent on what is needed most in the area yet still connecting the boulevard as a whole.

**Level of Research:** Undergraduate **Department:** LA **Faculty Advisor:** Margaret Bryant

