



**Ecology and Sustainable Solutions**

**PROGRAM &  
ABSTRACTS**

2014 Annual Conference  
Mid-Atlantic Chapter  
Ecological Society of America  
March 28<sup>th</sup> – 31<sup>st</sup>, 2014

Hosted by University of Maryland  
College Park, MD



UNIVERSITY OF  
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## Major Sponsors

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2014 Annual Conference  
Mid-Atlantic Chapter  
Ecological Society of America  
April 28th – 31st, 2014

Hosted by University of Maryland  
College Park, MD 20742

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## 2014 MA-ESA General Meeting Schedule – Special Events

<b>Friday March 28th</b>	
6:00 PM	<b>Tour of the University of Maryland Golf Course</b> University Boulevard and Stadium Drive
7:00 PM	<b>Drinks and Appetizers</b>  Mulligans Bar and Grill at the Clubhouse
LATE	
<b>Saturday March 29th</b>	
6:00 PM	<b>Banquet and Student Presentation Awards</b>  Atrium, STAMP Student Union  Keynote Address: Al Todd
6:15 PM	
6:30 PM	
6:45 PM	
7:00 PM	
7:15 PM	
7:30 PM	
7:45 PM	
8:00 PM	<b>MA-ESA Saturday Night Event: Food and Drink through Fermentation</b>  Hosted by the Yeast Culture Club. Plant Science Building, enter by Reagents Dr.
8:15 PM	
8:30 PM	
8:45 PM	
9:00 PM	
LATE	
<b>Sunday March 30th</b>	
8:00 AM	<b>Field trip</b>  Smithsonian Environmental Research Center at Edgewater, MD  Vans depart College Park at 8:00 AM and are expected to return by 1:00 PM
9:00 AM	
10:00 AM	
11:00 AM	
12:00 PM	
1:00 PM	

**The schedule for the main meeting events is on the next page.**

## 2014 MA-ESA General Meeting Schedule – Meetings

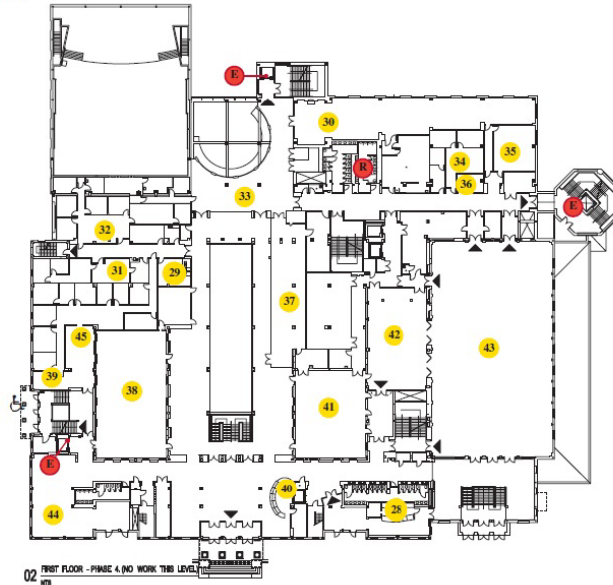
Saturday March 29th									
	Atrium	Margaret Brent A	Margaret Brent B	Pyon Su	Thurgood Marshall				
8:30 AM	Registration & breakfast in the Prince George's Room								
8:45 AM									
9:00 AM									
9:15 AM									
9:30 AM	Opening Remarks								
9:45 AM	Keynote Talk: David Inouye								
10:00 AM									
10:15 AM									
10:30 AM		Morning Break in the Prince George's Room							
10:45 AM									
11:00 AM	Keynote Talk: Ann Bartuska								
11:15 AM									
11:30 AM									
11:45 AM									
12:00 PM	Lunch buffet outside the Atrium								
12:15 PM									
12:30 PM						MAESA business meeting (Calvert Room)	Science writing workshop for students		
12:45 PM									
1:00 PM									
1:15 PM									
1:30 PM		Oral Session 1A: <i>Water; interface of terrestrial and aquatic environments</i>	Oral Session 1B: <i>Urban ecology</i>	Oral Session 1C: <i>Evolution, population and community ecology</i>	Oral Session 1D: <i>Invasions and regeneration</i>				
1:45 PM									
2:00 PM									
2:15 PM									
2:30 PM	Afternoon Break in the Prince George's Room								
2:45 PM									
3:00 PM						Oral Session 2A: <i>Water; interface of terrestrial and aquatic environments</i>	Oral Session 2B: <i>Urban ecology</i>	Oral Session 2C: <i>Evolution, population and community ecology</i>	Oral Session 1D: <i>Invasions and regeneration</i>
3:15 PM									
3:30 PM									
3:45 PM	Poster Session in the Prince George's Room								
4:00 PM									
4:15 PM									
4:30 PM									
4:45 PM									
5:00 PM									
5:15 PM									
5:30 PM									

# Maps of Meeting Rooms

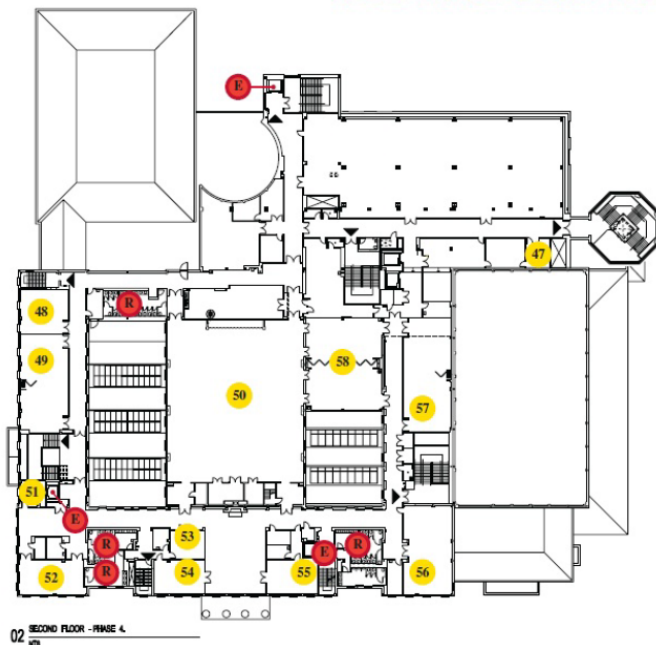
## First Floor

- 28 – Coffee Bar (1203)
- 29 – Multicultural Involvement & Community Advocacy (1120)
- 30 – Adele’s (1240)
- 31 – Graduate Student Suite (1121)
- 32 – Event Services/Marketing
- 33 – North Court (1482)
- 34 – Undergraduate/Graduate Legal Aid (1235)
- 35 – Nanticoke Room (1238)
- 36 – Marketing Asst. (1236)
- 37 – Stamp Gallery (1220)
- 38 – Atrium (1107)
- 39 – Off Campus Housing (1110)
- 40 – Information Desk (1201)
- 41 – Prince George’s Room (1210)
- 42 – Grand Ballroom Lounge (1209)
- 43 – Grand Ballroom (1206)
- 44 – Reading Room (1105)
- 45 – Office of Fraternity & Sorority Life (1110)
- R – Restrooms
- E – Elevator

## FIRST FLOOR



## SECOND FLOOR



## Second Floor

- 47 – Technology Services - IT Help/  
Audio Visual Services (2220)
- 48 – Thurgood Marshall Room (2113)
- 49 – Margaret Brent Room (2112)
- 50 – Colony Ballroom (2203)
- 51 – Harriet Tubman (2110)
- 52 – Pyon Su Room (2108)
- 53 – Edgar Allen Poe Room
- 54 – Calvert Room
- 55 – Crossland Room
- 56 – Juan Ramon Jimenez Room
- 57 – Benjamin Banneker Room
- 58 – Charles Carroll Room
- R – Restrooms
- E – Elevator

## Keynote Titles and Speaker Biographies

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### David Inouye

*The effects of global and regional climate change on phenology of wildflowers and animals in the Colorado Rocky Mountains*

*Saturday, March 29<sup>th</sup> 9:45-10:45 AM*

David Inouye is a Professor in the Department of Biology, where he has taught since 1976. Each summer he migrates to the Rocky Mountain Biological Laboratory, where he will spend his 44th summer this year, continuing long-term studies of the phenology and abundance of wildflowers and plant demography initiated in 1973. He has served as an NSF program officer, is on editorial boards, the advisory boards of the USA National Phenology Network and North American Pollinator Campaign, and is President-elect of the Ecological Society of America

### Ann Bartuska

*Saturday, March 29<sup>th</sup> 11:00 AM-Noon*

Dr. Ann M. Bartuska is Deputy Under Secretary for USDA's Research, Education, and Economics (REE) mission area. She came to REE in September, 2010 from the USDA Forest Service, where she was Deputy Chief for Research & Development, a position she had held since January 2004. She served as Acting USDA Deputy Undersecretary for Natural Resources and Environment from January - October of 2009, and was the Executive Director of the Invasive Species Initiative in the Nature Conservancy. Prior to this, she was the Director of the Forest and Rangelands staff in the Forest Service in Washington, DC.

Bartuska is an ecosystem ecologist with degrees from Wilkes College (B.S.), Ohio University (M.S.) and West Virginia University (Ph.D.). She represents USDA on the Committee on Environment, Natural Resources and Sustainability of the White House National Science and Technology Council and also is co-chair of the Science and Technology for Sustainability Roundtable of the National Academies. Bartuska is currently on the Multi-disciplinary Expert Panel (MEP) of the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES), chartered by UNEP, and is active in the Ecological Society of America, serving as Vice-President for Public Affairs from 1996-1999 and as president from 2002-2003. She has served on the Board of the Council of Science Society Presidents and is a member of AAAS (American Association for the Advancement of Science) and SACNAS (Society for the Advancement of Chicanos and Native Americans in Science).

### Al Todd, Alliance for the Chesapeake Bay

*Saturday, March 29<sup>th</sup> 6:00 -7:30 PM*

## Oral Presentation Concurrent Session 1

<b>Time</b>	<b>Session 1A: Water; interface of terrestrial and aquatic environments (Margaret Brent A)</b>	<b>Session 1B: Urban ecology (Margaret Brent B)</b>	<b>Session 1C: Evolution, population and community ecology (Pyon Su)</b>	<b>Session 1D: Invasions and regeneration (Thurgood Marshall)</b>
1:30 PM	<i>Spatiotemporal variability in thermal sensitivity of streams in sub-basins of the Roanoke (VA-NC)</i> Amy Villamagna, Dept of Fish and Wildlife Conservation, Virginia Tech	<i>Tree canopy-cover growth projection in redeveloped urban residential lots in Falls Church, Virginia</i> David Chojnacky, Virginia Tech	<i>Density effects on common milkweed (Asclepias syriaca) growth, herbivory and pollination</i> Abigail Kula, College of William and Mary	<i>The influence of historical land use on the woody communities of an eastern deciduous forest</i> Daniel Breen, Towson University
1:45 PM	<i>Do roads impact populations of freshwater turtles?</i> Alexandra Doran, Elizabethtown College	<i>Ecological restoration of urban forest patches: A "possibility-based" approach.</i> Lea Johnson, Bates College	<i>Gone with the wind: effects of a tornado blowdown and subsequent forest management on the small mammals.</i> Steve Sheffield, Bowie State University	<i>Impacts of Celastrus-primed soil on common native and invasive woodland species.</i> Stacey Leicht, Young, Arnold Arboretum of Harvard University
2:00 PM	<i>Effects of liming on fish and food webs of headwater streams of south-central Pennsylvania.</i> Natasha Wingerter, Shippensburg University	<i>Responding to "Counting the books while the library burns" - saving parks &amp; gardens from deer damage.</i> Eugene Meyer, Natural History Soc. MD	<i>Effects of inbreeding and herbivory on foliar volatile production in Mimulus guttatus.</i> Ariela Haber, University of Virginia	<i>Asian earthworm invasion: The stable isotope perspective</i> Chih-Han Chang, Department of Earth and Planetary Sciences, Johns Hopkins University
2:15 PM	<i>Shrub expansion into coastal grasslands: Seed dispersal patterns of Morella, the dominant shrub on Atlantic coastal barrier islands of North America</i> Benjamin Dows, Virginia Commonwealth University	<i>Effect of Soil Rehabilitation in Arlington Va. Streetscapes on Stormwater Mitigation Potential</i> David Mitchell, Virginia Tech	<i>How do young gopher tortoises parallel adaptation assimilation and predator avoidance?</i> Thomas Radzio, Drexel University	<i>The impact of exotic shrub invasion on the trophic structure of a deciduous forest litter community</i> Gerald Woodworth, University of Virginia



## Oral Presentation Concurrent Session 2

Time	<b>Session 2A: Water; interface of terrestrial and aquatic environments (Margaret Brent A)</b>	<b>Session 2B: Urban ecology (Margaret Brent B)</b>	<b>Session 2C: Evolution, population and community ecology (Pyon Su)</b>	<b>Session 2D: Invasions and regeneration (Thurgood Marshall)</b>
3:00 PM	<i>Escaping enemies – but also mutualists – during range expansion of <i>Avicennia germinans</i></i> Mayda Nathan, University of Maryland	<i>Wind as ecological factor in behavior of white-tailed deer: tool for sustainable management?</i> Michael Rodgers, Bryn Athyn College	<i>Evidence for parallel adaptation to climate across the natural range of <i>Arabidopsis thaliana</i></i> Frank Stearns, University of Maryland, College Park	<i>Geographic variation in the skin microbiome of <i>Plethodon salamanders</i> and its antifungal members</i> Carly Muletz, University of Maryland
3:15 PM	<i>Carbon dynamics in urban watersheds of the Chesapeake Bay</i> Rose Smith, University of Maryland	<i>Communicating Complexity in Transdisciplinary Science Teams for Policy: Applied Stasis Theory</i> Marybeth Shea, University of Maryland, College Park	<i>Effects of larval environment on metamorphic phenotype and performance: Disentangling emergent and nonlinear processes</i> Julie Charbonnier, Virginia Commonwealth University	<i>A possible ecological role of polyphenol oxidase in roots of <i>Bromus</i>, an invasive plant genus</i> Kimberly Plank, Rutgers University – Newark
3:30 PM		<i>Suburbanization affects bird populations along the Roanoke River in Roanoke County, Virginia.</i> Lauren Strong, Roanoke College	<i>Detecting Community Scale Impacts of Vegetation to Explosives Soil Contamination</i> Stephen Via, Virginia Commonwealth University	<i>A ReSurvey of Invasive Species In Historic St. Mary's.</i> Zarrin Thompson, St. Mary's College of Maryland
3:45 PM			<i>Soil and microbial proteins change during hundreds and thousands of years of pedogenesis</i> Jinyoung Moon, Virginia Tech	

## Poster Titles

	<b>Title</b>	<b>First Author</b>	<b>Affiliation</b>
1	Carbon sequestration potential of Lake Burullus, Egypt, a vast Mediterranean wetland complex	Amr Keshta	University of Maryland
2	Conewago Creek Assessment: Determining the state of impairment in an agricultural watershed	Thomas Murray	Elizabethtown College
3	Daily trajectories of white tailed deer suggest separate continuities of day and night foraging path	Eugene Potapov	Bryn Athyn College
4	Effects of urban land use change and human activities on soil carbon stocks and fluxes	Yujuan Chen	Virginia Tech
5	Evolution of herbicide resistance	Wendy Peer	University of Maryland
6	Spatial and temporal variation in acorn tolerance of insect damage in oaks of the Central hardwoods	Matthew Suchocks	Wilkes University
7	The impact of native flowers on beneficial insect predators in an agricultural setting	Tom Marino	Hood College
8	Adjacent land cover as an indicator of amphibian richness in Frederick County wetlands	Evelyn Michael	Hood College
9	Measuring insect biodiversity in an established pollinator habitat meadow	Michael Lavarn	Hood College
10	Native wildflower effects on insect-mediated pollination of soybeans	Lisa Kuder	Hood College
11	The Ecological Research as Education Network: Collaborative ecological research that advances science and engages students	Jeffrey Simmons	Mount St. Mary's University
12	Nutrient contribution of the seagrass <i>Halophila hawaiiiana</i> to associated invertebrates	Matthew Speilman	University of Maryland
13	Developing a system of national climate assessment indicators to track climate change impacts	Richard Pouyat	U.S. Forest Service
14	Recruitment of experimental garlic mustard and Japanese stilt-grass populations in metro forests	Janet Morrison	The College of New Jersey
15	Can supplemental phenylalanine increase the level of protection from UV-B radiation in soybean?	Alison Post	University of Maryland

16	Photomorphogenic responses of two <i>Populus</i> clones to supplemental UV-B radiation	Laura Templeton-Brandt	University of Maryland
17	Evaluating the sustainability and natural subsidy of the oyster aquaculture industry in Maryland	Tim Williamson	University of Maryland
18	Severe weather and tree mortality in a mixed hardwood forest of the New Jersey Highlands	Brian Wlodawski	Ramapo College of New Jersey
19	Assay for Education: Exploring urban soils' function and microbial composition	Dietrich Epp Schmidt	Universtiy of Maryland
20	Alternative simulation of soil phosphorus in the Chesapeake Bay Watershed Model	Alisha Mulkey	University of Maryland
21	Analysis of the microbial controls on nitrogen movements and transformation in agricultural soil	Holly Bowen	University of Maryland
22	Competitive ability and potential invasion mechanisms of <i>Oplismenus undulatifolius</i>	Cody Kepner	Towson University
23	Compost makes the garden grow? The effect of <i>Eisenia fetida</i> on the growth of chives and oregano	Tereasha Santos	Roanoke College
24	Deer as seed dispersal agents in forests of differing vertical structure	Christine Burns	Dickinson College
25	Eastern hemlock ( <i>Tsuga canadensis</i> ) health across habitat gradients in the presence of woolly adelgid	Lauren Adrion	Ramapo College of New Jersey
26	Ecosystem service benefits from public and private conservation lands	Lisa Scott	Virginia Tech
27	Effect of salinity on microbial communities in freshwater wetlands	Ashley Robey	University of Maryland
28	Emergence Patterns and Distribution of Overwintering Wood Frogs ( <i>Rana sylvatica</i> )	Jilena Yeager	The Richard Stockton College of New Jersey
29	Evaluating the effects of specific attributes of suburbanization on bird community composition at six locations along the Roanoke River	Thomas Mack Granger	Roanoke College
30	Factors affecting the distribution of the Hemlock Woolly Adelgid	Jill Hautaniemi	Dickinson College
31	Hydrus modeling of soil water movement and urban tree root depth under resin-bound gravel pavement	Francisco Javier de la Mota	Virginia Tech
32	Patterns of forest recovery in deer exclosures following overbrowsing and stiltgrass expansion	Laura Hart	Dickinson College
33	Population matrix model for <i>Castanea dentata</i> and the Implications for Re-introduction	Elise Elwood	College of William and Mary

34	Project Wavyleaf: A citizen science mapping initiative	Daniel Bolton	Towson University
35	Seasonal movements and habitat preferences in populations of painted turtles and spotted turtles	Daniel Gillespie	Shippensburg University
36	Seed bank-vegetation composition relationships in restored and natural wetlands	Liza McFarland	University of Maryland
37	Seed Dispersal of <i>Oplismenus undulatifolius</i>	Gregory Lande	Towson University
38	Seed Production, Biomass and Germination of <i>Oplismenus undulatifolius</i>	Artura Garcia II	Towson University
39	Small compounds targeting <i>Arabidopsis</i> RACK1A protein regulate diverse environmental stress resistance	Joanna Akinlosotu	Howard University
40	Soil microbial metabolism of carbon and nitrogen in urban and rural forests	Elizabeth Kulka	University of Maryland
41	The consequences of diversity on ecosystem stability: Testing Elton in microcosms	Stephanie Clements	Roanoke College
42	Water quality improvements in Lake Placida following installation of a new dam	Brandon Costik	Elizabethtown College
43	Plant chemical defenses: Allelopathy in the plumeless thistle	Kristina Borst	St. Mary's College of Maryland
44	Solitary turbines and bats: Preliminary results from a case study in Lewes, Delaware	Kimmi Swift	Delaware State University
45	The effect of forest composition and caddisfly larvae on vernal pond communities	Katie Seymore	Shippensburg University
46	Population genetic diversity and ecological invasion	Megan Wyles	The College of New Jersey
47	Wetland restoration affects soil microbial community composition and functional capacity	Christine Prasse	University of Maryland
48	Searching for evidence of microbial oligotrophy using 16S RNA/DNA ratios	Glade Dlott	University of Maryland
49	The role of human legacies on the assembly of urban plant communities	Anna Johnson	UMBC
50	Fine-scale spatial variation in the impacts of mangrove top predators	Alexander Forde	University of Maryland
51	Native tree seedlings and over-abundant white-tailed deer in the metropolitan forest	Nicole Mallotides	The College of New Jersey
52	Variation in the abundance of a spring ephemeral wildflower in deer-ridden suburban forests	Shane Wilkins	The College of New Jersey
53	Earthworm species composition in pastures and forests: The role of functional diversity	Elsa Wieboldt	Roanoke College

54	Mass changes of six migratory passerine species during stopover at a small, isolated urban patch	Julián Rondón-Rivera	The State University of New Jersey
55	Effects of decreased freshwater input on east Louisiana marsh phenology	Yu Mo	University of Maryland
56	Stormwater runoff from a sloped greenroof located in the Mid-Atlantic region of North America	Scott Tjaden	University of Maryland

# Oral Abstracts

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## Oral Session 1: Water; interface of terrestrial and aquatic environments

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### 1. Spatiotemporal variability in thermal sensitivity of streams in sub-basins of the Roanoke (VA-NC)

Amy Villamagna, Dept of Fish and Wildlife Conservation, Virginia Tech

Paul Angermeier, U.S.G.S., Virginia Cooperative Fish and Wildlife Research Unit

C. Andrew Dolloff, Forest Watershed Science Aquatics Team Leader, USDA Forest Service Southern Research Station

Effects of climate change on stream ecosystems are a common concern among freshwater conservationists worldwide. The relationship between air and stream temperatures is thought to be affected by a suite of biophysical and geological factors; however, the relative influence of these factors on stream thermal sensitivity appears to differ widely across landscapes. Quantifying the thermal sensitivity of streams is the first step to (i) describing this complex relationship, (ii) recognizing factors that influence or buffer stream temperature, and (iii) identifying streams that are most (or least) vulnerable to climate change. Based on 3 years of continuous paired air and stream temperature data from first- and second-order streams in the Roanoke River (VA, USA; n=28) and Chattahoochee River (GA, USA; n=22) basins, we calculated and compared thermal sensitivity among sites within and across the summers of 2011, 2012, and 2013. We found significant intra- and inter-annual differences in thermal sensitivity and that Chattahoochee streams were less responsive to air temperature changes (mean annual sensitivity ~0.27-0.5) than Roanoke streams (0.6-0.76), despite greater air temperature variance. We derived potential explanatory variables from elevation, land cover, soil type, and precipitation data using GIS and ran linear regressions to evaluate the explanatory power of each. The best-fit models differed among years and basins and never explained more than 50% of the observed variation in thermal sensitivity. We discuss the results of our analysis in the context of comparable recent studies, explore the mechanistic and conservation questions that have emerged, and describe avenues for future analysis.

### 2. Do roads impact populations of freshwater turtles?

Alexandra Doran, Elizabethtown College

Stephen Smith, Elizabethtown College

David Bowne, Elizabethtown College

Roads clearly are a source of mortality for individual turtles. Whether this mortality is great enough to impact population structure is a question we seek to answer. We hypothesize that freshwater turtle populations in areas with high road density will have an increased ratio of males to females due to increased female mortality rate while making nesting movements. Turtle populations from ponds across the nation were studied in a collaborative effort of faculty and students organized through TurtlePop, a pilot project of the Ecological Research as Education Network (EREN). Faculty and students at each institution captured turtles, determined size, gender, and age, and then submitted the data to

Elizabethtown College. We used a geographic information system (GIS) to characterize the road density and distance to nearest road for each pond using spatial layers obtained from the National Wetland Inventory and state departments of transportation. We analyzed the relationship between roads and sex ratio for the most commonly found species, the painted turtle (*Chrysemys picta*). Preliminary findings suggest that neither road density nor proximity to roads impact sex ratios of painted turtles in the 17 ponds in which at least ten individuals were captured. Our finding is counter to several published reports of the relationship between roads and turtle populations. As TurtlePop is an ongoing project, we will continue to refine our analysis to more thoroughly understand road effects on turtles.

### **3. Effects of liming on fish and food webs of headwater streams of south-central Pennsylvania**

**Natasha Wingerter, Shippensburg University**

**Theo Light, Shippensburg University**

**Aryanna James, Shippensburg University**

**Jamie Salmon, Shippensburg University**

Stream liming is a common mitigation method used to correct the water chemistry in acidified streams. We studied six headwater streams on North and South Mountains, three naturally neutral, and three acidic. Each of the acidic streams was sampled upstream of a lime treatment site, 0.5 km downstream, and 2 km downstream. We sampled fish and invertebrates at each site and examined gut contents of brook trout. Stable isotopes of carbon and nitrogen were analyzed from invertebrates and trout to determine trophic relationships. Trout consumed mainly terrestrial insects in the summer; we expect to see more aquatic invertebrates in winter gut contents. Invertebrate abundance and diversity was greatest in both the naturally neutral and acidic reaches, and lower in the limed sites. Fish were most abundant and diverse in naturally neutral sites, and scarce to absent in all acidic stream sites. Although liming seems to improve pH, it does not restore a functioning ecosystem.

### **4. Shrub expansion into coastal grasslands: Seed dispersal patterns of *Morella*, the dominant shrub on Atlantic coastal barrier islands of North America**

**Benjamin L. Dows, Virginia Commonwealth University**

**Donald R. Young, Virginia Commonwealth University**

Expansion of woody plants into grasslands has been observed throughout North America including barrier islands of the Atlantic coast where species of *Morella*, a bird dispersed shrub, are dominant. Invasion, colonization, and establishment patterns are determined by initial patterns of seed dispersal. To better understand invasion mechanisms an ‘encroachment zone’ (the landscape where active *Morella* encroachment occurs) was identified on Hog Island, VA. Extent of seed dispersal throughout the encroachment zone and the proportion of seeds dispersed under different cover conditions were investigated by seeds traps ( $n = 82$ ) of screen mesh and wood frame, each  $0.21 \text{ m}^2$ . Seeds were collected monthly. Non-linear Least Squares Estimates (nl-LSEs) of the log-transformed density ( $\# \text{ seeds} / \text{m}^2$ ) were used to determine the dispersal curve of *Morella* propagules throughout the encroachment zone with respect to distance from thicket edge. A one-way ANOVA with Tukey HSD contrasts was used to analyze dispersal differences among cover types.

A total of 4667 seeds were collected. The nl-LSEs found that a negative exponential function best fit the distribution of seeds dispersed throughout the encroachment zone which indicates a leptokurtic (fat-tailed) dispersal distribution, a common characteristic of spreading populations. The ANOVA and Tukey HSD tests revealed differences in proportion of seeds dispersed among cover types. The majority of seeds were dispersed closest to fruiting *Morella*. Proportions of seeds dispersed under co-occurring shrub species suggests facilitative roles in functioning as perches for frugivorous birds that disperse seeds away from parent plants and into uncolonized portions of a landscape.

## **5. Are we reaching the vulnerable when we communicate flood risk?**

**V. Beth Kuser Olsen, University of Maryland**

**Bahram Momen, University of Maryland, College Park, Department of Environmental Science and Technology**

**Kaye L. Brubaker, University of Maryland, College Park, Department of Civil and Environmental Engineering and MWRRC**

**Gerald E. Galloway Jr., University of Maryland, College Park, Department of Civil and Environmental Engineering**

**Lewis (Ed) Link, University of Maryland, College Park, Department of Civil and Environmental**

During the past five years, loss of lives, property, and commerce due to flooding have surpassed all previous records. Flooding severity, intensity, and damage will most likely worsen due to climate change. Our best practical tool in reducing losses is to communicate flood risk and preparedness effectively to those at risk. The US Federal Emergency Management Agency (FEMA) dedicates a substantial amount of time and resources to reaching vulnerable communities via town hall meetings. However, an important consideration is whether or not the demographics of the meeting participants represent the populations at risk. We statistically compared demographics from FEMA Region III population data (U.S. Census Bureau-USCB) and data sampled from 10 randomly selected FEMA-endorsed flood risk management meetings and found that the meeting participants were older, English-only speakers, better educated, from higher incomes, and more likely to own a home than USCB data indicate for the general population.

## **6. Escaping enemies – but also mutualists – during range expansion of *Avicennia germinans***

**Mayda Nathan, University of Maryland**

**Daniel Gruner, University of Maryland**

Species undergoing range expansion face the prospects of both enemy release and spatial mismatch with mutualists. Whether this trade-off influences the rate or occurrence of range expansion is largely unknown. We tested for evidence for this trade-off in the black mangrove, *Avicennia germinans*, which is currently expanding its range northward in Florida. In particular, we examined the interactions between *A. germinans* and its pollinators and florivores – interactions that directly impact *A. germinans*' reproduction and ability to colonize new sites. During the 2013 flowering season, we monitored rates of floral



visitation by insects and the frequency of florivory at six sites spread throughout the eastern Florida *A. germinans* distribution. We also conducted pollen limitation experiments at two sites – one central to the eastern Florida distribution, and one at the distribution’s northern edge – to detect differences in pollinator effectiveness between sites. Floral visitation rates decreased with proximity to the range edge, and while pollen limitation was evident at both sites, it was more pronounced at the northern site. In contrast, trees farther from the range edge had higher proportions of their floral buds damaged by herbivores, and total flower number per tree increased toward the range edge. Taken together, these results confirm decreased encounters with both pollinators and florivores as *A. germinans* spreads northward, and point to the importance of considering both mutualisms and antagonisms in predictions of species distributions.

## **7. Carbon dynamics in urban watersheds of the Chesapeake Bay**

**Rose Smith, University of Maryland**

**Sujay S. Kaushal, University of Maryland**

Carbon cycling in rivers and streams constitutes a globally significant flux from terrestrial ecosystems. Urbanization affects the quantity and form of carbon transported from watersheds, with implications both for water quality and greenhouse gas emissions on regional and global scales. For instance, urban land cover contributes novel sources of organic and inorganic carbon, and influences principal physical drivers of C export such as flow and temperature. The objectives of this study are to 1) determine the annual carbon (organic inorganic) load from four urban watersheds of the Chesapeake Bay, 2) evaluate the relative abundance of gaseous (CO<sub>2</sub>) and dissolved carbon export from these streams, and 3) determine the role of stream metabolism on carbon export, assessing the sensitivity of metabolic processes to a variety of biophysical drivers. Two years of bi-weekly DOC and DIC samples have been collected at four USGS gaging stations with continuous flow and water quality (pH, temperature, dissolved oxygen, turbidity, and conductance) sensors. Mean DOC and DIC concentrations vary from 2.6- 4.9mg/L and 8.2-16.8mg/L across the four sites, and both are significantly (P<0.05) correlated with daily discharge at all sites. Study watersheds drain urban/suburban land cover. We use the USGS-developed LOADEST (Runkel et al. 1998) for hydrologic carbon export, CO<sub>2</sub>SYN (Lewis and Wallace, 1998) for inorganic carbon partitioning and the Baysean Metabolic Model (Holtgrieve et al. 2010) to estimate ecosystem metabolism and gas exchange. This study provides insights into the controls on carbon export and the potential for and greenhouse gas emissions from urban-impacted streams.

## **Oral Session 2: Urban ecology**

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### **1. Tree canopy-cover growth projection in redeveloped urban residential lots in Falls**

**Church, Virginia**

**David Chojnacky, Virginia Tech**

**Laura Y. Johnson, Virginia Tech, Department of Forest Resources and Conservation**

**John A. McGee, Virginia Tech, Department of Forest Resources and Conservation**

Each residential redevelopment in the City of Falls Church, Virginia, is required to retain or plant enough trees for 20% canopy cover within 10 years. The City Arborist has two years during site redevelopment to influence tree cover on these private lands through redevelopment plans. However, implementation guidelines provide little information about how long it takes for various tree arrangements to reach 20% cover. We are studying 20 residential lots (more pending continued funding) that were initially developed at least 60 years ago but redeveloped within the last 15 years, generally with larger replacement houses. Trees were inventoried prior to redevelopment in the redevelopment plans; these provide initial measurements. Both trees “saved” from construction and new trees planted are available for growth assessment, but determining exact planting dates (needed for growth period) is problematic for some lots. We are modeling tree canopy growth in two steps from a periodic tree diameter (dbh) growth model linked to a dbh-to-tree crown diameter model. GIS techniques are then used to calculate non-overlapping canopy cover within each lot from tree crown diameter measurements and/or model predictions; aggregation of tree canopy polygons using the GIS “dissolve” function eliminates overlap. Through assessment of canopy growth on these sampled lots, we are developing a projection tool for canopy growth at future redevelopment sites under various preservation and planting scenarios. Our results will give urban forest managers better knowledge of how redevelopment plan practices impact the tree canopy and potentially improve urban forest management of residential redevelopment.

## **2. Ecological restoration of urban forest patches: A “possibility-based” approach**

**Lea Johnson, Bates College**

**Steven N. Handel, Rutgers University**

Highly altered conditions may preclude attainment of reference conditions that are often used to judge the success of ecological restoration. Urban areas cover an increasingly large portion of the Earth’s surface and are now home to more than half of humanity. Ecological restoration can provide critical environmental benefits, and restoration of urban forests is becoming a common method for addressing a suite of urban environmental problems. To evaluate the urban applicability of models for restoration used in less degraded sites, we examined long-term effects of ecological restoration in urban forest remnants in five large New York City parks 15-20 years after invasive woody species (*Celastrus orbiculatus*, *Ampelopsis brevipedunculata*, and *Rosa multiflora*) were removed and a diversity of native trees were planted. We compared plant community composition and structure in forests that were restored with forests that were similarly invaded but not restored over the same time period.

We found that restored forests differed significantly in their composition and structure from forests that were not restored. Structural complexity and native tree regeneration were greater in restored sites. Degree of management effort was important to these differences, and biophysical factors, especially soil conditions, were key to community composition. Successional trajectories of these restored forests were redirected, but their location in urban environment guarantees a future of human-caused disturbance. Our findings suggest that in the urban environment, long-term management and legacies of past disturbance are both key to predicting restoration outcomes. Site history (particularly soil legacies) and the resources available for long-term management must be considered when setting pragmatic goals for urban restoration."

### **3. Responding to “Counting the books while the library burns” - saving parks & gardens from deer damage**

**Eugene Meyer, Natural History Soc. MD**

The challenge in Lindenmayer's article is to specify trigger points with actions in conservation programs. For suburban parks that have failed regeneration of oaks, etc., I propose adding trigger points: current information from park neighbors about deer damage to plantings – gardens as sentinels – and forest conditions, to the FLIR images often used by sharpshooting programs. A question: who has experience collating conservation information from citizens who expect information to lead to results? Action: recent proposals for briefer, more frequent hunts fit deer movements, and would dovetail with the proposed sentinel garden concept. Action flexibility: good news is that for designated places in Maryland, hunting laws provide much flexibility which I describe. In addition, laws regulating human predation on deer are in flux because of widespread recognition by the public of deer-vehicle collisions, deer destruction of gardens, woods, etc. Two accounts of prior advocacy are essential reading. Warren's "Hunter's Game" notes how prior hunting laws had winners and losers. Frye's "Deer Wars" describes resistance to changing laws from top-down advocacy even when lead by an outstanding wildlife biologist rather than hunters. Many Mid-Atlantic hunters effectiveness is weather-limited and confined to a few weekends. Listening to them, and using analogies with our own fields, ecologists can easily understand when resistance arises to changing regulations. Listening, we can develop common plans to save habitats in specific places, and eventually enjoy seeing deer. Opportunity: ecological damage is remarkably broad in trophic cascade, so specialists in many aspects of ecology can contribute to understanding recovery.

### **4. Effect of soil rehabilitation in Arlington VA. streetscapes on storm water mitigation potential**

**David Mitchell, Virginia Tech**

**Susan D. Day, Virginia Tech Departments of Forest Resources and Environmental Conservation; Horticulture**

**Vincent Verweij, Arlington County Department of Parks and Recreation, Natural Resources Division, Arlington, Virginia**

Soil profile rebuilding (SPR) is a soil improvement technique that uses deep incorporation of compost to reduce soil compaction, increase tree growth and accelerate soil carbon accumulation. Because of its potential effect on soil structure, SPR may be valuable as a storm water mitigation best management practice. The technique is intended for use in locations of extreme soil disturbance or compaction such as near new building construction, in road medians and urban roadside plantings. The treatment has been evaluated in plot experiments in Blacksburg, Virginia, where the soil surface was kept bare via herbicide in order to isolate the effect of SPR on soil carbon stores. In these experiments, hydraulic conductivity was lowest at the soil surface, likely due to the lack of typical landscape surface treatments, such as turfgrass or mulch. We installed SPR in new sidewalk cutouts in October 2012 in Arlington, Virginia for evaluation in an urban environment, with typical mulch and turfgrass groundcovers. We hypothesize that both surface and subsoil of the treated plots will have lower bulk density, higher hydraulic conductivity, greater soil aggregate stability, more soil organic carbon, and more moderated temperatures than control plots. We will present preliminary results and consider implications for storm water management in urban streetscapes.

**5. Wind as ecological factor in behavior of white-tailed deer: tool for sustainable management?**

**Michael Rodgers, Bryn Athyn College**

**Fredrik Bryntesson, Bryn Athyn College**

**Sherri Cooper, Bryn Athyn College**

**Eugene Potapov, Bryn Athyn College**

Wind either can help or hinder hunting efforts in sustainable management of deer populations. However, to date there was no scientific study on the effects of wind on the movement of the free-roaming white-tailed deer (*Odocoileus virginianus*). A total of 32 white-tailed deer were monitored using high density radio-tracking (5 min between fixes) in a suburban land area north of Philadelphia that covers the Pennypack Ecological Restoration Trust (PERT) preserve. Geographical coordinates of deer were merged with weather parameters from a nearby weather station. The slope, aspect, elevation and habitat type of the deer GPS fixes were analyzed with respect to wind speed and wind direction. All tracked deer were highly selective for slope at the various wind speed gradations analyzed. Both aspect and elevation appeared to show no selectivity by the deer when analyzing for wind speeds only. The animals were more randomly distributed along aspect gradients at higher wind speeds. Circular regression analysis of wind direction versus aspect of patch selected by deer reveals that the deer routinely select patches with aspect either leeward or tangential to wind direction. The results provide a foundation for predictive models, which can be used in sustainable management of the deer.

**6. Communicating Complexity in Transdisciplinary Science Teams for Policy: Applied Stasis Theory**

**Marybeth Shea, University of Maryland, College Park**

**Cameron Mozafari, University of Maryland, College Park**

This paper presents an application of stasis theory for the purpose of consulting with interdisciplinary teams of scientists working in the early stages of composing a science policy advisory document. By showing that stasis theory can be used as an organizing conceptual tool, we demonstrate how cooperative and organized question-asking practices calm complex interdisciplinary scientific disputations in order to propel productive science policy work. We believe that the conceptual structure of stasis theory motivates scientists to shift their viewpoints from solitary expert specialists toward that of allied policy guides for their advisory document's reader. We further argue that, through the use of stasis theory, technical writers can aid interdisciplinary scientists in policy writing processes, thus fostering transdisciplinary collaboration.

**7. Suburbanization affects bird populations along the Roanoke River in Roanoke County, Virginia**

**Lauren Strong, Roanoke College**

**Rachel Collins, Roanoke College**

Suburbanization reduces and alters bird habitats to a point where bird diversity in cities is much lower than rural areas. The effects of suburbanization on bird communities likely changes throughout the year due to seasonal changes in occurrence, behavior, and habitat requirements of birds. Therefore, the use of refuge habitats likely changes throughout a year. Riparian habitats, bisecting suburban landscapes, are important refuge habitats for birds. I examined how bird communities changed in riparian refuge habitats across a suburbanized gradient during summer and winter months. I predicted that (1) diversity and evenness would increase with decreased suburbanization and (2) species composition would shift from being dominated by synanthropic birds to being dominated by forest interior specialists with decreasing suburbanization. Overall, species richness did not differ across the suburbanization gradient but, Simpson's Diversity Index did increase with decreasing suburbanization. The invasive European Starling dominated species composition in highly developed sites all year long. Species composition, in less suburbanized sites, had higher evenness containing more forest specialists such as the wintering Golden-crowned Kinglet. Conservation of riparian contiguous forests nearby urban areas can be essential for maintaining populations of habitat sensitive species.

### **Oral Session 3: Evolution, population and community ecology**

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#### **1. Density effects on common milkweed (*Asclepias syriaca*) growth, herbivory and pollination.**

**Abigail A. R. Kula, College of William and Mary**

**Harmony J. Dalglish, College of William and Mary**

Habitat loss and fragmentation are major threats to populations worldwide. Although rare plants may be under direct threat due to habitat destruction, species experiencing low density or increased rarity may be at higher risk to changes in density compared to species that are rare naturally. Plant population density affects individual plant performance due to lower resource availability because of intraspecific competition and additionally through altered outcomes of plant–insect interactions due to changes in resource availability or insect behavior. It is critical to examine the interplay of these factors across a range of densities to explore the potential for nonlinear effects of density on plant–insect interactions. Milkweeds (*Asclepias* spp.) provide an exceptional study system to investigate the joint effects of plant–insect interactions and density on population dynamics because milkweed interactions with herbivores and pollinators are well-studied, and they show declining abundance in agricultural settings. At seven field sites, we located *S. syriaca* populations at a range of densities and marked and mapped plants in 1m wide transects. Across the transects, milkweed density ranged from 1 to 4.5 stems per square meter. Overall, we found a negative relationship between plant density and proportion of leaves damaged by herbivores—plants in higher density transects had lower herbivory. This research provides a basis for understanding the importance of insects on plant growth and reproduction in the context of changing plant population densities and will provide a critical foundation for linking individual plant-level performance to population effects.

## **2. Gone with the wind: effects of a tornado blowdown and subsequent forest management on the small mammals**

**Steve Sheffield, Bowie State University**

**Carlos A. Ludica, Susquehanna University**

**John W. Wenzel, Powdermill Nature Reserve, Carnegie Museum of Natural History**

Tornados are common natural weather phenomena that have been shown to highly influence ecosystem structure and function. In eastern deciduous forests, tornados often cause a substantial amount of physical damage, which greatly decreases the spatial heterogeneity of the forest. A tornado struck the area of Ligonier, PA on 1 June 2012, creating a path of severe canopy damage about 8 miles long and affecting about 90 acres of forest. Following the tornado, experimental forest management for each blowdown area was initiated which included salvage logging, no salvage logging, and control (unaffected forest). In Nov 2013, we established a small mammal live-trapping grid across both forest treatments and control forest, with trapping occurring seasonally (4X/year). Initial trapping of 120 trap-nights yielded 41 total individuals (34.2% trap success). The forest small mammal assemblage is composed mainly of *Peromyscus leucopus*, *Clethrionomys gapperi*, and *Blarina brevicauda*. All species were trapped both in open areas as well as forested cover areas. Overall, 34% of small mammals were trapped in non-salvaged areas, 29% in salvaged areas, and 37% in control areas. The number of mammals trapped in open areas was slightly higher in the no salvage logging areas where coarse woody debris covered the ground. Although these mammals all strongly prefer forested habitat, the added complexity of the ground cover seems to make the non-salvaged blowdown area a favored habitat.

## **3. Effects of inbreeding and herbivory on foliar volatile production in *Mimulus guttatus***

**Ariela Haber, University of Virginia**

**Consuelo De Moraes, Pennsylvania State University**

**Mark Mescher, Pennsylvania State University**

**David E. Carr, Blandy Experimental Farm, University of Virginia**

The volatile compounds emitted by plant foliage serve as key host-location cues for foraging and ovipositing insects. Herbivory can induce changes in volatile phenotype that are known to play an important role in plant defense. Induced volatile compounds can repel herbivores by indicating reduced host plant quality due to prior herbivory, or they can function as an indirect plant defense by attracting herbivore enemies. Since inbreeding increases homozygosity, it increases expression of deleterious recessive alleles that could disrupt biosynthesis of volatile compounds. *Mimulus guttatus* is a mixed-mating herb for which inbreeding is known to reduce resistance to herbivory. However, the mechanisms underlying these effects remain largely unexplored. In this study we collected foliar volatile samples from inbred and outbred *M. guttatus*. Plants were paired by maternal family so that one served as a control and the other was damaged by *Helicoverpa zea* larvae to elicit an induced response. Volatile samples were then eluted and quantified using gas chromatography. Two of the 52 emitted compounds showed significant induction in outbred, but not inbred plants. One of these compounds accounted for 13% of the average constitutive volatile mass but 29% of the average induced volatile mass, suggesting a huge potential for this compound to function as a defensive signal. Future work will investigate the role of these compounds in resistance of *M. guttatus* to its specialist herbivore *Junonia coenia*. These results will

have broader implications for the evolution and ecology of plant-herbivore interactions and the evolution of plant mating systems.

#### **4. How do young gopher tortoises parallel adaptation assimilation and predator avoidance?**

**Thomas A. Radzio, Drexel University**

**Michael P. O'Connor, Drexel University**

Many reptiles bask to raise their body temperatures and increase energy assimilation. Ho parallel wever, basking can expose individuals to increased predation risk, which may lead juveniles of some species to exhibit an energetic strategy that includes limited basking. We are investigating how hatchlings and juveniles of the gopher tortoise (*Gopherus polyphemus*), a burrowing reptile of the southeastern United States, behaviorally balance energy assimilation and predation risk in different environments. Little is known of the behavior of young gopher tortoises in part due to their tendency to flee into burrows when approached. Using video and miniature temperature recorders, we determined that hatchling and juvenile tortoises from Georgia spend great amounts of time basking and engage in extensive behavioral thermoregulation by frequently shuttling between relatively cool burrows and warm surface microhabitats. In simulated predator approaches, hatchlings and juveniles retreated into burrows long (often 30 seconds) before the arrival of a walking researcher, indicating that tortoises uses non-visual cues to identify potential predators. Tortoises emerged soon following disturbance, particularly when burrows were cool, suggesting that individuals adjust hiding times in response to physiological costs of refuge use. To illustrate these behaviors, we will present video clips of tortoise interactions with real and simulated predators. The ability of young tortoises to sense potential predators at long distances may be key to enabling hatchling and juveniles to exhibit an energetic strategy that includes extensive, albeit secretive, basking activity.

#### **5. Evidence for parallel adaptation to climate across the natural range of *Arabidopsis thaliana***

**Frank Stearns, University of Maryland, College Park**

**Charles B Fenster, Department of Biology University of Maryland, College Park**

How organisms adapt to different climate habitats is a key question in evolutionary ecology and biological conservation. Species distributions are often determined by climate suitability. Consequently, the anthropogenic impact on earth's climate is of key concern to conservation efforts because of our relatively poor understanding of the ability of populations to track and evolve to climate change. Here we investigate the ability of *Arabidopsis thaliana* to occupy climate space by quantifying the extent to which different climate regimes are accessible to different *Arabidopsis thaliana* genotypes using publicly available data from a large scale genotyping project and from a worldwide climate database. The genetic distance calculated from 149 single nucleotide polymorphisms among 60 lineages of *Arabidopsis thaliana* was compared to the corresponding climate distance among collection localities calculated from nine different climatic factors. *Arabidopsis thaliana* was found to be highly labile when adapting to novel climate space, suggesting that populations may experience few constraints when adapting to changing climates. Our results also provide evidence of a parallel or convergent evolution on the molecular level supporting recent generalizations regarding the genetics of adaptation.

## **6. Effects of larval environment on metamorphic phenotype and performance:**

### **Disentangling emergent and nonlinear processes**

**Julie Charbonnier, Virginia Commonwealth University**

**James Vonesh, Virginia Commonwealth University**

**Ivan Gomez Mestre, Estación Biológica de Doñana, CSIC**

For organisms with complex life cycles, plastic responses to environmental variation in early life stages may have consequences for performance in subsequent life stages. In aquatic systems, variation in intra-specific density dependence and hydroperiod can affect larval duration and post-metamorphic performance. The relationships between density and metamorphic phenotype are frequently nonlinear. We investigate the interactive effects of hydroperiod and larval density dependence on metamorphic phenotype and post-metamorphic performance in the Western Spadefoot toad (*Pelobates cultripes*) in Donana National Park, Spain. We conducted a factorial experiment in outdoor mesocosms in which we manipulated hydroperiod and five levels of larval density. We quantify the functional relationship between larval stage density dependence on larval duration, metamorph size, fat stores, limb morphology and locomotor performance and test whether this functional form changes under different hydroperiod regimes. Relationships between larval density and most metamorphic endpoints were nonlinear and variation in hydroperiod altered this relationship in simple predictable ways. Metamorph mass, snout-vent and limb length decreased asymptotically with increasing density and frogs from drydown treatments were smaller and had shorter limbs than those from control treatments. Time to metamorphosis increased asymptotically with increasing density with frogs from drydown treatments emerging earlier. Interestingly, fat stores and jumping performance only depended on hydroperiod, with frogs from drydown treatments characterized by reduced fat stores and jumping performance. We demonstrate that the functional relationship between density and phenotype is consistent across hydroperiod environments. Rather than modulating the dynamics between density and phenotype, hydroperiod shifts the relationship within the parameter space.

## **7. Detecting community scale impacts of vegetation to explosives soil contamination**

**Stephen Via, Virginia Commonwealth University**

**Julie C. Zinnert, Virginia Commonwealth University**

**Donald R. Young, Virginia Commonwealth University**

Soils contaminated with explosive compounds are a persistent global problem. The two most common explosive compounds in the environment are 1,3,5-Trinitroperhydro-1,3,5-triazine (RDX) and 2,4,6-Trinitrotoluene (TNT). Both compounds inhibit seed germination, seedling establishment, and overall adult plant growth and function. As such, age based impacts have the potential to alter plant community composition. Our goal was to evaluate woody and herbaceous plant species community composition on plots contaminated with various explosives. Species composition was determined in areas of known RDX, TNT, and Composition B (a mixture of RDX and TNT) contamination. Plots outside of the contamination areas were included as references. Species diversity and richness were calculated and nonmetric multidimensional scaling (NMS) ordination was used to determine community shifts. This



NMS was followed by a Monte Carlo test to ensure stability. Field measurements were coordinated with airborne hyperspectral imagery flights. Diversity metrics in contaminated areas were different from reference areas and greater differences were observed in the herbaceous community. NMS ordination revealed a separation between reference and contaminant plots and the Monte Carlo test ensured the reliability of the NMS findings. Differences were also observed via the hyperspectral data; plant stress metrics differentiated areas of contamination from the reference areas. Such community shifts as seen here can have long lasting ecological impacts and could potentially remain long after the contaminant has left the system.

## **8. Soil and microbial proteins change during hundreds and thousands of years of pedogenesis**

**Jinyoung Moon, Virginia Tech**

**Mark A. Williams, Department of Horticulture, Virginia Polytechnic and State University**

Amides, peptides, and proteins have been shown to compose a large fraction of soil organic matter and tend to accumulate during pedogenesis (soil development). This is counter to the traditional view that peptides and proteins are quickly decomposed and mineralized by heterotrophic microorganisms. This change in conceptual view represents they are a large pool of biogeochemically important C and N, and further study is thus needed to determine whether amide-type molecules tend to accumulate in soil and have long residence times. Furthermore, we are interested in determining if the types of proteins change and if these changes are related to biotic or abiotic factors associated with pedogenesis. Despite their abundance and functional importance, it is not known neither if there are patterns of change, nor whether the source and fate of amino acids are determined by soil properties. The objective was to determine the pattern of hydrolyzable amino acids -monomers of peptides and protein- in mineral soils undergoing development from 100-4000 years. A chronosequence at Wilderness State Park, Lake Michigan was studied for this objective. Amino acid composition changed as a result of pedogenesis, showing four major shifts, and overall supporting the hypothesis that these shifts are associated with pedogenesis. All basic amino acids had a clear pattern, accumulating ranged from 34% to 135% during 4000 years of soil development. Gly, Asp, and Ala were positively correlated with pH, but negatively correlated with development stage of soil.

## **Oral Session 4: Invasions and regeneration**

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### **1. The influence of historical land use on the woody communities of an eastern deciduous forest**

**Daniel B. Breen, Towson University**

**Vanessa B. Beauchamp, Towson University**

Historical land use can strongly influence forest succession, and sites with a longer forested history tend to exhibit greater species richness and fewer invasive plant species than regrowth forests with a more persistent agricultural legacy. The Middle Patuxent Environmental Area (MPEA) comprises a 413 ha secondary successional forest in Howard County, Maryland. Previously cleared and utilized for agriculture beginning in the eighteenth century, it has since become reforested at staggered rates after

varying land-use practices. I surveyed 99 long-term monitoring plots at the MPEA in 2012 with the purpose of grouping the MPEA into logical vegetation communities dominated by similar species, thus providing insight into succession and the influence of historical land use on present-day vegetation. Trees and shrubs were each classified into five communities through a hard noise clustering analysis using the R package *vegclust*, and an indicator species analysis identified the species most associated with each group. Non-metric multidimensional scaling was also conducted to identify each community's most correlated environmental and historical characteristics. The tree communities were all defined by native species associated with different successional stages that corresponded to their dates of agricultural abandonment, while the shrub communities displayed some greater variation and dominance of invasive species. My results are being compiled into recommendations for management of the MPEA's natural resources, including invasive species control and restoration.

## **2. Impacts of *Celastrus*-primed soil on common native and invasive woodland species.**

**Stacey A. Leicht-Young, Arnold Arboretum of Harvard University**

**Sarah T. Bois, The Linda Loring Nature Foundation, Nantucket, MA**

**John A. Silander, Jr., University of Connecticut, Storrs, CT**

Invasive plant species have been shown to alter soil environments resulting in changes in soil chemistry, biota, and nutrient cycling. Few studies have focused on how soil changes affect co-occurring native species or plants of different life forms. This study focused on the soil effects of the liana, *Celastrus orbiculatus* (oriental bittersweet), a prominent invader of eastern North America, using two different approaches. In a litter-addition experiment, addition of *C. orbiculatus* leaf litter to uninvaded soils in the field resulted in an increase in soil nutrients, pH, and nitrogen mineralization. In a complimentary common garden pot experiment, a suite of common, ecologically similar, native and invasive lianas and shrubs were grown in soils primed with *C. orbiculatus*. The invaded soil was compared to uninvaded field and potting control soils. The change in soil attributes was not significantly different when grown with native or invasive plants, however, soils grown with lianas showed a much greater decrease in nutrients than those grown with shrubs. Although soils from locations with *C. orbiculatus* were higher in nutrients than uninvaded soils, plant growth, as measured in root:shoot, root and stem biomass, relative growth rate of volume, and final biomass were not different in invaded and uninvaded soils for either lianas or shrubs. However, lianas had similar growth patterns in nutrient-sparse potting soil, while shrubs growing in potting soil had lower growth. Thus, negative impacts of invaded soils on plant growth are not universal, and may not be manifest in the absence of competition for resources.

## **3. Asian earthworm invasion: The stable isotope perspective**

**Chih-Han Chang, Department of Earth and Planetary Sciences, Johns Hopkins University**

**Katalin Szlavecz, Department of Earth and Planetary Sciences, Johns Hopkins University**

**Michael Bernard, Department of Earth and Planetary Sciences, Johns Hopkins University**

**Tim Filley, Earth and Atmospheric Sciences, Purdue University**

**Scott Pitz, Department of Earth and Planetary Sciences, Johns Hopkins University**

In North America, invasive European earthworms have been shown to redistribute nutrients in different pools in the soil and accelerate flux rates among the pools. In recent years, a group of Asian invasive earthworms, *Amyntas*, has been widely reported invading forests already inhabited by European species in the Mid-Atlantic region, causing a “second wave of invasion” where the soil ecosystem, already modified by European species, is going through another transition. The objective of this study is to understand how the invading Asian species affect the European and native earthworms through interspecific interaction by conducting a lab mesocosm experiment using  $^{13}\text{C}$  and  $^{15}\text{N}$  double-enriched leaf litter. Our results showed that the stable isotope signature of the North American native species *Eisenoides lonnbergi* is not affected by any of the European or Asian earthworms, suggesting that the native species occupies its own unique stable isotope niche, which may contribute to its survival and success in the field under the pressure of invasive earthworms. When the Asian *Amyntas hilgendorfi* is present, the European earthworms *Octolasion lacteum* and *Lumbricus rubellus* became more depleted in  $^{13}\text{C}$  and  $^{15}\text{N}$  (by 3.0‰ and 2.3‰ for  $^{13}\text{C}$  and 15.8‰ and 10.0‰ for  $^{15}\text{N}$ , respectively), while the Asian earthworm became more enriched when the European species are present. This provides strong evidence that *A. hilgendorfi* is a superior competitor for leaf litter and its invasion could lead to diet shift in the two European species through competition.

#### **4. The impact of exotic shrub invasion on the trophic structure of a deciduous forest litter community**

**Gerald Woodworth, University of Virginia**

**David E. Carr, University of Virginia, Blandy Experimental Farm**

Biological invasions may impact the multi-trophic interactions of ecosystems. Exotic species invading deciduous forest can change litter inputs, impacting detrital food-webs. Microbial decomposer communities may differ between exotic and native leaves due to differences in physical and biochemical properties. Effects on this foundational trophic level could then cascade through the food-web. This study investigated the effects of the invasive plants *Lonicera maackii*, *Rhamnus davurica*, and *Ailanthus altissima* on the litter-dwelling communities of a hardwood forest in Virginia. We placed sets of litter bags containing native, invasive, or mixed leaves in each habitat. After four months, bags were retrieved at 10-day intervals. Microbial and fungal abundance samples were taken from each bag and the remaining litter was placed in Berlese-Tullgren funnels. We calculated arthropod abundance, richness, and diversity for habitat and litter, and identified organisms to the lowest taxon to categorize trophic function. We found more bacteria in each invasive litter, and more fungi in *Lonicera* litter than in native. Native habitat had more arthropods than *Lonicera*. Diversity excluding ants was greater in both native habitat and litter than *Rhamnus*. Native habitat had greater richness of five trophic groups (predators, detritivores, herbivores, fungivores, and omnivores) than *Ailanthus* and *Lonicera*, and native litter had greater abundance of these groups than *Lonicera* and *Rhamnus*. However, within native habitat, these trophic groups were more abundant in *Ailanthus* and *Lonicera* litter than native. These results show that by altering the nutrient base exotic plant invasions can impact the multi-trophic interactions in a forest ecosystem.

## 5. Geographic variation in the skin microbiome of *Plethodon* salamanders and its antifungal members

Carly Muletz, University of Maryland

Karen R. Lips, University of Maryland

Plant and animal associated microbial communities can be predictive of disease. Yet, we know little about what processes generate and maintain the structure of host associated microbial communities. Our objectives were 1) to characterize the entire skin bacterial community on three host species to understand how the host's evolutionary history and environment influences bacterial community structure, and 2) to identify culturable skin bacteria from these hosts that inhibit the growth of a fungal pathogen to determine the distribution of bacteria that may offer protection against fungal infection. We focused on *Plethodon* salamanders as they may be protected from a cutaneous fungal pathogen, *Batrachochytrium dendrobatidis* (Bd; implicated in worldwide amphibian decline) due to their protective skin bacteria. We sampled three *Plethodon* species (total n = 110) along latitudinal and elevational gradients in three protected areas in Maryland and Virginia. Preliminarily, we found that (i) salamanders at one protected area, Shenandoah NP, had significantly more bacterial species overall as well as more functionally important anti-Bd bacterial species than at the two other protected areas sampled (Catoctin MP and Mt. Roger's NRA), (ii) within each protected area there was no differences in bacterial diversity among salamander species or populations at different elevations and, (iii) anti-Bd bacterial members were dominant members of the entire bacterial community. These results suggest a relationship between high microbial diversity and more protective bacterial species, regional variation in microbial composition, no influence of host species or fine-scale elevation variation on bacterial diversity, and potential selection for antimicrobial bacterial species.

## 6. A possible ecological role of polyphenol oxidase in roots of *Bromus*, an invasive plant genus

Kimberly Plank, Rutgers University, Newark

David Kafkewitz, Rutgers University, Department of Biological Sciences

Claus Holzapel, Rutgers University, Department of Biological Sciences

One of the principal questions in plant community ecology is what enables species to be invasive. The novel weapons hypothesis states that some plant species produce phytotoxic allelochemicals unknown to the invaded environment, thus allowing successful establishment. Phenolics are notoriously allelopathic chemicals, entering the environment through leachate or litter. In phenolic conformation, allelochemical compounds can serve as substrates for the enzyme polyphenol oxidase (PPO), which roots of the grass genus *Bromus* exude in high amounts in comparison to other grass genera. As seedlings of the highly invasive genus *Bromus* possess high levels of PPO, I hypothesized PPO is used as a defense against allelopathic plants; non-PPO plants were predicted to be suppressed by allelopathic plants. Greenhouse competition results supported the hypothesis as PPO-plants responded to phenolic-allelopathic *Centaurea stoebe* by producing greater biomass than controls and both PPO/non-PPO grasses were suppressed by non-phenolic-allelopathic *Artemisia vulgaris*. When grown with decomposing litter of either *C. stoebe* or *A. vulgaris* both PPO/non-PPO-producers produced greater biomass, suggesting a net benefit from added carbon that possibly overwhelmed potential allelopathy. As predicted, leachate of *A. vulgaris* was

significantly allelopathic to both PPO/non-PPO-producers; PPO-producers tolerated *C. stoebe* leachate whereas non-PPO-producers were significantly suppressed. Field surveys indicate *Bromus tectorum* occurs further from *A. vulgaris* compared to other species. In summary, experiments and field surveys support the hypothesis that the unique presence of PPO in *Bromus* enables these grasses to cope with allelopathic competitors that use phenolics as weapons. PPO therefore might act as a novel defense in invaded ranges.

## **7. A resurvey of invasive species in historic St. Mary's**

**Zarrin Thompson, St. Mary's College of Maryland**

**Emily Raushert, St. Mary's College of Maryland**

Invasive plants are a cause of concern in many ecosystems because they can outcompete native plants for space and resources. Invasives are generally associated with human-mediated disturbance, and in the United States, some areas have been heavily impacted for a long time. St. Mary's City, Maryland is one of the earliest sites of European settlement in North America and consequently has a long legacy of human modification of the environment. One of the management goals of this area is to preserve the area as it appeared during the time of settlement. A survey of the invasive plants conducted in 2000 identified twelve common non-native species. To investigate whether this distribution was stable, we conducted a resurvey of this area and compared both which areas were becoming more invaded and which species were increasing in their distribution. The species investigated included *Clematis terniflora*, *Dioscorea batatas*, *Hedera helix*, *Lonicera japonica*, *Vinca minor*, *Phyllostachys aurea*, *Ligustrum sp.*, *Rosa multiflora*, *Ailanthus altissima*, *Broussonetia papyrifera*, *Melia azedarach*, *Morus alba*, *Microstegium vimineum*, and *Perilla frutescens*. Using the same subplots defined in the original survey, we surveyed transects around the perimeter, recording the presence and relative abundance of each study species. The most commonly found species was Japanese honeysuckle (*Lonicera japonica*), and English ivy (*Hedera helix*) had increased the most in its distribution. Additionally, it seemed that subplots in areas receiving more traffic gained the most invasives over this 13-year period. These results indicate that even areas with a long legacy of human impacts continue to gain new invasive species, and that new species arriving are encountering communities mainly composed of non-native species.

## Poster Abstracts

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### 1. **Carbon sequestration potential of Lake Burullus, Egypt, a vast Mediterranean wetland complex**

**Amr E. Keshta, University of Maryland**

**Ebrahim M. Eid, Botany Department, Faculty of Science, Kafr El-Sheikh University, Egypt**

**Kamal H. Shaltout, Botany Department, Faculty of Science, Tanta University, Egypt**

**Ahmed A. Sharaf El-Din, Botany Department, Faculty of Science, Tanta University, Egypt**

**Andrew H. Baldwin, University of Maryland, College Park**

Wetland protection and restoration measures can improve carbon sequestration potential, but little is known about carbon storage in the large coastal wetland lagoon complexes fringing the Nile River delta. The objective of the present study was to assess the distribution of soil organic carbon (SOC) in vegetated and unvegetated sites in the Burullus Mediterranean lagoon in Egypt to estimate SOC stock and carbon sequestration rate (CSR). Soil profile cores were collected in vegetated and unvegetated locations at 8 sites spanning the lagoon and analyzed for soil organic matter and bulk density. At vegetated sites, aboveground plant biomass was also determined. SOC content decreased significantly from 29.0 g C kg<sup>-1</sup> at depth 0-5 cm to 26.2 g C kg<sup>-1</sup> at 25-30 cm. SOC density significantly increased from 17.0 kg C m<sup>-3</sup> at 0-5 cm to 24.5 kg C m<sup>-3</sup> at 25-30 cm. The SOC stock ranged between 581.5 Gg C in the vegetated sites and 2310.4 Gg C in the unvegetated sites. The average CSR of the vegetated sites was slightly higher than that of the unvegetated sites (11.1 and 10.9 g C m<sup>-2</sup> y<sup>-1</sup>, respectively). Thus, we conclude that Lake Burullus is an important Mediterranean location for sequestration of atmospheric carbon.

### 2. **Conewago Creek Assessment: determining the state of impairment in an agricultural watershed**

**Lauren Breza, Elizabethtown College**

**Hannah Brubach, Elizabethtown College**

**Abigail Steele, Elizabethtown College**

**Thomas Murray, Elizabethtown College**

The Conewago Creek drains 53 square miles of residential, agricultural and forested landscapes from its headwaters near Mt. Gretna to its mouth at the Susquehanna River. In 1998, nearly 45 miles of the Conewago and its tributaries were listed on the Section 303(d) list of impaired waters. In 2008, the Conewago Creek Initiative was established to bring state, federal and local agencies together to improve the Conewago. At the same time, the USDA Natural Resources Conservation Service (NRCS) named the Conewago one of three showcase watersheds in the Chesapeake Bay watershed. Development of a Watershed Implementation Plan has led to completion of ten riparian buffer, stream bank fencing and stream stabilization projects to date. NRCS and local Conservation Districts have also worked with farmers to implement a wide variety of best management practices throughout the watershed. In this project, we sampled three locations along the main stem of the Conewago to assess whether the various restoration projects and best management practices were making a difference in the water quality of the Creek. The three sites were sampled following PA DEP's Instream Comprehensive Stream Evaluation Survey. Habitat assessment and pebble count data show the stream bed is still clogged in places with fine

sediments. Index of Biotic Integrity (IBI) scores for all three sites were low, and indicate that to date, the Creek remains impaired. Sampling will continue as the more restoration projects are installed.

### **3. Daily trajectories of white tailed deer suggest separate continuities of day and night foraging path**

**Eugene Potapov, Bryn Athyn College**

**Michael Rodgers, Bryn Athyn College**

**Frederik Bryntesson, Bryn Athyn College**

**Sherri Cooper, Bryn Athyn College**

We analyzed daily trajectories of 34 deer instrumented with GPS/GSM radio-collars which transmitted spatial and temporal data at high-frequency intervals (5 min) for the observation periods of 1 to 6 months. The trajectories were analyzed separately for daytime (from sunrise to sunset ) and nighttime (from sunset to sunrise). The results show that during each day or night period the deer stay at one or two ‘encamping’ areas where they rest (presumably laying on the ground) and make one or two loops of travel. The travel loops made by an individual throughout the observation period rarely coincided, and represented foraging trips. The encamped locations could be re-visited. The deer’s locations at the sunrise and sunset were usually close to one of the encamping areas, and were in the close proximity of each other. It appears that at the sunrise the deer prefer to be within a visual range from the previous sunset location, and at the sunset they prefer to be in the areas within the visual range of the previous sunrise point. This suggests that the deer maintain continuation of the landscape perception separately for night and day time. This leads to a conclusion that the animals maintain two continuous foraging paths: one for nights, another for days; each of the paths are constructed by Markovian perceptual Brownian bridges set up by the sensors used in particular conditions. The ways the trajectory analysis relates to sustainable management of the white-tailed deer and other animals are discussed.

### **4. Effects of urban land use change and human activities on soil carbon stocks and fluxes**

**Yujuan Chen, New Jersey State Forestry Services**

**Richard V. Pouyat, USDA Forest Service**

**Susan D. Day, Departments of Forest Resources and Environmental Conservation and Horticulture, Virginia Tech**

**Ian D. Yesilonis, USDA Forest Service**

Urbanization and human activities significantly affect the soil carbon (C) cycle and are closely tied to land use change. Although urban land occupies only about 3% of land globally, impacts may be significant at local and regional scales. How land use change and human habitation affect the soil C cycle is not fully understood making it difficult to develop local and regional policy. This study aims to assess net changes in C stocks and fluxes resulting from land use change and link these changes to specific management practices. We hypothesize that these net changes will vary by biome and initial C stocks of the remnant natural area. Land use history, city development patterns, and population density within each biome will influence the gain or loss of C stocks and fluxes to both land use change and management efforts.

Our study asks: (1) What is the net effect of urban land use change on soil C stocks and fluxes? (2) What is the overall effect of human habitation in terms of population per unit area and development pattern on urban C stocks and fluxes? (3) What are effective policy and management practices to either enhance C sequestration or mitigate emissions during and after land use change? Methods will include meta analysis of literature and of existing data and sensitivity analyses to assist decision making. A conceptual model and preliminary results will be presented.

## **5. Evolution of herbicide resistance**

**Wendy Peer, University of Maryland**

**Jemina Cornejo, University of Maryland**

**Esteban Triplett, University of Texas, Pan-American**

**Gezhegn Gute, University of Maryland**

Current efforts to “stack” herbicide resistance traits in genetically modified crops produced by agrosience/seed biotechnology companies is expected to increase resistance to multiple herbicide classes and the amount of herbicide load required to control weeds. *Amaranthus* spp. are the largest genera affecting food security and commodity crops in North America, with *Amaranthus palmeri* (Palmer’s amaranth) reducing soybean and maize/corn yields (17-68% and 11-91% respectively) and reducing lint and seed yield while increasing harvest time 2- to 3.5 times due to lodging in cotton. Individual *A. palmeri* biotypes have developed resistance to at least five classes of herbicides: enolpyruvyl shikimate-3-phosphate synthase (EPSP) (glyphosate), acetolactate synthase (sulfonylurea), mitosis (dinitroanilines) and photosystem II (triazine) inhibitors, as well as auxinic herbicides [dicamba, 2,4-dichlorophenoxyacetic acid (2,4-D)]. Why is *Amaranthus* so adaptable and fitness is maintained under herbicide selective pressure? With 26 species native to the lower 48 states, *Amaranthus* is thought to promiscuously hybridize, thus providing a rationale for trans-species transfer of herbicide-resistance traits. Glyphosate resistance in *A. palmeri* is linked to amplification of copy number and expression of the target gene, EPSP. The outstanding question is whether this mechanism underlies *A. palmeri* resistance to the other herbicides. *Amaranthus* is a good model weed to study herbicide resistance and gene flow as it is diploid, easily crossed, and is amenable to greenhouse growth.

## **6. Spatial and temporal variation in acorn tolerance of insect damage in oaks of the Central Hardwoods**

**Matthew Suchocks, Wilkes University**

**Patrick R Lello, Wilkes University**

**Michael Yuhas, Wilkes University**

**Shealyn Marino, Wilkes University**

**Michael A Steele, Wilkes University**

Plants generally employ two defensive strategies to reduce damage by herbivores: Tolerance, a compensatory strategy, and Resistance, a strategy that relies on specific physical and chemical adaptations to prevent herbivory. In the oaks, it is generally assumed that insect damage in both the leaves and fruit (acorns) is achieved through the resistance imparted by tannin concentrations. In past studies, however, we have found that in many acorn species, a combination of chemical gradients in



acorns direct damage of acorns away from the embryo, allowing in many instances for partially damaged seeds to still germinate and establish. Here we compare patterns of insect predation and partial seed consumption across a latitudinal gradient (NY to NC) over a three-year period. We also evaluate patterns of partial seed damage in two long-term data sets (20 and 14 years) to further determine the consistency of this pattern of seed damage. In all three data sets, weevils (*Curculio* spp.) were significantly more likely to occur in the basal half of the seeds. In other studies in which we simulated insect and rodent damage, we found considerable ability of acorns to tolerate damage by these predators and still germinate. We suggest that a number of characteristics of acorns (seed size, seed chemistry) synergistically promote partial damage and survival of acorns and therefore comprise an effective strategy of tolerance for withstanding the impact of seed predation.

**7. The impact of native flowers on beneficial insect predators in an agricultural setting**  
**Tom Marino, Hood College**  
**Jordan Roberts, Hood College**  
**April Boulton, Hood College**

Even though agricultural technologies have improved dramatically over the last few decades, there is growing interest in various agro-environmental schemes. One such method is planting wildflower borders along field margins—known to attract bees and other beneficial insects. The goal of this research was to examine how such native flowers can increase beneficial insects, especially predators. Using a combination of sticky traps, sweep nets, and field observations (via transect sampling), we collected specimens from July-August, 2013 in both experimental (flower border) and control (no flower border) fields on a soybean farm in Frederick County, Maryland. Our results indicate that insect predators were significantly more abundant and diverse in the experimental plot, which supports our initial hypothesis that native wildflowers would attract a variety of beneficial insects to the soybean rows.

**8. Adjacent land cover as an indicator of amphibian richness in Frederick County Wetlands**  
**Evelyn Michael, Hood College**  
**April M. Boulton, Hood College**

Amphibians are often used as environmental indicators because their populations are affected when undesirable conditions exist. Certain types of amphibians, like wood frogs, are very sensitive to pollutants and other environmental factors. Others, like the American toad, are more tolerant. Amphibian species richness at 10 wetland sites in Frederick County, Maryland was observed for 6 years. A 200-meter buffer of the adjacent land cover around wetland sites was manually digitized into five land cover categories using ArcMap™. The amount of land cover was compared to the amphibian species richness found at each wetland site from 2007-2012. Land cover within the 200-meter buffer was also digitized using the ArcMap™ Spatial Analyst extension. Five random coordinates within each of the 200-meter buffers were selected and visited to compare current land cover with manual and automatic digitization. We hypothesized that amphibian species richness would be higher in wetlands with adjacent natural land cover than at wetland sites with adjacent cover of impervious surface, agriculture, or lawn. Increased

surface water in the 200-meter buffer was also hypothesized to correlate with increased amphibian species richness. Our findings are discussed in the context of dominant land cover patterns in this region.

## **9. Measuring insect biodiversity in an established pollinator habitat meadow**

**Michael Lavarn, Hood College**

**Ronald Albaugh, Hood College**

**April Boulton, Hood College**

This study measured insect biodiversity in an established plot of native wildflowers planted adjacent to a soybean field in Frederick, MD to determine which flower species are attracting the greatest number of insect pollinators, in addition to the composition of such beneficial insects. From June to July 2013, a collection of all plant species growing in the plot was taken. Plants were collected, identified, pressed, and mounted as herbarium specimens. One or two individuals of each insect species were then collected from the flowers using a vacuum sampler and sweep net, which were then pinned and labeled for the voucher collection at Hood College. Insects were classified to order, family, genus, and in some cases, species. The flower species from which the insects were removed was also recorded. Observations were made two times a day at ten meter intervals along a 100 meter stretch of the wildflower plot. One individual of each flower species was observed at each location for a period of three minutes. The number of individuals within an insect order was recorded at the ten locations for each flower species. Eastern Daisy Fleabane was the dominant flower, followed by Wild Bergamot. Hymenoptera was the dominant insect order at this site, followed by Diptera and Hemiptera. The variety of native pollinators found on each of the wildflowers in this study suggests that native wildflower mixes alongside crop fields can enhance pollinator biodiversity.

## **10. Native wildflower effects on insect-mediated pollination of soybeans**

**Lisa Kuder, Hood College**

**April Boulton, Hood College**

In the last few decades monocultures have become highly efficient and profitable. While advantageous from an economic standpoint, a simplified landscape puts many pollinators at risk (Carvell et al. 2011). However, agro-schemes such as uncropped margins sown with native wildflowers can effectively improve bee richness and abundance in intensely farmed areas (Sheper et al. 2013). Consequently, a healthy bee fauna can help guarantee insect-pollination, which is a requirement of most crops. Recent studies indicate that insect pollination can also substantially enhance production of self-pollinating crops like soybeans (Milfont et al. 2013). A field experiment was carried out to examine the effects of a native wildflower border on insect-mediated pollination of an adjacent crop of soybeans. Pollinator exclusion cages (N = 90) were compared to a control group (N = 90). Total seed and pod numbers of non-caged soybean plants were significantly higher (P.0005) than those of caged plants. Benefits of the pollinator habitat were most noticeable in the rows closest to the native flower border where insect visitation increased the total number of pods by up to 24%. Honey bees were notably absent while the crop bloomed, so it appears that pollination services were performed primarily by wild bees. Field observations suggest two additional benefits of adding a pollinator meadow, an increase in predatory insects and positive changes in hydrology. Our results demonstrate how supplementing modern-day landscapes,

typified by monocultures and fragmentation, can be an affordable way to boost dwindling bee populations while naturally enhancing crop yields.

**11. The Ecological Research as Education Network: Collaborative ecological research that advances science**

**Jeffrey Simmons, Mount St. Mary's University**

**Laurel Anderson, Ohio Wesleyan University**

**David Bowne, Elizabethtown College**

**Jerald Dosch, Macalester College**

**Tracy Gartner, Carthage College**

**Dan Hornbach, Macalester College**

**Karen Kuers, Sewanee: The Univ. of the South**

**Erin Lindquist, Meredith College**

**Kathleen LoGiudice, Union College**

**Tim McCay, Colgate University**

**Bob Pohlad & Carolyn Thomas, Ferrum College**

The Ecological Research as Education Network (EREN) is a collaborative venture formed in 2009 focused on (1) developing collaborative research projects among primarily undergraduate institutions (PUIs) at regional to continental scales, with special attention to the constraints of scientists with significant teaching responsibilities, (2) designing those projects to maximize student engagement in authentic science while maintaining a goal of generating publication quality, transformative data, and (3) creating an online database of future and existing data sets collected from the network of PUIs.

The effectiveness of the collaboration was evaluated against the three goals listed above. The EREN network consists of over 230 members, mostly ecology faculty from primarily-undergraduate institutions (PUIs). Nine collaborative projects have been launched under the EREN framework and are in various stages of development. Research protocols and curricula have been developed and assessment of the curricula is ongoing. A pre-/post-test for the Stream Temperature project indicated a significant improvement in 1) knowledge of heat budgets, 2) ability to use formulas in spreadsheets, and 3) thinking across spatial scales. Two projects have posted datasets online that are intended for use by both researchers and teachers.

Through collaboration and networking EREN members are making important contributions to our understanding of ecological systems at regional to continental scales while working within the time and resource constraints of the PUI environment. By involving students in all phases of these studies, we are broadening their understandings of how ecological drivers vary over space and time."

**12. Nutrient contribution of the seagrass *Halophila hawaiiiana* to associated invertebrates**

**Matthew Speilman, Hawaii Pacific University**

**Catherine Unabia, Hawaii Pacific University**

Seagrasses worldwide are primary producers contributing to the food webs of associated and transient organisms including turtles, fish, and invertebrates. Little is known about the food web contribution of the endemic and ecologically threatened seagrass species *Halophila hawaiiiana* to the associated benthic invertebrate communities in Hawaii. Using a combination of three stable isotopes (d13C, d34S, and d15N) and a mixing model, we examined the relationships between producers including *Halophila hawaiiiana*, epiphytes, algae, reported values for POM, and several associated invertebrates in Maunalua Bay on the southern shore of Oahu, HI. Samples of another non-native seagrass, *H. decipiens* were taken from a nearby site (Kahala) for comparison to *H. hawaiiiana*. Seagrasses were enriched in d13C compared to other local producers while epiphytes separated from d34S enriched algae. d15N values were more homogenous but still separated seagrasses. The snail *Smaragdia bryanae*, reported to be an obligate herbivore on *Halophila hawaiiiana*, was the only species to show isotopic values indicating a possible 100% diet of seagrasses. The nudibranch *Stylocheilus striatus* had values similar to its reported food source of *Lyngbya majuscula*. Six other invertebrates had values closer to algae and epiphytes, with seagrasses contributing from zero to a maximum of 50%. POM contributed the most to the deposit feeding *Mesochaetopterus sagittarius*. Organisms within seagrass sediments appear to rely primarily on local micro and macro algae with smaller but significant contributions from seagrasses and POM. Our observations seem to confirm the obligate feeding status of *Smaragdia bryanae* on *H. hawaiiiana*.

### **13. Developing a system of national climate assessment indicators to track climate change impacts**

**Richard Pouyat, U.S. Forest Service**

**Kenney, M.A., U.S. Forest Service**

**Janetos, A.C., Boston University**

**Chen, R., U.S. Forest Service**

**Arndt, D., U.S. Forest Service**

The National Climate Assessment (NCA) is being conducted under the auspices of the U.S. Global Change Research Program (USGCRP), which is required to provide a report to Congress every 4 years. Part of the vision for the NCA process is a system of physical, ecological, and societal indicators that communicate key aspects of the physical climate, climate impacts, vulnerabilities, and preparedness for the purpose of informing both decision makers and the public with scientifically valid information such as the development and implementation of climate adaptation strategies in a particular sector or region. These indicators will be tracked as a part of ongoing assessment activities, with adjustments as necessary to adapt to changing conditions and understanding. The NCA indicator system will be designed to address questions important to multiple audiences including (but not limited to) non-scientists (e.g., Congress, U.S. citizens, students), resource managers, and state and municipal planners in a conceptually unified framework. The NCA indicator system will include both current indicators and leading indicators. Current indicators describe current status and trends relative to a historical baseline. Leading indicators are used to project changes in important parameters that could result from possible climate changes. The NCA indicators will be scalable, so that they can be presented as a national aggregate, where appropriate, and also provide information for indicators at state, regional, and local scales.

**14. Recruitment of experimental garlic mustard and Japanese stilt-grass populations in metro forests**

**Janet Morrison, The College of New Jersey**

**Alison Ball, The College of New Jersey**

**John Speigel, The College of New Jersey**

**Giovanna Tomat-Kelly, The College of New Jersey**

Fragmented forests in the metropolitan landscape are subject to co-invasion by multiple non-native plant species. In the forests of eastern North America, two important herb layer invaders are garlic mustard (*Alliaria petiolata*) and Japanese stilt-grass (*Microstegium vimineum*). We have established a well-replicated, five-year field experiment that includes staged invasions of both species across six forests in a suburban/exurban region. After applying the initial seed addition treatments in Fall 2012, we observed highly variable recruitment among forests and among the approximately twenty 16 m<sup>2</sup> plots per forest per species that had seeds added. We added equal numbers of seeds to each addition plot, but by July 2013 recruitment of garlic mustard ranged from 0-188 plants per plot, and for stilt-grass it was 13-605. Stilt-grass clearly dominated the initial stage of invasion. Recruitment success was highly significantly different among forests for both species. We hypothesized that differences in leaf litter quantity may explain the variation, since it also varied significantly among forests. Indeed, on average, fewer garlic mustard plants recruited in forests where leaf litter samples were, on average, more massive. Mean sample leaf litter mass explained 68% of the variation among forests in mean recruitment of garlic mustard, but did not explain stilt-grass recruitment. Within each forest, regression of the number of plants per plot on leaf litter mass explained a substantial part of the variation in only one of the six forests, and only for stilt-grass, which was negatively affected by greater leaf litter. The next steps are to understand why leaf litter mass differs among forests and how it affects recruitment of these two invaders of the herb layer.

**15. Can supplemental phenylalanine increase the level of protection from UV-B radiation in soybean?**

**Alison Post, University of Maryland**

**Martina Gonzalez Mateu, University of Maryland**

**Ashlea Glickstein, University of Maryland**

**Katherine Warpeha, University of Illinois at Chicago**

**Joe H. Sullivan, University of Maryland**

One of the more common responses of plants to UV-radiation is the induction of secondary metabolites that absorb UV and protect potential targets of damage. However, we still have a poor understanding of how UV is perceived and the mechanisms of UV tolerance. We have previously shown that the addition of phenylalanine (Phe) to seeds of *Arabidopsis* and soybean can enhance the synthesis of potential screening compounds and increase UV tolerance in etiolated seedlings. In this study we examined the effects of supplemental Phe on phenolics in three soybean (*Glycine max* (L.) Merr.) cultivars. Seedlings were exposed to either, 3, 5 or 7 kJ of UV when weighted with a common UV weighting function. Seed or foliar treatment with 1 mmol supplemental Phe led to increased epidermal UV screening in primary and trifoliolate leaves in all three cultivars including the Clark-magenta isolate of Clark, that does not produce flavonoids. However, the magnitude of this response decreased with leaf age suggesting that Phe

levels were initially limiting the response but the combination of exhausting the supply of supplemental Phe and or the development of other limitations (e.g. enzyme activity) may have become more important as the plants developed. These results suggest that the available pool of Phe may be an important limiting factor in the development of UV-protection mechanisms in young seedlings but further studies are needed to determine the allocation of the supplemental Phe and the long-term responses under field conditions.

**16. Photomorphogenic responses of two *Populus* clones to supplemental UV-B radiation**  
**Laura Templeton-Brandt, University of Maryland**  
**Alison Post, University of Maryland**  
**Gary Coleman, University of Maryland**  
**Joe H. Sullivan, University of Maryland**

While early work on plant responses to increasing levels of UV-B radiation centered on detrimental impacts of UV-B radiation, research over the last decade has focused on photomorphogenic responses and the elucidation of UV photoreceptor(s). One such receptor, UVR8, identified in *Arabidopsis*, has received much attention in recent years. Database annotations indicate UVR8 is also present in *Populus*, but the extent to which variation in responses is attributable to the presence of UVR8 or downstream components has not been evaluated. This study evaluated photomorphogenic responses of two poplar clones to supplemental UV-B in order to evaluate the possible role of UVR8 in poplar. Clones of *Populus trichocarpa* (Nisqually) and *Populus tremula* X *P. alba* hybrid (INRA 717-1B4) were grown for 8 weeks in two separate glasshouse experiments and exposed to one of four levels of UV-B radiation (0, 2, 4 and 6 kJ of UV-B when weighted with Caldwell's commonly-used biologically effective action spectrum). Leaf area, biomass, chlorophyll and UV-screening compounds were measured at periodic intervals.

Leaf area and biomass were reduced and specific leaf weight increased by medium and high levels of UV-B in the Nisqually clone. These parameters were largely unaffected in the INRA 717-1B4 clone. In contrast, chlorophyll content was not affected in either species but UV-screening compounds were elevated in both species under all supplemental UV levels. These results demonstrate inter-specific differences in the effects of UV-B on leaf morphology but not in the expected increase in foliar UV-screening compounds.

**17. Evaluating the sustainability and natural subsidy of the oyster aquaculture industry in Maryland**  
**Tim Williamson, University of Maryland**  
**David R. Tilley, University of Maryland, College Park**  
**Elliot Campbell, University of Maryland, College Park**

Oyster aquaculture is largely believed to be a sustainable industry in the Chesapeake Bay because it benefits water quality and does not deplete wild stocks. Few, if any, studies have evaluated the sustainability of oyster aquaculture operations in the Chesapeake Bay. We used an emergy analysis to evaluate the sustainability of two rearing methods of American oysters (*Crassostrea virginica*) in the Chesapeake Bay; on-bottom cage culture and floating raft culture. Both methods use on-shore nursery systems and deploy adult oysters in open cages at designated Aquaculture Enterprise Zones (AEZ). Floating raft culture suspends mesh bags containing adult oysters at the water surface close to shore,

whereas on-bottom culture holds oysters in cages on the sediment approximately 9.5 km from the aquaculture facility. To date, preliminary results for on-bottom culture are available. Our emergy analysis showed that emergy inputs are  $2.13E18$  solar emjoules per joule (sej/J) in non-renewables (F) and  $9.37E14$  sej/J in renewable resources (R). The largest non-renewable inputs were goods and services from the economy, and triploid oyster seed, produced in hatcheries. The greatest renewable emergy input was microalgae feed, produced and delivered to the AEZ by natural energies. The sustainability index for on-bottom culture was low (0.00044). Non-renewable emergy inputs far outweighed renewable emergy inputs. This analysis did not account for additional yields of oyster aquaculture such as habitat provision, nutrient cycling, and water quality improvements. Further research will incorporate these factors into the analysis and will compare results to floating raft culture methods.

## **18. Severe weather and tree mortality in a mixed hardwood forest of the New Jersey Highlands**

**Brian Wlodawski, Ramapo College of New Jersey**

**Alexander Myers, Ramapo College of New Jersey**

**Eric Wiener, Ramapo College of New Jersey**

In 2011 and 2012, three severe weather events impacted forests of the New Jersey Highlands. The purpose of this study was to examine the species composition and size of trees that were killed by the storms in a 58.7 hectare forest study plot at the Apshawa Preserve, West Milford, New Jersey. The species, trunk diameter, waypoint and direction of fall were recorded for every tree that had been killed by storms during that time period. For each toppled tree, a survey of neighboring trees was conducted to compare with the species composition of trees killed by the storms. A total of 223 trees were killed directly by storms (direct mortality), and 60 trees were knocked over by neighboring trees. Chi square analysis revealed that direct mortality of *Quercus rubra* (red oak) and *Q. velutina* (black oak) was statistically significantly greater than predicted by their abundance, while direct mortality of *Betula lenta* (black birch) and *Q. montana* (chestnut oak) was statistically significantly lower than predicted by their abundance. Trunk diameter size class of *Q. rubra* was negatively correlated with an index that standardized direct mortality relative to abundance. No such relationships were found for any other species.

The high impact of storms on *Q. rubra* and *Q. velutina* is of particular concern given that these species are already in decline due to invasive herbivores. Further analysis will examine whether topography and edaphic features are predictive of spatial trends, and whether results from the study site are indicative of more widespread phenomena.

**19. Assay for Education: Exploring urban soils' function and microbial composition**

**Dietrich Epp Schmidt, University of Maryland**

**Katalin Szlavecz, Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, USA**

**D. Johan Kotze, Department of Environmental Sciences, University of Helsinki, Lahti, Finland**

**Ian Yelsonis, USDA Forest Service, c/o Baltimore Ecosystem Study, Baltimore, USA**

**Richard Pouyat, USDA Forest Service, USA**

**Heikki Setäl, University of Helsinki, Finland**

**Sarel Cilliers, North-West University South Africa**

**Hornung Erzsébet, Szent István University, Hungary**

**Stephanie A. Yarwood, University of Maryland, USA**

The Global Urban Soils Ecology and Education Network (GLUSEEN) is an international collaborative effort to design a student-accessible assay of soil microbial community function. This assay can be correlated with a supplementary dataset containing microbial community composition data from urban settings globally. Decomposition rates have a significant impact on local nutrient availability and global carbon cycling; these data can be applied to understand local ecosystem dynamics and global processes (e.g. climate change) and as such are a powerful educational tool. A pilot study has begun in five cities (Baltimore, USA; Helsinki and Lahti, Finland; Budapest, Hungary; and Potchefstroom, South Africa) with 20 sampling sites per city that are categorized as either Reference Ecosystem (control located outside the city), Urban Remnant (located within the city), Maintained Lawn, or Ruderal (highly disturbed). Soils have been sampled for chemical and microbial community analysis, and decomposition assays have been started using commercially available pyramid tea bags. We expect that microbial community composition is related to overall community function, and therefore is an important measurement for urban soils. For example, arbuscular mycorrhizal fungi (AMF) are plant symbionts that are known to contribute to plant P and N acquisition, and to affect the surrounding microbial community composition. If urbanization alters the realized niches of fungal species, we expect to see an associated shift in bacterial community composition, and decomposition rate. My future research will use the Long Term Ecological Research site in Baltimore to study the AMF community response to urbanization along an urban-rural gradient.

**20. Alternative simulation of soil phosphorus in the Chesapeake Bay Watershed Model**

**Alisha Mulkey, University of Maryland**

**Frank Coale, Department of Environmental Science and Technology, University of Maryland**

**Joshua McGrath, Department of Environmental Science and Technology, University of Maryland**

**Peter Vadas, USDA-Agricultural Research Service**

**Lori Lynch, Department of Agriculture and Resource Economics, University of Maryland**

Current restoration efforts for the Chesapeake Bay (Bay) include a comprehensive Total Maximum Daily Load (TMDL), released in 2010. The TMDL, in order to protect the Bay's beneficial uses, establishes a pollution cap and implementation timeline for reducing the load of nutrients and sediment to receiving



waters. The magnitude of the Bay watershed requires a multi-jurisdictional partnership for achieving TMDL goals. Central to such efforts is the Bay Watershed Model (WSM). The WSM simulates nutrient and sediment concentrations in soil and water, and ultimate transport and load delivery to the Bay across varying management scenarios. Within the WSM, phosphorus (P) nutrient cycling is simulated in three pools: soluble phosphates (PO<sub>4</sub>), insoluble inorganic P, and organic P. Transformations among these P pools occurs primarily by adjusting model parameters to dictate the rate of exchange between soil pools and to maintain a steady rate (target) of P loss. However, increasingly watershed scale studies on P sources and transport continue to affirm greater complexity of soil P and the important connections between nonpoint sources, field management, and flow across the landscape. The intent of this research is to improve the simulation of soil P dynamics and factors contributing to field P losses by using an independent P loss modeling tool as an alternative to the current WSM soil P simulation. Outcomes from the alternative simulation will be assessed and compared to target values from the WSM.

**21. Analysis of the microbial controls on nitrogen movements and transformation in agricultural soil**

**Holly Bowen, University of Maryland**

**Hanna Poffenbarger, University of Maryland**

**Jude Maul, Beltsville Agricultural Research Center, USDA**

**Steven Mirsky, Beltsville Agricultural Research Center, USDA**

**Stephanie Yarwood, Environmental Science and Technology, University of Maryland**

Nitrogen cycling is of paramount importance in agricultural soils, as nitrogen is often a limiting nutrient for plant growth. In addition, the loss of nitrogen as nitrate or nitrous oxide (N<sub>2</sub>O) can lead to a number of serious environmental issues including eutrophication and increased radiative forcing, respectively. The objective of this study is to determine if a new fertilizer application mechanism, sub-surface banding of poultry litter, can enhance fertilizer efficiency without leading to an increase in N<sub>2</sub>O emissions, when compared to a traditional broadcasting approach. This study is unique in that it relates the nitrogen use efficiency of the application mechanism to the microbial communities and nitrogen cycling functional guilds which control the nitrogen transformations in the soil. In order to investigate these processes, a spatial sampling grid was set up horizontally across the interrow and vertically from the soil surface down to 30 cm. For this study ammonia and nitrate are analyzed for each sample as well as a suite of nitrogen cycling functional genes ureC, amoA, nirK, nirS, nosZ2, and 16S. This study design will give new insights about environmental controls on the nitrogen cycling microbial community, the nitrogen transformations occurring in the soil, and relate this information to larger scale processes such as nitrogen efficiency of different fertilizer management techniques and N<sub>2</sub>O emissions from agricultural soil.

**22. Competitive ability and potential invasion mechanisms of *Oplismenus undulatifolius***

**Cody Kepner, Towson University**

**Vanessa Beauchamp, Towson University**

Invasive plant species can enter novel habitats through several mechanisms including superior competitive ability, soil microbe feedbacks, empty niches, or enemy release. Investigating and understanding these mechanisms of invasion success is essential to the management of invasive species and for establishing strategies that can forecast their expansion into naturalized areas. A invasive species

in mid-Atlantic forests is the shade tolerant perennial grass *Oplismenus undulatifolius*. We conducted a greenhouse experiment determine the competitive ability of *O. undulatifolius* against *Microstegium vimineum*, another highly invasive grass species found in Maryland, and a native mix of perennial grasses. We also examined the potential roles of mycorrhizal fungal feedbacks and shade tolerance in invasion of *O. undulatifolius* into forest understories.

While there was no evidence that *O. undulatifolius* participated in positive feedback with mycorrhizal fungi, there was strong evidence that *O. undulatifolius* invades forests via exploitation of empty niches. When grown in *O. undulatifolius* was affected to a much greater degree than either *M. vimineum* or the native grass mix. This indicates that post agricultural legacies and overabundant deer populations, which lead to depauperate understories, may be a major facilitator of *O. undulatifolius* invasion. Growth of *O. undulatifolius* was marginally higher in the shaded but shade did not affect its performance against competitors. Understanding the mechanisms that underlie invasive species colonization is important to the preservation of native habitat as invasive species facilitate the decline and in some cases loss of native species in susceptible areas.

### **23. Compost makes the garden grow? The effect of *Eisenia fetida* on the growth of chives and oregano**

**Tereasha Santos, Roanoke College**

**Rachel Collins, Roanoke College**

Non-native earthworms dominate many earthworm communities in eastern deciduous forests and cause changes in ecosystem properties including altering nutrient cycles and reducing plant abundance and diversity. One mode of introduction of non-native earthworms is from composting. Gardeners buy earthworms to compost vegetation matter then use that compost contaminated by adults and eggs to fertilize gardens. Supporters of composting report that earthworms increase productivity of garden plants, but this topic is understudied in the scientific literature. We examine whether the popular composting earthworm (i.e., the “red wriggler” (*Eisenia fetida*)) does indeed increase plant productivity of two commonly grown garden herbs (*Allium schoenoprasum* (chives) and *Origanum vulgare* (oregano)). Specifically we predict that as we increase earthworm abundance, plant productivity will increase because earthworms will increase the nutrients available to the plants. To test this prediction we conducted a greenhouse experiment using 4-liter pots, with either chives or oregano seeds planted. We tested the effects of earthworm on our herbs using three treatment levels of worm abundance (0, 5, and 20 earthworms per pot). We replicated each species X treatment combination six times resulting in 36 experimental pots. Initial results indicate that earthworms do not have a strong effect on productivity, but if earthworms affect garden herb productivity, this pattern is likely to change as the plants reach maturity. Understanding the effects that earthworms have in garden environments will help us assess the cost and benefits of using non-native earthworms for composting and releasing them into the natural environments.

### **24. Deer as seed dispersal agents in forests of differing vertical structure**

**Christine Burns, Dickinson College**

**Carol Loeffler, Dickinson College**

Overpopulation of white-tailed deer (*Odocoileus virginianus* Zimmerman) is a growing problem throughout the eastern United States. This study investigates the role that deer play as seed dispersers focusing on two main questions. Are they now spreading invasive plant species? Which species are viable after passing through the deer? I compare seed dispersal by white-tailed deer at two contrasting sites: the Florence J. Reineman Wildlife Sanctuary in Landisburg, Pennsylvania, where heavy deer browsing has eliminated the understory allowing invasive species such as Asian stilt grass (*Microstegium vimineum*) to take over the forest floor, and a nearby stretch of heavily-hunted forested (State Gamelands 170) with comparable canopy tree composition but with a dense understory. Twenty-seven deer pellet samples containing between 10 and 30 pellets were collected from both locations. Half of each sample was planted to investigate germination rates, and the other half was dried and sorted for seed counts and types. To date 29 seedlings have sprouted and I have counted as many as 160 seeds in some samples. Over twenty species of seeds have been identified between with “seed 8” at Reineman and “seed 1” at SGL being the most abundant by far. This research hopes to inform future management of Reineman Wildlife Sanctuary as well as provide insight into the continued viability of this wildlife sanctuary and others like it given the deer problem.

- 25. Eastern hemlock (*Tsuga canadensis*) health across habitat gradients in the presence of woolly adelgid**  
**Lauren Adrion, Ramapo College of New Jersey**  
**Eric Wiener, Ramapo College of New Jersey**

In recent decades, hemlock woolly adelgids (*Adelges tsugae*), and to a lesser extent hemlock elongate scales (*Fiorinia externa*), have had significant negative impacts on eastern hemlock (*Tsuga canadensis*) populations from southern Maine to northern Georgia. This study examined hemlock trees along a ridge in Harriman State Park, NY in order to identify tree and habitat variables that might correlate with hemlock health where adelgids and scales have been prevalent. Hemlock trees in the study area were mapped and surveyed for trunk diameter, habitat, slope position, stratum, light availability, patch density and an index of canopy health. In addition, tree rings were evaluated from increment cores to examine patterns of growth before and after the arrival of woolly adelgids to the area. Tree health ratings varied dramatically, with 50 % - 90 % of the branches severely impacted by herbivores for most trees. Contrary to the results of other studies, preliminary data suggest that slope position and trunk diameter (19.3 cm - 56.3 cm) were not significantly correlated with hemlock tree health. Conversely, preliminary examination of tree rings suggest that trunk diameter growth was impacted differently in wet versus dry habitats following the arrival of the hemlock woolly adelgids. However, patterns varied greatly even among trees within the same habitat. Overall, results suggest that patterns of resistance to, and tolerance of, the insect pests that are plaguing Eastern hemlocks can be complex. Further research will examine the potentially important role that light environment plays in the study population.

- 26. Ecosystem service benefits from public and private conservation lands**  
**Lisa Scott, Virginia Tech**  
**Julia Gillespie, Virginia Tech**  
**Amy Villamagna, Virginia Tech**

Natural landscapes offer a variety of ecosystem services that convey local and widespread human well-being benefits. Public and private in situ land conservation protects these vital services; however, growth in public protected areas (PPAs) has declined over the past several decades. Although privately owned conservation easements have grown in popularity and significance, their ability to protect ecosystem services is largely unknown. This study assessed and compared the ecosystem service capacities of federal and state PPAs to conservation easements to estimate protection capabilities. We mapped surface water regulation, groundwater protection, riparian filtration, freshwater recreational fishing, biodiversity support, carbon storage, and erosion control in PPAs and easements in North Carolina and Virginia using spatially explicit models, publically accessible data, and GIS. Results suggested that differences in ecosystem service capacities between PPAs and private easements were relatively minimal and that state and federal PPAs were rarely both significantly greater than ecosystem service capacity within easements. This suggests that private easements provide considerable protection of ecosystem services and offer possibilities for enhancing conservation throughout the landscape.

**27. Effect of Salinity on Microbial Communities in Freshwater Wetlands**

**Ashley Robey, Eleanor Roosevelt High School and University of Maryland**

**Andrew Baldwin, University of Maryland College Park**

**Stephanie Yarwood, University of Maryland College Park**

Methane, a greenhouse gas 23 times more potent than carbon dioxide, comes from a variety of sources, but freshwater wetlands are one of the largest sources. Methanogens are favored in freshwater more than saltwater wetlands due to competition with sulfate reducers. Future climate change scenarios predict that saltwater will encroach in tidal freshwater wetlands. This rise in salinity could cause a change in the microbial communities present in wetland ecosystems. We hypothesize that the methanogen population will decrease, as the quantity of sulfate-reducing bacteria increases. The composition of methanogens and sulfate-reducing bacteria in soil could change as more salt tolerant strains are selected. Experimental wells made of PVC pipes were installed in Jug Bay, a Maryland tidal freshwater wetland. Half of the wells served as controls and the others were regularly amended with aquarium salt for two years. Soil samples were collected in summer 2012 and DNA was extracted. Gene copy numbers of bacteria, archaea, and methanogens were determined with Q-PCR. Methane community composition was determined with T-RFLP profiles. Although archaeal 16S gene copy numbers differed between the two treatments, no other differences were observed in treatments. Methanogen composition of the salt and no salt samples did not differ significantly, but composition did differ significantly between the well positions. These data indicate the methanogen community vary spatially across the wetland and suggest that multiple locations with a wetland must be studied to accurately reflect the community.

**28. Emergence Patterns and Distribution of Overwintering Wood Frogs (*Rana sylvatica*)**

**Jilena Yeager, The Richard Stockton College of New Jersey**

**William J Cromartie, The Richard Stockton College of NJ**

The wood frog (*Rana sylvatica*) utilizes distinct habitats for different portions of its annual lifecycle to feed, breed, and overwinter. The loss of any one habitat could present negative consequences for the population. A wetland buffer zone around a vernal pond can better protect frogs' breeding and partial

feeding habitat. This study, conducted on The Richard Stockton College of New Jersey's campus, sampled the winter distribution and densities of wood frogs to determine if a reduced 175 ft. or the typical 300 ft. buffer zone protects the majority of the wood frogs' winter habitat. Three consecutive rows of drift fencing and pitfall traps were constructed in early February. The first row was near the edge of the vernal pond, the second row was 175 ft. away, and the third row was 300 ft. away from the vernal pond. Thus, frog captures in the various zones gave insight into approximately how far from the vernal pond the frogs were overwintering. Results indicated that a proportion of frogs spend the winter farther than 300 ft. away from the vernal pond, thus the current buffer regulations do not protect the entire wood frog winter habitat. Consistent frog movement began after the first two days of temperatures (°F) in the low 50s with rainfall. Twelve percent of the frogs captured were female. Understanding the wood frogs' terrestrial habitat use harbors implications for land use policy and best management techniques.

**29. Evaluating the effects of specific attributes of suburbanization on bird community composition along the Roanoke River**

**Thomas Mack Granger, Roanoke College**

**Lauren Strong, Roanoke College**

**Rachel Collins, Roanoke College**

Birds have very specific habitat requirements and therefore are differentially tolerant to habitats that have been highly impacted by suburbanization. In an attempt to determine which attributes of suburbanization bird species are most sensitive to we used GIS datasets in combination with bird census data.

Specifically, we examined the relationships between predictor variables (e.g., total amount of urban landscape, road density, and amount of edge and core forest area) and response variables (e.g., breeding season bird diversity and species composition) at six locations along the Roanoke River. Our sites are in riparian habitat along a gradient of suburbanization. One of the best predictors of bird diversity as measured with Simpson's index was amount of core forest. None of the variables tested correlated well with richness. The total amount of urban area strongly affected species composition. Our results suggest that species richness, a metric often used to assess habitat quality, is not sensitive enough to indicate the effects that human development has on bird communities.

**30. Factors affecting the distribution of the Hemlock Woolly Adelgid**

**Jill Hautaniemi, Dickinson College**

**Rosabeth Link, Dickinson College**

**Carol Loeffler, Dickinson College**

The Eastern hemlock (*Tsuga canadensis* (L.) Carr.) is a valuable riparian tree species that benefits many organisms. Hemlock stands in much of the northeastern United States are experiencing widespread mortality and may soon be eliminated due to infestation by an invasive insect, the Hemlock Woolly Adelgid (HWA *Adelges tusga* Annand). One biological control method uses predatory lady beetles such as *Pseudocymnus tsuga* Sasaji & McClure, *Laricobius nigrinus* Fender, and *Laricobius rubidus* LeConte, but establishing stable beetle populations is challenging. This study focuses on the distribution of the HWA across a topographically diverse landscape and addresses two main questions: 1) How does hemlock tree condition vary between stands located on ridge-tops and in stream valleys? 2) How does HWA abundance vary between hemlock stands located on ridge-tops and in stream valleys? Between the

years of 2013 and 2014, sixteen paired study sites of ridge-top and stream valley stands were identified and at least ten trees per site were sampled for tree condition (crown density, crown ratio, and new growth) and HWA abundance. Data show lower overall tree condition and higher abundance of HWA for ridge-tops stands than for stream valley stands. If ridge-top hemlocks have consistently more HWAs, they could provide a location where predatory beetles can become established even during low points in the HWA population cycle. These results could be directly applied by forest managers involved in treating HWA infestations, in order to help protect this native tree.

**31. Hydrus modeling of soil water movement and urban tree root depth under resin-bound gravel pavement**

**Francisco Javier de la Mota, Virginia Tech**

**Susan D. Day, Virginia Tech**

In urban areas, trees are often planted in sidewalk cutouts that have a variety of surface coverings. For at least a decade, resin-bound gravel, a type of pervious pavement, is being used in many cities as one of these surface treatments where traditionally no mulch or soil cover has been used. We hypothesize that vertical distribution of soil water may be influenced by resin-bound gravel, possibly resulting in more superficial rooting and a reduced ability of trees to resist drought, particularly in arid climates.

We propose to calibrate Hydrus, a modelling environment that analyzes both saturated and unsaturated water flow through layered soils and other porous media, to evaluate the soil profile created in these tree cutouts with resin-bound gravel surface coverings and compare these results to profiles with no surface covering. We will construct soil/pavement profiles with and without trees and monitor soil moisture throughout the profile over time and in response to a variety of rain events. These data will be used to calibrate Hydrus and allow us to predict how moisture will be distributed in a variety of urban soil profiles. Finally we will measure new root growth to determine the impact of water location on root distribution. This poster will present details of the proposed research plan.

**32. Patterns of forest recovery in deer exclosures following overbrowsing and stiltgrass expansion**

**Laura Hart, Dickinson College**

**Carol Loeffler, Dickinson College**

Overpopulation of white-tailed deer, *Odocoileus virginianus*, in a forest can lead to an unhealthy shift in vegetative understory diversity. Nine deer exclosure and control plot pairs set up in 1992 at Reineman Wildlife Sanctuary in Landisburg, Pennsylvania have shown that trees and understory vegetation can grow back if they are isolated from deer browsing. However, in the two decades since these plots were established, the growth of Japanese stiltgrass, *Microstegium vimineum*, has increased dramatically. The purpose of our experiment was to determine if understory diversity could still recover in areas so overgrown by stiltgrass. New exclosures mirroring the location and plant composition of the old plots were established in August of 2012, and their change in plant composition after one year was recorded in terms of number of species, number of individuals, percent cover, and Shannon-Weiner diversity. Over the first year, the new fenced plots became significantly more diverse than the control plots in one out of

three study areas, with similar trend in a second area, largely due to an increase in *Rubus* percent cover. Plots in a third area, on a ridgetop, did not reflect this trend, likely because *Rubus* is less abundant at the higher altitude. Shading of *Microstegium* by *Rubus* may act to clear space for saplings to develop in the future, but continued maintenance and observance of the exclosures will be necessary to see if this prediction holds true, and to determine if a healthy vegetative understory can be reestablished and maintained at Reineman Sanctuary.

**33. Population matrix model for *Castanea dentata* and the implications for Re-introduction**

**Elise Elwood, College of William and Mary**

**Harmony Dalglish, College of William and Mary**

**Nathanael Lichti, Purdue University**

**Sara Fitzsimmons, Penn State**

Restoration efforts are increasingly important due to the alarming global rate of biodiversity loss. The successful re-introduction of extirpated populations is an important tool of restoration.

Determining demographic parameters for a population has the potential to strengthen re-introduction attempts, as these parameters impact the ability and speed at which populations are established. American chestnut (*Castanea dentata*) used to be prominent in forests of the eastern United States, however, was decimated by an exotic fungus that spread through the entire range of the species in the early 20th century (chestnut blight). This study uses new data collected between 2011 and 2013 on growth, survival, and reproduction from a regenerating chestnut population in Maine to develop a matrix model. Over 1100 chestnuts were measured in at least 1 year, with 230 chestnuts measured in 2011 and 2012, 130 trees measured in 2012 and 2013, and 55 trees measured all three years. Additionally, survival information for 2012 to 2013 was determined for 614 chestnuts. Survival of new recruits (76.9%) is significantly lower than older seedlings (97.4%). Growth rate varied with age and by year, with a higher growth rate within the first year of growth and in 2013. We observed inter-annual differences in recruitment with no recruits in 2011, 17 in 2012, and 35 in 2013. We parameterize a matrix population model for this population, and through elasticity analysis, provide valuable information to better understand how different management actions may affect the population growth rate and re-introduction attempts of American chestnut.

**34. Project Wavyleaf: A citizen science mapping initiative**

**Daniel Bolton, Towson University**

**Mohsin Majid, Towson University**

**Jesse Day, Towson University**

**Jonathan Smoley, Towson University**

**Andrew Chau, Towson University**

**Eric Forbes, Towson University**

**Josh Dehlinger, Towson University**

**Siddharth Kaza, Towson University**

**Vanessa Beauchamp, Towson University**

Citizen science is research conducted by the general public that contributes to the systematic collection and analysis of data. The utilization of citizen scientists, while not a new idea, has increased in recent

years with the advancement of mobile communication technology and GPS enabled smartphones. For example, citizen science initiatives used to crowd-source data on plant phenology and bird ecology have been incredibly successful. The decentralized nature of citizen science also makes it ideal for tracking invasive species. One such species is wavyleaf basketgrass (*Oplismenus undulatifolius*). Wavyleaf basketgrass is native to Southeast Asia and southern Europe. It has recently been found in several Maryland and Virginia counties and may become a widespread concern in woodland areas. In order to develop plans to control or remove wavyleaf basketgrass, land managers must know where wavyleaf populations are located, how fast it spreads, and where it might spread to next. All of this information is currently unknown. Having an accurate distribution map is essential to understanding the ecology of wavyleaf basketgrass. Students and researchers with the School of Emerging Technologies at Towson University have developed a mobile application to collect these essential data. Using GPS enabled smartphones, citizen scientists send presence and absence locations researchers. Data collected by the mobile application are used to create the distribution map needed by land managers. The goals of this application are to be simple to use, provide high quality data through trained citizen scientists, and bolster public awareness of the ecological impact of wavyleaf basketgrass.

### **35. Seasonal movements and habitat preferences in populations of painted turtles and spotted turtles**

**Daniel Gillespie, Shippensburg University**

**Timothy J. Maret, Shippensburg University**

We utilized radiotelemetry and trapping to compare seasonal movements and habitat preferences in overlapping populations of spotted turtles (*Clemmys guttata*) and painted turtles (*Chrysemys picta*) in central Pennsylvania. Data were collected through one full season, lasting from May 2013 through June 2014. The site is a matrix of various wetland types, including shrub swamps, forested vernal pools, wet meadows, and ponds interspersed upland forests across approximately 80 hectares. Habitat types have been determined based on several qualities such as dominant plant species, overhead cover, and water seasonal depth. The 2014 season will also include amphibian egg surveys for each habitat through the spring. Data collected thus far has shown a strong separation in microhabitat selections and uses between the two species, despite many of the habitats being close to each other. Spotted turtles have shown a strong preference for shallow, seasonal pools. Most of the spotted turtles throughout the season have been found in shallow, buttonbush (*Cephalanthus occidentalis*) dominated swamps, with variable overhead cover. In early spring the most uniquely spotted turtle habitat is a vernal pool that is centrally located within the wetland matrix. This site is the most isolated by upland habitats relative to others, and is the quickest to dry in late spring/early summer. Painted turtle habitats were primarily large deep swamps and ponds which are not at risk of drying up. Typically they are without overhead cover and are often dominated by pond lilies. Radiotelemetry data on seven individuals in 2013 (four spotted; three painted) has shown that both species showed cases of extensive travel and little travel. Overall spotted turtles tended to travel overland more frequently, whereas the majority of painted turtle travel was in water within habitats or closely placed deepwater habitats. Following the 2014 season, ArcGIS software will be used to map the habitats along with turtle locations. A preference for ephemeral spring habitats and more extensive overland travel could be leading to the decline of spotted turtles due to habitat fragmentation and human encroachment. The results of this study could provide valuable insight required for the conservation of this species and its' habitat.



**36. Seed bank-vegetation composition relationships in restored and natural wetlands**  
**Liza McFarland, University of Maryland**  
**Andrew Baldwin, University of Maryland**

Above-ground plant communities in restored wetlands often differ significantly from local reference systems. Vegetation composition can also vary distinctly across small distances even within one wetland. Seed bank assessment, when compared with a vegetation survey, may provide insight into mechanisms controlling post-restoration ecosystem development. As part of the Mid-Atlantic Conservation Effects Assessment Project, above-ground vegetation and seed bank communities of 15 depressional wetlands were surveyed on the Delmarva Peninsula of Maryland and Delaware (10 restorations from prior-converted cropland, and 5 natural forested depressions). Within each wetland, hydrologic zones (emergent, temporarily flooded, upland) were also denoted and sampled. In a series of PERMANOVA analyses, seed banks showed stronger similarities than above-ground vegetation overall between restored and natural wetlands. Seed banks were also more similar in composition across a hydrologic gradient than above-ground vegetation communities. Although above-ground vegetation surveys are useful in evaluating restorations, seed banks provide more similarities in community comparisons between restored and natural systems, which creates a stronger indication of restoration trajectory toward reference communities.

**37. Seed Dispersal of *Oplismenus undulatifolius***  
**Gregory Lande, Towson University**  
**Arturo Garcia, Towson University**  
**Daniel Bolton, Towson University**  
**Vanessa B. Beauchamp, Towson University**

Efficient seed dispersal is a common trait of exotic plant species. *Oplismenus undulatifolius* (wavyleaf basketgrass) is a relatively new invasive grass species in Maryland that, instead of having hooks or barbs for dispersal, produces a sticky substance. A better understanding of how much *O. undulatifolius* seed can be dispersed by human and animal vectors, and the effectiveness of other modes of dispersal will help determine how quickly this species may spread through forests in the mid-Atlantic region. We tested the amount of seed dispersed via epizoochory on humans, dogs, and deer and also examined the role of gravity, water, and wind in *O. undulatifolius* dispersal. Results from epizoochory show that in 50 m, dogs can pick up an average of 2000 seeds for a short haired dog and anywhere from 10,000 to 16,000 seeds for a long-haired dog, and deer can pick up an average of 190 seeds per leg. Epizoochory by humans demonstrated that nearly 90% of the seed adhered to fleece or denim remained stuck for more than seven days unless manually removed. Lastly, from late September through early December an average of 1340 seeds per square meter fell into soil flats from overhanging vegetation. Wind dispersal was non-existent and hydrochory trials are ongoing. The unique dispersal capabilities of *O. undulatifolius* suggest this species has the potential to spread quickly and become a major invader in mid-Atlantic forest understories."

**38. Seed Production, Biomass and Germination of *Oplismenus undulatifolius***

**Artura Garcia II, Towson University**

**Daniel Bolton, Towson University**

**Gregory Lande, Towson University**

**Vanessa Beauchamp, Towson University**

*Oplismenus undulatifolius*, (wavyleaf basketgrass), is a relatively new invasive grass species in Maryland. Although the exact range of *O. undulatifolius* in the United States is unknown, it seems to dominate forest understories. Propagule pressure is one way to quantify establishment by an invasive species, and it can be an important tool in forming models about the continued expansion of *O. undulatifolius*.

To assess the propagule pressure of *O. undulatifolius*, we determined the amount of seed available for dispersal biweekly between September and November in 2012 and 2013 at three sites near Baltimore, MD. We also assessed biomass and germination rate of seed collected at each dispersal date and location and estimated the total amount of seed produced per square meter at each of the three study sites.

Seed abundance differed by time and site and peak seed production occurred at different dates at different sites. In 2012, peak seed production occurred in late October for two sites and in early October at the third site.

Average seed mass in 2012 peaked in early October at two sites and early November at the third site.

Finally, analysis of germination showed a significant effect of temperature, location and time on the rate of germination. Seeds planted at room temperature had a higher rate of germination than those, which were cold-stratified, with maximum germination rates at 85%. Seed collected in late October had a higher rate of germination than seed collected at any of the other dates.

**39. Small compounds targeting *Arabidopsis* RACK1A protein regulate diverse environmental stress resistance**

**Joanna Akinlosotu, Howard University**

**Deborah Fadoju, Howard University Department of Biology**

**Hemayet Ullah, Howard University Department of Biology**

RACK1 (Receptor for Activated C Kinase 1) is a WD-40 type scaffold protein, conserved in eukaryotes, from plants to humans. It plays a regulatory role in diverse signal transduction and stress response pathways. Analysis of loss of function mutants in *Arabidopsis* indicates that RACK1A- the predominant isoform, negatively regulates environmental stress signaling, including salt stress resistance. It is hypothesized that chemical knock-out, as opposed to genetic knockout of RACK1A, will provide a functional advantage to protect plants from environmental stress. Site directed mutagenesis studies indicated that key post-translational modifications (such as sumoylation at K273 and tyrosine phosphorylation of Y248 residues) regulate RACK1A's interaction with other proteins. In order to facilitate the identification of small compounds that bind to the functional pocket, we deduced the crystal structure of RACK1A protein at 2.4 Å resolution. This crystal structure of RACK1A was used to identify dozens of small compounds that could potentially bind to the Y248 pocket. These compounds could potentially inhibit Y248 phosphorylation and bind to purified recombinant RACK1 proteins with a kD value in the micro-molar ranges. In this study, we evaluated the effectiveness of the compounds in regulating environmental stress responses in *Arabidopsis thaliana* and a variety of agricultural plants. Since it is known that RACK1 is involved signal transduction for the growth hormone, auxin, we

expected that the small compounds we raised to regulate the function of RACK1 would regulate auxin. Our results show that SD29, one of the key small compounds, positively regulates the pathway of auxin in *Arabidopsis*. It is also known that RACK1 is involved in many stress response pathways that are mediated through the production of reactive oxidative species. Our results using a diaminobenzadine (DAB) assay indicate that the small compounds we identified as potential regulators do inhibit the generation of reactive oxidative species in *Arabidopsis* in response to specific stressors, like salt. These compounds are also effective in regulating salt stress responses in a wide variety of crop plants including tomato, beans, and pepper. Finding the genetic mechanisms that regulate environmental stress responses in plants has high relevance to studies of ecological genetics. This work is also important for developing plants suited for revegetation of degraded areas and agriculture in marginal environments.

#### **40. Soil microbial metabolism of carbon and nitrogen in urban and rural forests**

**Elizabeth Kulka, University of Maryland**

**Marla S. McIntosh, University of Maryland**

**Stephanie A. Yarwood, University of Maryland**

**Carmen Tartera, Food and Drug Administration**

Urban and rural forests have experienced historically different levels of temperature and CO<sub>2</sub>. The climate differences between these forests may result in soil microbial communities which have adapted to these environments and are metabolically different as a result. A change in the carbon/nitrogen metabolism of the microbial community, in turn, may affect the carbon and nitrogen cycles of these forests. Specifically it may affect the rate at which carbon and nitrogen are cycled, as well as the magnitude of inputs, outputs, and stored carbon and nitrogen components in these systems.

This study examined the general structure of three urban and three rural forest soil microbial communities in the Baltimore Metropolitan Area using DNA Q-PCR, and examined the carbon and nitrogen metabolism of the forest soil communities using Biolog Ecoplates™ and PM3b plates. The initial hypothesis was that there would be higher rates of carbon and nitrogen metabolism in urban than in rural forests. This is a preliminary study, and will be further elaborated by examining the microbial biomass carbon/nitrogen, microbial respiration rates of these soils, as well as conducting greenhouse experiments with controlled CO<sub>2</sub> and temperature treatments mimicking levels expected in 2050.

#### **41. The consequences of diversity on ecosystem stability: Testing Elton in microcosms**

**Stephanie Clements, Roanoke College**

**Rachel Collins, Roanoke College**

Elton predicted that an ecosystem's stability increases as the species diversity increases. One such test of stability is a system's ability to resist an invader. We tested the hypothesis that as diversity increases, the capability of systems to be invaded by a top predator would decrease. We established multi-trophic level microcosm communities of microscopic eukaryotes and bacteria. We tested two independent variables: three levels of diversity (4, 7, or 13 species) and top-predator/ invader identity (either *Daphnia* or *Gammarus*). Our response variables were the persistence of the invader and the abundance and richness of the photosynthetic organisms. We found that top-predators, regardless of whether they were the invader, had low survival especially in the low diversity treatments. However, survivorship of these top

predators increased when they were added after communities matured. The mechanism through which the effect of diversity was operating was likely species-specific attributes of community members and not anything inherent in diversity itself (such as biotic resistance). Understanding the mechanisms through which diversity controls system dynamics in microcosms can help us understand natural systems where manipulating mechanistic drivers is not possible.

**42. Water quality improvements in Lake Placida following installation of a new dam**  
**Brandon Costik, Elizabethtown College**  
**Jeffrey Royer, Elizabethtown College**  
**Thomas Murray, Elizabethtown College**

Lake Placida is a eutrophic lake on the campus of Elizabethtown College with a history of non-point source and sediment loading from its drainage basin. A restoration project in 2002 resulted in the creation of upstream wetlands, enhanced riparian buffers and littoral zone plantings. The replacement of the outlet dam in 2013 resulted in a second restoration effort to enhance both littoral zone plantings as well as the fish population. We report the results of water quality monitoring conducted in the fall of 2013. Weekly samples of nitrate, phosphate, ammonium, oxygen, temperature and pH and conductivity were collected at both the lake outlet and its primary inlet stream. In addition, vertical profiles of all variables were collected until the lake was completely mixing. As in past monitoring efforts, nitrate levels are lower in the lake outlet compared to the lake inlet. Phosphorus levels and ammonia levels remained high however, possibly due to release from the sediments which had been exposed during the construction of the dam. Water column transparency was high, much higher than in the past, perhaps indicating that despite the high phosphorus levels, the newly planted littoral zone and its epiphytes were helping to improve the quality of water in the lake. Sampling is continuing this spring and it is hoped that the initial improvements observed will continue.

**43. Plant Chemical Defenses: Allelopathy in the plumeless thistle**  
**Kristina Borst, St. Mary's College of Maryland**

Thistle species are known for their distinct spikey appearance, an added protection against herbivory. With proportionally more noxious weed species than other flowering plant genera, the genus *Carduus* is of interest in assessing how its species have become such great invaders. The plumeless thistle *Carduus acanthoides* decreases plant diversity, inhibiting the growth of neighboring plants, favoring their own offspring's survival. Allelopathy, a chemical defense released by plants that inhibits the growth of neighboring plant species, is thought to be partially responsible for these effects. There is little information on the method and location of chemical excretion or on the allelochemical used by *C. acanthoides* in this process. We investigated whether *C. acanthoides* appeared to have allelopathic effects and which parts of the plant might be responsible for this. A total of three experiments were conducted. The first experiment involved growing target species, *Trifolium repens* and *Chenopodium album*, in the presence of either thistle or the control *Lactuca sativa*. In the second experiment dried root and foliage samples of *C. acanthoides* and *L. sativa* were mixed in with the soil of target species without the experimental plant present. Height of target species(cm) was recorded in determining growth. The last experiment tested effect of thistle extract, via 12 hr soxhlet extraction in ethanol, on seed germination in the target species over a week. We found that thistle extract, inhibited seed germination in both species

(P0.01). This suggests the presence of an inhibitory chemical within *C. acanthoides*. Results of both greenhouse experiments exhibited no significant difference in the effect of *L. sativa* compared to *C. acanthoides* on plant growth (P0.05). Further study would aim to isolate the chemical and test the concentration at which said chemical becomes inhibitory to other species as well as improve upon both greenhouse experiments. This research has implications for the management of this invasive species.

**44. Solitary Turbines and Bats: Preliminary Results from a Case Study in Lewes, Delaware**

**Kimmi Swift, Delaware State University**

**Kevina Vulinec, Delaware State University**

**Megan Wallrichs, Delaware State University**

**Jeffrey Buler, University of Delaware**

**Greg Shriver, University of Delaware**

We are conducting a post-construction assessment of bat activity at a solitary wind turbine located along the shoreline near the Delaware Bay and Atlantic Ocean in Lewes, Delaware. For this initial report, we present the preliminary results from the 2012-2013 flight/migratory season. Our objectives were to determine if the turbine is an attractant/repellent for bats, assess the turbine's impact on local and migratory bats by monitoring bat activity, and examine correlations between turbine rotation, bat activity, and bat mortality. To measure bat activity, we set two Wildlife Acoustics SongMeter SM2BAT 384Khz passive recorders at similar heights near the turbine: one recorder 15 m away from the turbine and the second 200 m away. We analyzed calls and classified species with Sonobat v3.2.0. We also conducted carcass searches during the flight period using standardized protocols. During 2012 we recorded 7700 passes at the near detector and 1493 passes at the far detector; fatalities totaled 32 for the year with the majority occurring after an extended shutdown of the turbine during July. Passes for the 2013 season totaled 1143 at the near detector and 573 at the far detector. From July-October 2013 bimonthly curtailment protocols were instituted with a total of 23 fatalities for the season. Our data suggest a potential for mitigation through limited curtailment.

**45. The effect of forest composition and caddisfly larvae on vernal pond communities**

**Katie Seymore, Shippensburg University**

**Tim Maret, Shippensburg University**

Red maple trees are overtaking normally oak dominated eastern deciduous forests, which may alter the leaf litter dynamics in forested wetlands. Previous research has demonstrated that leaf litter differences influence the growth and survival of larval caddisflies, important shredders in vernal pond communities. We conducted a mesocosm experiment investigating how the shift in leaf litter and presence/absence of caddisfly larvae affected vernal pond food webs. Our results indicate that the shift in leaf substrate type and the influence of caddisflies affected the growth and metamorphosis of amphibian larvae. Maple leaves processed by caddisflies yielded higher total biomass of wood frogs than did oak leaves or either leaf type in the absence of the detritivore. The rate of survival to metamorphosis was also greater in the presence of the shredder. These results highlight how changing forest composition can impact associated wetland communities.

**46. Population genetic diversity and ecological invasion**

**Megan Wyles, The College of New Jersey**

**Brian Giacobelli, The College of New Jersey**

**Michael Readinger, The College of New Jersey**

**Angel Lugo, The College of New Jersey**

**Janet A. Morrison, The College of New Jersey**

Biological invasion is cause for great concern ecologically as a major cause of decreased biodiversity at the global scale. In order to better understand the processes that facilitate invasion, we conducted a dual study of *Andropogon virginicus*, a perennial bunchgrass that is native to the eastern United States, but invasive in Hawaii and naturalized in California. We asked whether population genetic diversity plays a role in the invasiveness of this plant. We used ISSR genetic fingerprinting to assess whether four *Andropogon virginicus* populations from Hawaii and four populations from California have levels of genetic diversity that are higher, lower, or equivalent to those of four native plant populations. We found that the diversity of non-native populations is similar to that of the native populations. We also conducted an experimental greenhouse study on *A. virginicus* to test the hypothesis that population success in a heterogeneous, novel environment is related to population genetic diversity. Again, we saw no significant differences in the ability of experimental plant population to thrive based on its genetic diversity. Taken together, our results illustrate that population-level genetic diversity does not seem to be a determining factor in the ability of *Andropogon virginicus* to become widespread and invasive.

**47. Wetland restoration affects soil microbial community composition and functional capacity**

**Christine Prasse, University of Maryland**

**Andrew H. Baldwin, University of Maryland**

**Stephanie A. Yarwood, University of Maryland**

Soil microorganisms are central to wetland biogeochemical cycling, but wetland restoration effects on microbial community composition and function are not well understood. Previous research suggests restored wetland soils differ significantly in physical and chemical properties from their natural counterparts even when plant community composition is similar. We investigated plant-microbe relationships in restored and natural tidal freshwater wetlands from two tributaries of the Chesapeake Bay. Soil samples were collected from the root zone of *Typha latifolia*, *Phragmites australis*, *Peltandra virginica*, and *Lythrum salicaria*. Soil microbial composition and seven functional genes, representing nitrification, denitrification, methanogenesis, and methane oxidation, were evaluated. This study reveals restoration method and edaphic features may override the influence of plant species on microbial communities and microbial communities in restored wetlands can differ from those of natural wetlands for many years.

**48. Investigation of Bacterial and Archaeal Community Structure and Activity in an Incubated Oxisol and Mollisol**

**Glade Dlott, University of Maryland**

**Jude Maul, Beltsville Agricultural Research Center, USDA ARS**

**Jeffrey Buyer, Beltsville Agricultural Research Center, USDA ARS**

**Stephanie A. Yarwood, University of Maryland**

Communities of bacteria and archaea in soils have been studied intensely in the last decade, but the degree to which microbial community dynamics affect large-scale ecologic function is unclear. Recent studies have suggested that microbial communities are not always resistant to disturbance, and that certain bacteria (i.e. Acidobacteria) may generally share an ecological niche at high taxonomic rank, up to the phylum level. This would suggest that changes in the relative proportions of these taxa in the microbial community may have functional relevance. However, most studies of community structure use DNA, rather than rRNA, to assign taxonomy and construct phylogenetic trees. This does not necessarily measure the active soil microbial community, as many soil microbes may persist in dormant forms, and DNA is potentially stable in soils over a long time period. In order to test the functional coherence of different taxonomic levels of soil prokaryotes, we extracted DNA and rRNA from microbes in different soils incubated for one year with varying carbon and moisture availability. Microbes identified by sequencing DNA coding for 16S rRNA were assumed to represent the overall microbial community, and those identified by sequencing transcripts of 16S rRNA itself were assumed to represent only the active subset of the community. Total and active communities diverged in all samples, and distinct communities developed according to soil type and incubation conditions. By further studying the ratios of active to total microbial taxa across these stable communities, we may gain further insight into the functional coherence of these taxa.

**49. The role of human legacies on the assembly of urban plant communities**

**Anna Johnson, UMBC**

**Christopher M. Swan, UMBC**

Biotic homogenization is defined as the increasing similarity of species composition in multiple locations, as a consequence of increasing abundance of common or invasive species, combined with losses of rarer and endemic species. Urban ecosystems are hypothesized to be especially prone to biotic homogenization. Patterns of functional and phylogenetic homogenization of plant diversity independent of changes in species richness, at the scale of entire cities, are well established. However, fewer studies have investigated how shifts in the composition of urban species pools may alter spatial variation in community assembly within cities.

We surveyed herbaceous plant species identity and abundance in 31 unmanaged vacant lots, located in a densely-urban neighborhood in Baltimore, Maryland, USA and compared taxonomic, functional and phylogenetic diversity between sections of the lot where a residential building was once located (building footprint), and the area that was originally the garden or backyard (remnant garden). Local variation in the legacy of human influence on plant community assemblage structure was hypothesized to lead to compositional divergence of contemporary communities, as well as differences in community diversity, despite a regionally homogenized species pool. We uncovered significant divergence between these

“human legacy” groups in composition and diversity, as measured by taxonomic, functional and phylogenetic metrics. We discuss how local variation in human legacies of management can drive differential patterns of herbaceous plant community assembly, reducing the effect of regional-scale biotic homogenization at both the local, individual lot scale and at the scale of turnover between lots.

**50. Fine-scale spatial variation in the impacts of mangrove top predators**

**Alexander Forde, University of Maryland**

**Daniel Gruner, University of Maryland**

Top predators can play a disproportional role in regulating community structure and ecosystem function through direct and indirect impacts that cascade through interaction webs. The strength and reach of these cascades are often context dependent, covarying with habitat structural complexity, plant productivity, traits of intermediate predators, and interaction network architecture. We investigated ecological impacts of top predators (insectivorous birds) on arboreal arthropod communities in mangrove forests and the extent to which they depend on local productivity and structural shelter. We experimentally prevented or allowed birds access to small red mangrove trees (*Rhizophora mangle*) using netting in two experiments on a 92ha mangrove island of the coast of Belize. In one experiment we manipulated predator access to individual trees with exclosures (approx. 1.5m on all sides) in adjacent areas of high and low nutrient availability at multiple sites. In the second experiment we varied structural shelter on trees by adding empty flannel-moth cocoons, which are abundant and naturally colonized by arthropods, especially spiders and ants. Data were collected on arthropod communities, plant growth and herbivory repeatedly over >1 year.

**51. Native tree seedlings and over-abundant white-tailed deer in the metropolitan forest**

**Nicole Mallotides, Department of Biology, The College of New Jersey**

**Janet A. Morrison, Department of Biology, The College of New Jersey**

Temperate, deciduous, metropolitan forests are essential ecosystems for natural biodiversity and ecosystem services, and they also serve as a way for dense urban-suburban human populations to connect with nature. These forests, however, are threatened by overabundant deer, which can have negative effects on the future forest due to lack of seedling recruitment of a diversity of tree species. We examined native tree seedling abundance and related it to the level of deer pressure in three forests that have high but differing deer pressure. Surprisingly, we found that in the forest with greatest chronic deer pressure (Rosedale) there was significantly higher mean percent cover of native tree seedlings, which we measured in forty 16 m<sup>2</sup> plots per forest. Also, Rosedale had the lowest current deer pressure, which we quantified with browse signs on native woody plants below 1.4 m. The shrub layer is almost nonexistent in Rosedale, offering little food or shelter to deer, so they may tend to avoid it currently, allowing tree seedling cover to increase. Tree seedling cover in all three forests was dominated mostly by the same 4-5 deer-resistant species, but one very resistant species, *Acer saccharum* (sugar maple), was an abundant seedling only in Rosedale, even though it also is an abundant canopy species in one of the other forests. We hypothesize that very severe, chronic deer pressure in metropolitan forests eventually results in low deer visitation, allowing the remaining deer-resistant tree seedlings an escape from current deer herbivory.



**52. Variation in the abundance of a spring ephemeral wildflower in deer-ridden suburban forests**

**Shane Wilkins, Department of Biology, The College of New Jersey**

**Janet A. Morrison, Department of Biology, The College of New Jersey**

The abundance of spring ephemeral wildflowers varies widely among suburban forests. We studied wildflower populations, including *Claytonia virginica* (spring beauties), within six deciduous forests in central New Jersey. The forests are in a region with over-abundant white-tailed deer (21 deer/km<sup>2</sup>), yet abundance of deer resistant *C. virginica* varied dramatically among them. We quantified the forests' levels of chronic deer pressure by measuring native shrub layer cover, near the end of the 2012 growing season, and current deer pressure with browse signs on native woody plants. We measured percent cover of *C. virginica* in 40 plots/forest in Spring 2012 and 2013. The plant was nearly absent from the three forests with lower chronic deer pressure, but was abundant in the forests with higher chronic deer pressure. Among the latter, *C. virginica* cover varied significantly in 2012, with greater cover in the forest with the greatest chronic pressure, but was more similar (greater in the other two forests) in 2013. Forests with severe deer pressure contain almost no shrub layer, leaving spring ephemerals as a primary food source in the early spring, which may allow for competitive release of wildflower species that are deer resistant. In heavily deer-ridden forests with few green plant species in the early spring, deer may even eat resistant plants. We found that forests with greater chronic deer pressure (lower shrub cover) also had lower current browse pressure, so any browsing on *C. virginicus* was also likely to be lower in these forests.

**53. Earthworm species composition in pastures and forests: The role of functional diversity**

**Elsa Wieboldt, Roanoke College**

**Rachel Collins, Roanoke College**

Earthworms are ecosystem engineers that alter nutrient cycling and productivity in lands used for food and timber production. Thus, earthworm abundance and species composition can effect food and timber production. We examined how earthworm community composition differs between adjacent forests and pastures in Southwestern Virginia at five sites with paired pastures and woodlots. We hypothesized that pasture and forest earthworm communities will differ predictably based on functional feeding groups (i.e., niche). Specifically we predicted that 1) in pastures anecic species will be more abundant and epigeic and edogeic species will be less abundant because soil compaction will negatively impact surface habitat; 2) in forests all three niches will be occupied; and 3) species diversity will differ more between pastures and forest of the same site than among different pastures or forests. Earthworm communities in all pasture and forest sites were comprised exclusively of non-native species. Counter to our predictions, we found only epigeic and edogeic species in the pastures and we found no differences in species diversity between or among habitats. In support of our predictions, we found all three niches were occupied in forest habitats. Taken together, our results suggest that through functional diversity, non-native earthworm communities are responding to physical attributes of habitats and likely altering ecosystem processes in these systems.

**54. Mass changes of six migratory passerine species during stopover at a small, isolated urban patch**

**Julián Rondón-Rivera, Rutgers-Newark, The State University of New Jersey**

**Michael Newhouse, NJ Meadowlands Commission**

**Claus Holzapfel, Rutgers-Newark, The State University of New Jersey**

We aim at understanding the role that small, scattered patches of vegetation within urban spaces have in bird migration. As urbanization accelerates, the presence of suitable habitats within an urban landscape can be critical for the survival of many migratory birds. It is possible that potential urban stopovers are been overlooked because of their small size. Therefore, the study is focused on a 0.3-acre wooded plot in Newark, NJ (Rutgers Campus). We investigate habitat selection and stopover duration in addition to birds' weight condition. During fall and spring of 2010-2013, 2659 migratory birds were banded and measurements of body conditions were obtained. Nets were deployed almost daily from early April to late May and early September to mid-November and recaptured birds were re-weighed and their fat deposits assessed. Six species yielded 187 recaptures which corresponds to a recapture rate of 7% (5-47%). The average estimated stay on the site was 1-9 days. These results might indicate that the urban habitat patch indeed acts as stopover site. Analysis of body mass indicates contrasting refueling performances amongst the six species. Gray Catbird, Hermit Thrush, Ovenbird, Swamp Sparrow and White-throated Sparrow are ground-foragers and in average gained in body weight during the estimated stopover time in spring and fall. On the contrary, Common Yellowthroat, a mid-canopy forager, showed a decrease in body weight during spring and fall stopovers at the urban patch. These findings suggest that certain foraging guilds may be able to benefit from isolated urban stopover while others might not.

**55. Effects of decreased freshwater input on east Louisiana marsh phenology**

**Yu Mo, Department of Environmental Science and Technology, University of Maryland  
College Park**

**Joyce Alex Riter, Department of Environmental Science and Technology, University of  
Maryland College Park**

**Michael Kearney, Department of Environmental Science and Technology, University of  
Maryland College Park**

Louisiana coastal wetlands consist of over 14,000 km<sup>2</sup> marsh. Within the coastal zone, along the gradients of water salinity, soil density, and land elevation, there are 4 major marshes: freshwater marsh, intermediate marsh, brackish marsh, and saline marsh. In 1999 and 2000, Louisiana marsh experienced the lowest freshwater input in over 40 years (1960-2000). To study the impact of decreased freshwater input on marsh phenology, we compared the phenologies of 4 marshes for years of 1999 and 2000 to that for year of 2007 (a normal year). The satellite-derived Normalized Difference Vegetation Index (NDVI) was collected as phenological records by Landsat satellite, which has 30 m spatial resolution and 16 day temporal resolution. Then they were fitted into a Gaussian function and a logistic function. Statistical analysis of the two algorithms used a SAS nonlinear mixed model. It was shown that the 4 marshes had different phenological patterns. Of all 3 years, freshwater marshes had the highest peak NDVI and highest integrated NDVI value, followed by intermediate, brackish, and saline marsh. In 2007, the date of peak NDVI occurred in July for all 4 marsh types. In contrasts, in 1999 and 2000, the dates of peak NDVI in freshwater marshes and intermediate marshes were delayed until August, while that of saline marsh

occurred in later in September. These result suggested a strong association between date of peak NDVI and fresh water input, and, moreover, indicate the potential for marsh phenological changes as global sea-level rise causes marine intrusion.

**56. Stormwater runoff from a sloped greenroof located in the Mid-Atlantic region of North America**

**Scott Tjaden, Department of Environmental Science and Technology, University of Maryland College Park**

**David Tilley, Department of Environmental Science and Technology, University of Maryland College Park**

Vegetated extensive greenroofs can reduce peak runoff rates during storm events. As the desire to install greenroofs expands beyond roofs with little slope to those with more steep slopes, like often found on residential homes, there is a need to understand how slope affects runoff. WaterShed, the University of Maryland's winning entry in the 2011 U.S. Department of Energy Solar Decathlon competition, integrated solar photovoltaics and energy efficient appliances with many living technologies into the design of the house to improve its environmental sustainability and energy consumption. The house, owned by a regional electric power utility, now serves as a showcase on how residential homes can positively influence their surroundings. The living technologies include vegetated green roofs, green walls, treatment wetlands, and bio-swales. The objective of our research was to compare the runoff between the sloped green roof and the adjacent sloped photovoltaic roof on WaterShed. This runoff will be measured by a custom designed flume capturing the runoff from each roof and return a flow rate. The resulting data will produce hydrographs which will allow a comparison of flow rates and total runoff between the two sloped roofs. This data is critical to not only the runoff analysis between the two type of roofs, but also providing an input to an evapotranspiration (ET) model for the green roof. How these living technologies perform over time is crucial for both ensuring regulatory standards are met and providing feedback for future improvements to the design and technology itself.

# Sunday Field Trip

We will travel from Regents Garage at UMD to Smithsonian Environmental Research Center (SERC), 647 Contees Wharf Rd, Edgewater, MD 21037

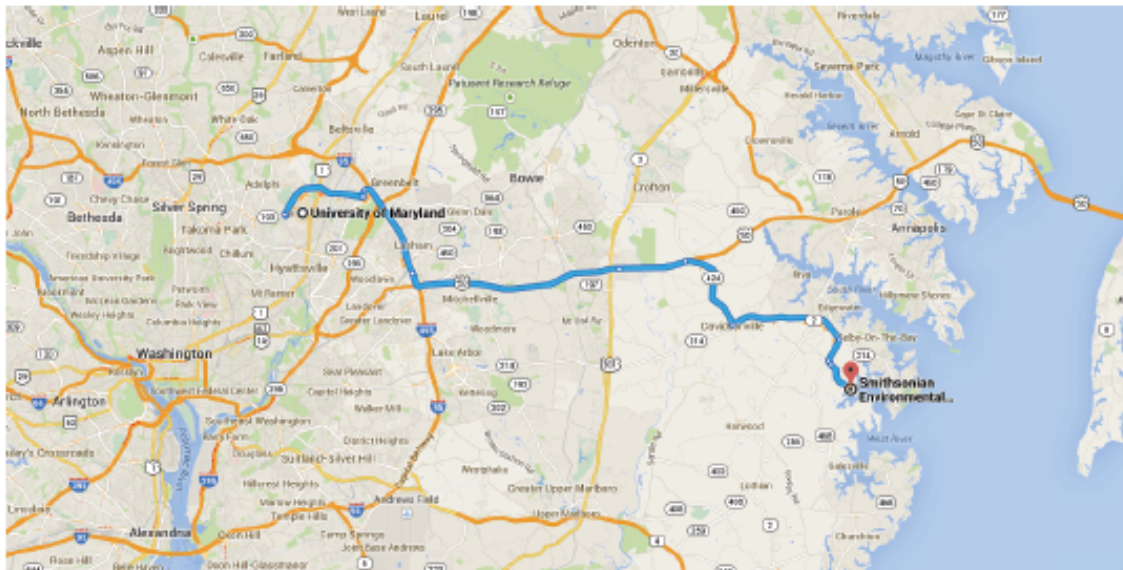
Vans will leave to caravan to SERC 8 am Sunday morning

## Map and directions



Drive 30.3 mi, 40 min

Directions from University of Maryland to Smithsonian Environmental Research Center



○ University of Maryland  
College Park, MD 20742

Take MD-193 E, I-495 S/I-95 S, US-50 E, US-301 N, ... and MD-214 E/W Central Ave to Contees Wharf Ln in 1

28.7 mi / 35 min

- ↑ 1. Head west on Campus Dr toward Adelphi Rd  
197 ft
- ↘ 2. Slight right onto Adelphi Rd  
197 ft
- ↘ 3. Slight right onto MD-193 E/University Blvd E  
Continue to follow MD-193 E  
3.7 mi
- ↙ 4. Turn left to merge onto MD-201 N/Kenilworth Ave toward I-95  
0.3 mi

- ↑
 5. Merge onto I-495 S/I-95 S via the ramp to Andrews AFB/Richmond  


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4.0 mi
- ↘
 6. Take exit 19A to merge onto US-50 E toward Annapolis  


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8.7 mi
- ↑
 7. Continue onto US-301 N/US-50 E  


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2.7 mi
- ↘
 8. Take exit 16 to merge onto MD-424 S/Davidsonville Rd  


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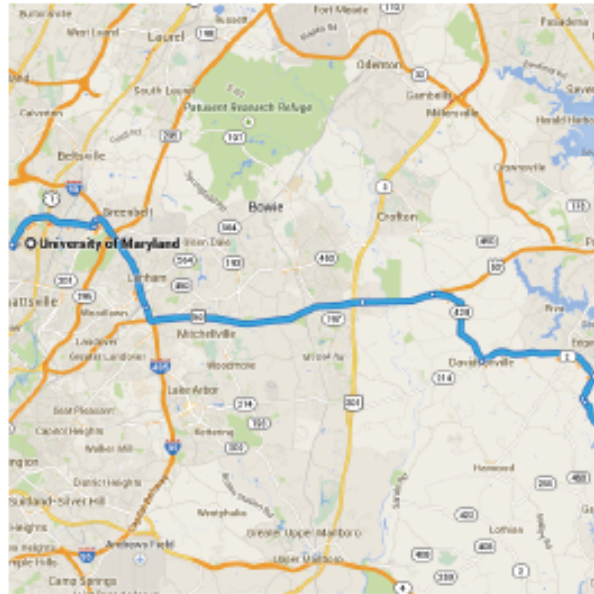
3.7 mi
- ↙
 9. Turn left onto MD-214 E/W Central Ave  


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4.7 mi
- ↘
 10. Turn right onto MD-468 E/Muddy Creek Rd  


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1.0 mi



**Drive to Contees Wharf Rd**

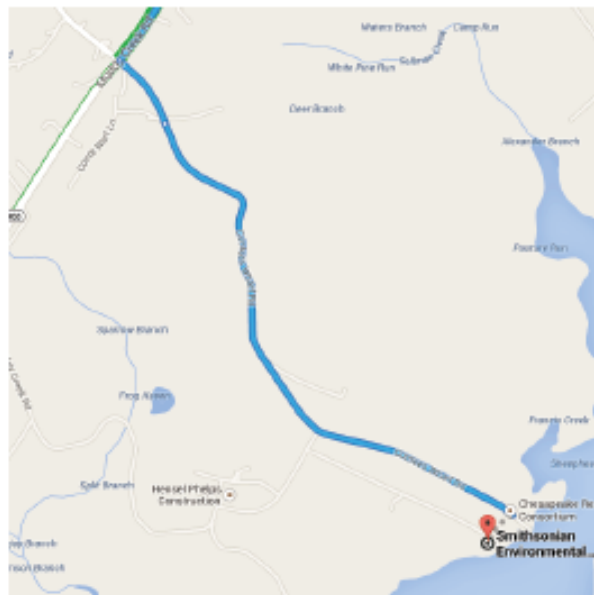
- 1.6 mi / 5 min
- ↙
 11. Turn left onto Contees Wharf Ln  


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0.2 mi
- ↑
 12. Continue onto Contees Wharf Rd  
 Destination will be on the right  


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1.4 mi



📍
**Smithsonian Environmental Research Center**  
 647 Contees Wharf Rd, Edgewater, MD 21037

## **Agenda at SERC**

9:00 am Meet at the new building (van or personal vehicles parks in the Visitor's lot)

9-10 am Introduction to the history of SERC, overview of the research– Dennis

Overview (with slide show) of the large multi-institutional NOAA funded project on assessing and predicting impacts and stressors on the land-water interface- Chris

10:00 am Get into vans (those who drove themselves will ride in SERC vans)

10:00-10:45 am Drive through back road, visit upland ecosystem

Stops: Weir, beaver pond; long term monitoring – Dennis

Tower; tree monitoring, soils and earthworm invasion, NEON– Dennis and Kathy

10-45-11:00 am Leave SERC at back gate, drive to GCERW site

11:00-noon: On the way to GREW short stop at BiodiversiTRee site – Kathy

The rest is on the marsh boardwalk, talk about CO2 enrichment experiment, sea level rise experiment, Phragmites invasion, etc– Dennis and Chris

At this point the tour is over. If the group wants to have lunch, the GCREW site has a nice porch, and the view is wonderful there.

Return to College Park

*Thank you to our gratuitous hosts Dr. Chris Patrick, Dr. Dennis Whigham, and Dr. Katalin Szlavecz!!*