AGENDA
BES 24th Annual Meeting
October 13-14, 2022
https://baltimoreecosystemstudy.org/

Location:
1st Floor, Auditorium
Merrick School of Business
11 West Mount Royal Avenue, Baltimore, MD, 21201
Google Maps Link

The BES Annual meeting brings together researchers, practitioners, and students from the Baltimore community and beyond who are interested in Baltimore as a social-ecological system and its sustainability, equity, and resilience.

Day 1 Thursday, October 13th

9:10-9:20 Welcome and Opening Remarks, Chris Swan, UMBC

9:20-9:30 Karl Steiner, Vice President for Research, UMBC

9:30-10:00 Introduction, Dan Coy, new Chief of Forestry, Baltimore City

10:00-11:00 Session 1 (Meghan Avolio, moderator)

Stewardship Mapping and Assessment Project: Results from 2011 and 2018
Dexter Locke, USDA Forest Service; Nancy F Sonti, USDA Forest Service; J. Morgan Grove, USDA Forest Service; Sarah Carpe, UMBC; Molly Radwell, Johns Hopkins University

Environmental stewardship groups conserve, manage, monitor, transform, educate, and advocate about their local environments: including land, air, water, toxics, and energy issues. The USDA Forest Service and many partners have been studying local environmental stewardship groups in Baltimore and a dozen other cities. This presentation reports briefly on the history of stewardship mapping in Baltimore and provides an update on the most recently completed survey. Specifically organizational characteristics (group attributes), where they physically work (geographies), and who they work with (their networks) from a 2018 survey will be shared. Changes from 2011 will also be discussed. Collectively these three domains of data provide a state of the stewardship in Baltimore City, providing unique opportunities for research and practice.

Changing probability of extreme rainfall in the Baltimore metropolitan region: some findings from a 22-year radar rainfall record

Andrew Miller, UMBC; James A. Smith, Princeton University; Mary Lynn Baeck, Princeton University; Elijah Clagett, Carnegie-Mellon University; Macawan Luu, UMBC

We report analyses of a two-decade radar rainfall data set with spatial resolution of 1 km2 and temporal resolution of 15 minutes over a 4,900-km2domain in the Baltimore-Washington metropolitan area. We developed bias-corrected radar rainfall fields using observations from the Sterling, Virginia WSR-88D radar and a network of rain gages. The data set covers the period between 2000 and 2021, focusing on the warm season (April – September). The period spans the transition from conventional reflectivity-based estimates of rainfall to estimates based on polarimetric fields. An overlap period from 2012-2015 is used to assess the impacts of changing measurement technologies on extreme rainfall estimates. We use a peaks-over-threshold approach grounded in the Gumbel distribution to examine rainfall extremes at multiple durations for each pixel in the domain. We map the spatial distribution of estimated rainfall depths for specified durations and recurrence intervals, and we use nonstationary frequency analysis to estimate the percent change from 2000 to 2021. We observe an increasing trend in the rainfall totals as well as increasing frequency of rainfall accumulations exceeding threshold values. We also observe complex spatial patterns in rainfall amounts and trends over time. Analysis of annual maximum streamflow records and frequency of discharge peaks over threshold from watersheds within the study domain reveal trends that mimic the trends derived from corresponding rainfall estimates over the same time period.

Population genetic structure of weedy plant species in cities

Ava Hoffman, University of Maryland, College Park; Jenny Cocciardi, Johns Hopkins University; Meghan Avolio, Johns Hopkins University

Cities can be a strong driver of evolution for organisms inhabiting cities. Impervious surfaces can block gene flow among populations while novel abiotic conditions serve as selective pressures, such as the urban heat island effect. We explored the patterns of urban evolution by performing reduced representation genome sequencing of more than 1700 leaf tissue samples from six weedy plant species across five cities, including Baltimore. We applied a recent technique (quaddRAD) which can detect and remove sequencing duplication and allow for greater numbers of samples to be sequenced at once. We then investigated genetic structure emerging from polymorphic loci and examined evidence for isolation by resistance and isolation by environment by considering the local and surrounding urban landscape derived from the National Land

Cover Database. Preliminary results suggest that quaddRAD is a viable method that can be applied to several weedy plant species collected from different urban locations. We also find preliminary evidence that population genetic structure differs among species and across cities, indicating that urban evolution can follow different trajectories. These results will serve to broaden our understanding of the effects of urban environments on genomic structure in rapidly evolving weedy plant species.

Cutting the Vines of White Supremacy: Urban Ecology and the Environmental Humanities

McKay Jenkins, University of Delaware; Terris King, Temple X and UMBC

The Stillmeadow Peace Park, a joint reforestation project overseen by the congregation of a Black Baltimore Church, the U.S. Forest Service, and the University of Delaware, has become a hub of forest ecology research, clinical restoration training, and environmental education for students from elementary school to graduate school. With the help of thousands of hours of student labor, the Stillmeadow project has mitigated hundreds of trees devasted by invasive insects and vines; planted some 4,000 native trees; and built hiking trails, meditation gardens and vegetable gardens in a 10-acre forest on church property. The project has become a national model for inter-agency urban environmental restoration; won an award as one of the Forest Service's top national community service projects; and been featured in regional and national publications like The Baltimore Sun, The Chesapeake Bay Journal and The Christian Science Monitor. Stillmeadow has also become a powerful place in which to teach environmental justice and the complex history of land use and race. McKay Jenkins, director of Environmental Humanities at the University of Delaware for the past 27 years, and Terris King, a veteran kindergarten teacher, UMBC graduate student and director of Baltimore's Temple X Schools, will discuss their collaborative multi-year effort teaching young people constructive ways to engage with challenging American history through their encounters in an urban forest.

11:00-11:15 Break

11:15-12:15 Session 2 (Dexter Locke, moderator)

The Baltimore Neighborhood Indicators Alliance as a Platform for Social-Ecological Data and Engagement

Seema Iyer, University of Baltimore

Modeling Multi-Scale Influences on Household Lawncare Decisions: Formal and Informal Neighborhood Effects on Fertilizer Use in the Baltimore Metro Region

David Newburn, University of Maryland, College Parl; Robert Johnston, Clark University; Colin Polsky, Florida Atlantic University; Haoluan Wang, Tom Ndebele, Clark University

Residential lawncare is commonly understood to be a multi-scale process. Among other lawncare behaviors, the intensity of a household's fertilizing may be influenced by social and geographic factors reflected in both formal institutions (e.g., homeowners associations) and informal socio-cultural norms that operate across multiple scales. This article builds on recent advances in the lawncare literature by developing a statistical model of lawncare behavior that explicitly accounts for household-scale and neighborhood-scale factors influencing fertilizer use, with the latter effect parsed into informal and formal components. We created a novel methodology to estimate informal neighborhood effects which are quantified for each surveyed household using property characteristics of the parcel relative to those of surrounding parcels. The model is estimated for two sequenced lawncare decisions faced by households—initial binary decision on whether to fertilize, and subsequent frequency decision on the number of applications for those who fertilize. The model is estimated using household survey data conducted in 2019 for a random sample of single-family homeowners in Baltimore County and City, with over 2,500 homeowners responding to the survey. Our model results indicate that informal neighborhood effects influence the initial binary fertilizer decision but not the subsequent fertilizing frequency decision. Meanwhile, formal neighborhood effects influence both decision stages. Findings further suggest that micro-level household characteristics can have different effects on the two fertilizer decisions, suggesting the importance of disaggregating the model into separate decisions on whether to fertilize and fertilizer frequency.

21st Century Cities Initiative and the Baltimore Area Survey

Mike Bader, Johns Hopkins University

Project VITAL: Vacant lot Improvement to Transform Adolescent Lives

Kristin Mmari, Johns Hopkins School of Public Health (JHSPH); Beth Marshall (JHSPH); Megan Latshaw (JHSPH); Anton Kvit (JHSPH); Rebecca Fix (JHSPH); Ross Hatton (JHSPH); Deborah Odih (JHSPH); Cara Wynchgram (JHSPH); Jamie Harding, Center for Livable Future; Morgan Grove, USDA Forest Service; Dexter Locke, USDA Forest Service; Michelle Kondo, USDA Forest Service; Seema Iyer, Baltimore Neighborhood Indicator Alliance; Cheryl Knott, Baltimore Neighborhood

Indicator Alliance; Kimberly Knox, Baltimore City Office of Sustainability, Abby Cocke Baltimore City Office of Sustainability; Katie Lautar, Baltimore Green Space; Laura Connelly, Parks and People Foundation; Naomi Sachs, University of Maryland, College Park; John Ciekot, Civics Works; Meghan Hazer, Department of Public Works; Natasha Neale, Environmental Control Board/BMORE Beautiful; Brandi Welsh, Environmental Control Board

12:15-1:30 Lunch

1:30-2:30 Posters

The Impact of Stream Restoration on Seed Dispersal Across Floodplains

Sara Kramer, Laura Gough, and Vanessa Beauchamp, Towson Unversity

Stream restoration via floodplain reconnection is a land management practice frequently used throughout Maryland to decrease the amount of nutrients and sediment entering the Chesapeake Bay. Floodplain reconnection lowers the floodplain to increase overbank flooding, letting the water flow onto the floodplain, slowing the water velocity. We predicted that if restoration successfully increased floodplain connection, it would also result in increased dispersal of seeds onto the floodplain (hydrochory). To evaluate how floodplain reconnection stream restoration projects in Baltimore County, Maryland impact hydrochory, deposited sediment was collected from turf mats placed at fourteen streams (7 restored and 7 unrestored) throughout Baltimore County from May to August 2021. The contents of the turf mats were distributed into pots in the Towson University greenhouse and seedlings were censused as they germinated until January 2022. Hydrochory was assessed as the total number of seeds that germinated (germinants). Seedlings were identified to genus or species to determine the number of species (richness) collected on each mat. Preliminary results suggest an increase in germinants and richness at restored sites. The next steps include determining if watershed urbanization results in an increased proportion of non-native seeds being dispersed in floodwaters.

The influence of domestic artificial selection on the genetic diversity of maple trees in urban forests

Beatriz Shobe, Meghan Avolio, Johns Hopkins University

Trees are an effective tool in mitigating the effects of climate change and as a result many urban centers are focusing efforts to increase the urban tree canopy cover. As government agencies, NGO’s and non-profits supply trees to local communities, bulk

purchases are often made from local nurseries. This leads to the concern that many trees will be closely related and therefore have limited genetic diversity. The extent to which these planted trees influence the genetic diversity, biotic community structure, and resilience of urban forests remains unknown. To address this concern, I am comparing the genetic diversity of the native Acer rubrum (Red maple) and invasive Acer platanoides (Norway maple). A. platanoides cannot interbreed with local native species, whereas A. rubrum cultivars are have a native gene pool with which to interact. Trees were measured and sampled during the summer of 2021 throughout Baltimore City, Baltimore County and parts of Howard County. Traits such as DBH, overall height, and location category were recorded. Location categories included urban forests, rural forests, park trees, street trees, managed residential trees and unmanaged residential trees. In addition, genetic analysis using microsatellite genotyping with phylogenetic results are expected in Winter of 2023. Further research will assess and compare the health and associated biodiversity of the known cultivars, hybrids, and wild type trees.

Visualizing high-resolution, high-frequency stream temperature data in Dead Run watershed, Baltimore County, Maryland

Hanna L. Donovan, John J. Lagrosa IV, Claire Welty, Mary McWilliams, Andrew J. Miller, UMBC

This research develops a methodology to visualize spatiotemporal fluctuations in stream temperature in Dead Run watershed, where temperature sensors recording data every 5 minutes have been deployed every 100 m across the 16-km stream network. GIS data from the National Hydrography Dataset (NHD) and GPS coordinates of the 160 deployed temperature sensors were used to create spatial snapshots representing stream temperature at a given point in time. NHD layers were buffered and rasterized at a 1-meter pixel resolution to spatially represent discrete sensor points as sections of the stream. Inverse-distance weighted interpolation was used to estimate temperature between sensors. Temperature estimates were coded using a color ramp for visualization purposes. The creation of discrete snapshots was then automated using ModelBuilder and ArcPy within the ArcGIS framework. Resulting batches of snapshots were then sequenced using animation software for selected intervals of time. This allows for visualization of how stream temperature responds to storm runoff, groundwater inputs, and air temperature.

Characterization of hydraulic conductivity of soil and saprolite cores in Dead Run watershed, Baltimore County, Maryland

Mitchell Richards, Mary McWilliams, and Claire Welty, UMBC

To characterize geologic heterogeneity for incorporation into groundwater models, we collected soil/saprolite cores at seven hilltop locations in the headwater area of Dead Run watershed and evaluated for hydraulic conductivity (K). The lithology consists of Mount Washington Amphibolite (mafic rock) transitioning to the Potomac Group of the Fall Zone. Cores were collected using an AMS 10.2 cm-diameter steel auger bucket, in increments of about 15 cm, to depth of refusal. Soil core lengths ranged from 1.4 m to 6.3 m. Each ~1200 cm3 sample was evaluated in the laboratory to determine K using a UMBC/CUERE-designed falling-head permeameter and Hvorzlev's equation. For each of ~140 samples, 6 measurements were taken and corrected to a water temperature of 20˚C. Average K values ranged from 10^-8 to 10^-5 m/sec, with a geometric mean of 8x10^-7 m/sec and an lnK variance of 2.1. As observed at other field sites, K values were log-normally distributed. The pattern of hydraulic conductivity varied systematically with depth. K decreased by ~ 1-2 orders of magnitude to a depth of about 0.7 m. As the soil transitioned to saprolite, K values then increased by 1-2 orders of magnitude to depths of 2 - 2.5 m. For longer cores, a decrease in K values of 1-2 orders of magnitude was observed below 2.5 m, followed by further OM increases/decreases over 1-2 m depths. Results illustrate pronounced zonal heterogeneity of the soil and saprolite for this system.

Simulation of coupled groundwater-surface water interactions in the urban critical zone

Maryam Rishehri and Claire Welty, UMBC; Mahdad Talebpour, Johns Hopkins University

As part of a NSF-funded Critical Zone Collaborative Network project, we are building three-dimensional coupled flow and transport models across five study watersheds in US East Coast cities, with the ultimate objective of simulating weathering processes at the watershed scale. To establish our workflow, we first constructed a model of Dead Run watershed using ParFlow CLM. The model was gridded at 40 m in the lateral direction and variably from 0.1 m to 8 m in the vertical direction, with the total model domain spanning 6000 m x 7200 m in the horizontal and 31 m in the vertical, for a total of 405,000 model cells. Input data sets included 30-m USGS DEM, 2018 1-m Chesapeake Conservancy land cover, both resampled to 40-m model gridding, and NLDAS2 ⅛ degree meteorological forcing data. Literature values were used for permeability and porosity inputs. A test simulation was conducted at an hourly time step for 2015, with five years of spin-up run before the simulation year. Simulated streamflow

was compared to observations at six USGS gaging stations located in the watershed, at a daily time step. Using Spearman's Rho and Total Relative Bias as evaluation metrics, good agreement was shown between measured and simulated streamflow timing and magnitude.

Urban effects on saprophagous macro-arthropods

Zsolt Tóth, Institute for Soil Sciences, Centre for Agricultural Research, ELKH; Pallieter de Smedt, Ghent University; Elisabeth Hornung, University of Veterinary Medicine Budapest; Katalin Szlavecz, Johns Hopkins University

Macrodecomposers provide important ecosystem services even in human dominated habitats including urban ecosystems, but the effect of urban land conversion on their species diversity and abundance has mostly been explored at local scale. We explored species richness and abundance patterns for two major arthropod taxa, terrestrial isopods and millipedes. Here we present two types of data: 1) species diversity in urban yards in Baltimore and cities in Belgium, and 2) results of the first global meta-analysis to quantify the general response to urbanization and to reveal the underlying mechanisms. For the latter, climatic, edaphic and urban parameters as well as methods of study were used as moderators. Altogether 156 paired observations were extracted from 59 urban studies conducted between 1980 to 2020. Urbanization had a negative effect on species diversity (species richness and Shannon index) for both macroarthropod taxa. However, both the direction and strength of their abundance response varied, resulting in a neutral effect of urban disturbance on them. The key drivers influencing the urban effects on macroarthropods were mean annual temperature and precipitation, absolute minimum temperature, and length of growing season. In contrast, residential yard surveys revealed high species richness that included rare and/or endemic species. Our study also highlights the importance of sampling methods (direct sampling, sieving, extraction, and pitfall traps) in interpreting soil biodiversity data. We conclude that while our global synthesis supports the general belief that that urbanization is a threat to soil arthropods, at local scales, urban green spaces can still harbor diverse fauna and thus warrant conservation efforts.

SUSTAIN: Software Infrastructure for Transformative Urban Sustainability Research

Claire Welty and John Lagrosa, UMBC; Shrideep Pallickara, Mazdak Arabi, Sangmi Lee, Pallickara, Jay Breidt, and Sudipto Ghosh, Colorado State University; Mikhail Chester, Arizona State University; Amir Agha Kouchak, San Diego State University

National Science Foundation has invested in several strategic research efforts in the area of urban sustainability, all of which generate, collect, and manage large volumes of spatiotemporal data. Voluminous datasets are also made available by governmental agencies and NGOs in domains such as climate, ecology, health, and census. These data can spur exploration of new questions and hypotheses, particularly across traditionally disparate disciplines, and offer unprecedented opportunities for discovery and innovation. However, the data are encoded in diverse formats and managed using a multiplicity of data management frameworks -- all contributing to a Balkanization of the observational space that inhibits discovery. The goal of this project, "SUSTAIN" (Software for Urban Sustainability to Tailor Analyses over Interconnected Networks), is to facilitate and accelerate discovery by significantly alleviating data-induced inefficiencies. SUSTAIN targets transformational capabilities for feature space exploration, hypotheses formulation, and model creation, and validation over voluminous, high-dimensional spatiotemporal data. SUSTAIN accomplishes these interconnected goals by enabling holistic visibility of the observational space, interactive visualizations of multidimensional information spaces using overlays, fast evaluation of expressive queries tailored to the needs of the discovery process, generation of custom exploratory datasets, and interoperation with diverse analyses software frameworks -- all of which can lead to better science. The purpose of this presentation is to provide an overview of SUSTAIN capabilities and to gauge interest of sustainability professionals in the MidAtlantic for participating in a virtual workshop to test-drive the SUSTAIN software and provide feedback to the development team.

2:30-3:30 Session 3 (Dexter Locke, moderator)

An overview of the fifth phase of research at the CAP LTER Program

Dan Childers, Arizona State University

Investigating the sensitivity and quality of running WRF-UCMs in LES mode for fine-scale simulations of urban hydrometeorological processes using Baltimore as a case study

Mahdad Talebpour, Johns Hopkins University; Claire Welty UMBC; Elie Bou-Zeid, Princeton University

To understand physical mechanisms driving fine scale hydrometeorological vulnerability across cities such as Baltimore to events like heat waves, physically realistic process-based models provide a powerful investigative tool in lieu of fine-scale observations. Moreover, advances in numerical weather prediction models have made possible fine-scale simulations of urban hydrometeorological processes across regional scales. In this study, we investigated the sensitivity and quality of fine-scale (150 m gridding)

urban simulations employing WRF with Urban Canopy Model (UCM) in LES mode (Weather Research and Forecasting Model in Large Eddy Simulation mode) using Baltimore as a case study (domain extent 97.8 km x 97.8 km). We evaluated the sensitivity of WRF's simulations of the urban heat island and land surface temperature (LST) distribution to (1) WRF's soil moisture spinup leading time (14, 8, and 5 days before analysis time) and (2) three different methods for converting National Land Cover Dataset urban categories to urban categories in WRF urban canopy models. Simulations spanned a 24-hour period August 21st, 2017, 12:00 EDT to August 22nd, 2017, 12:00 EDT. To evaluate model performance, we compared modeled LST distribution to Landsat 8 satellite LST data. Results indicate that the three simulations that used the original WRF land cover parameterization had the highest LST root mean-squared error (RSME) compared to Landsat data. While the simulation starting point had a smaller impact, scenarios starting one week before the analysis period had lower LST RSME and the spatial pattern was closer to the spatial Landsat LST distribution.

A Comparison of Benthic Communities and Water Quality in Red Run Watershed Over Two Decades of Urban Development

Nguyen Tien Anh Quach, Towson University; Susan Gresens, Towson University

The Red Run watershed was predominantly rural in 1987 and supported a naturally reproducing brook trout population. The watershed underwent extensive urban development in the 1990s, while BMPs were used to manage stormwater runoff and reestablish riparian buffers. Benthic data collected in 1987-1988 were compared with post-development data from 2009 in a paired design, to quantify the response of the benthic invertebrate community and to investigate potential causes of decline. The watershed has three sub-catchments differing in the degree of land cover change, including 1) a nature reserve (reference), 2) high-density residential housing areas, and 3) a former quarry. Results indicated 73% total increase in developed land in the watershed from 1987 to 2009. Development in the second sub-watershed also increased from 12% to 30%, while the reference sub-catchment had little further development. Concomitantly, mean chloride concentrations increased at downstream mainstem sites from 12 to 133 mg/L, but only increased from 5 to 24 mg/L in the reference sub-watershed. As a result, specific conductivity at mainstem sites doubled, whereas the reference sub-watershed had little changes. Benthic assemblages sampled in 1987 and 2009 were significantly different, as indicated by multivariate analysis of invertebrate density. Further, randomization tests on urban tolerance values and extirpation conductivity showed that several downstream, mainstem sites were significantly impacted by de-icing salts, resulting in loss of intolerant taxa. The study

demonstrated the inefficiency of reach-scale management and restoration on minimizing impacts of urban development and road salts on stream organisms.

Preliminary investigation of freshwater mussel reintroduction feasibility in a contaminated urban watershed

Nathalie Lombard, UMBC; Rachel Harrison, University of Maryland College Park; Lance Yonkos, University of Maryland College Park; Alfred Pinkney, US Fish and Wildlife Service; Upal Ghosh, UMBC

Located within a major urban environment, the Anacostia River continues to receive inputs of legacy pollutants from its watershed that accumulates in freshwater organism and leads to fish consumption advisories. Several ongoing projects in the Anacostia River are exploring the reintroduction of freshwater mussel, but it is unclear how contaminant levels in the watershed may affect their survival and growth. A preliminary investigation was conducted by deploying caged mussels (Elliptio complanata) at six selected tributaries of the Anacostia River in Summer 2016 and 2017. Survival and growth rate were recorded, as well as biochemical indicators of mussel health, i.e. protein, carbohydrate, and lipid content. Concentrations of PCBs, PAHs and Organochlorine Pesticides were jointly monitored in the water column, sediment porewater, and in the mussel tissue. Results of the study showed that several organic pollutants in the Anacostia River water exceeded the EPA water quality criteria for the protection of human health. Pollutant uptake was observed in mussel tissue over the three-month deployment period, in correlation with measured water concentrations. Despite the contaminant burden, biochemical health parameters suggested that conditions were suitable for mussel reintroduction.

Evaluating shifts in stormwater management using a hydrosocial framework

Mitch Pavao-Zuckerman, University of Maryland, College Park; Matthew Wilfong, Arizona State University; Paul Leisnham, University of Maryland, College Park; Debasmita Patra, University of Maryland, College Park

3:45 - 4:15 DOE IFL Urban Initiative (Claire Welty, moderator)

Social-Environmental Collaborative IFL (Integrated Field Laboratory)

Ben Zaitchik, Johns Hopkins University

4:15 Conclude

Day 2 Friday, October 14th

9:10-9:15 Welcome, Nancy Sonti and Dexter Locke, USDA Forest Service

9:15-10:30 Session 4 (Meghan Avolio, Moderator)

Long-term watershed studies in Baltimore

Peter Groffman, Cary Institute of Ecosystem Studies

The Baltimore Ecosystem Study (BES) established eight long-term watershed monitoring stations along an urban-rural gradient that capture the integrated influence of the biological, physical, built, and social aspects of urban ecosystem structure on watershed dynamics. Since 1998, continuous data on stream stage and discharge as well as weekly water samples for analyzing nitrate, phosphate, total nitrogen, total phosphorus, chloride, sulfate, turbidity, temperature, dissolved oxygen, and pH have been collected. The core data comprise 20 years of data on continuous streamflow and multiple elements from over 14,000 water samples, a physical archive of collected samples, and long-term plot-scale data that provide mechanistic support for the watershed studies. These biophysical data have been paired with periodic residential household and governance surveys. We are currently testing three hypotheses that have emerged from the long-term data, and that require continued long-term data collection to test. These hypotheses address how interactions between climate, watershed characteristics and human knowledge, values and efforts to manage watersheds will affect the flashiness of urban stream hydrology, and concentrations and exports of nitrogen, phosphorus, salt and metals over the next 20 years.

The National Urban Landowner Survey: Results from Baltimore

Nancy Sonti, USDA Forest Service; Dexter H. Locke, USDA Forest Service; Jesse Caputo, USDA Forest Service; J. Morgan Grove, USDA Forest Service; Amanda Robillard, UMass Amherst; Emma Sass, UMass Amherst; Brett Butler, USDA Forest Service

The intent of the Urban National Landowners Survey (UNLS) is to provide information about: who owns the trees across America's urban areas, why they own them, what they have done with them in the past, and what they plan to do with them in the future. In 2018 the first Baltimore, MD UNLS was completed. Most people valued trees on their property and in their neighborhood: they agreed that trees make the neighborhood a better place to live, that tree health should be considered during construction, and believed that good landscaping increases property values. But they also had concerns about tree branches damaging property, tree roots interfering with building foundations and/or septic systems, and tree branches breaking and causing a power outage. These

concerns may explain why the percentage of owners who removed trees was greater than those who planted trees, and why about two-thirds of owners who removed trees did not replace them. Owners are largely unaware of programs that cover the expense of planting new trees or cover the cost of caring for existing trees. Only six percent of Baltimore owners participated in tree planting programs in the previous five years. There may be opportunities to increase owners' awareness of such programs. There is some interest in local wood products, but most owners do not find urban wood-use to be important. Baltimore residential owners were most likely to have purchased wood chips and were most interested in wood chips as an urban wood product. The logistics of utilizing trees removed from private urban land may pose challenges, but also present an untapped opportunity for expansion of the urban wood economy.

Long-term changes in remnant forest soils and earthworm communities

Ian Yesilonis, USDA Forest Service; Sarah Placella, Root Applied Sciences; Csaba Csuzdi, Eszterházy Károly Catholic University; Katalin Szlavecz, Johns Hopkins University

Adaptation to the Urban Heat Island Across US Cities in Common Dandelion (Taraxacum officinale)

Eric Yee, Johns Hopkins University; Meghan L. Avolio, Johns Hopkins University

The urban heat island (UHI) is a powerful environmental filter and can be a strong ecoevolutionary force for urban plants. Weedy plant species in particular have been successful in the urban environment, but it is unclear if the plant response to UHI is evidence for adaptive evolution or phenotypic plasticity. To assess this, we conducted a greenhouse temperature experiment utilizing common dandelion (Taraxacum officinale) from four US cities with similar UHI strengths (Baltimore, MD; Minneapolis-St. Paul, MO; Phoenix, AZ; and Los Angeles, CA). Seeds were collected along a gradient of land surface temperature (LST) within each city, and selfed for one generation (F1) in order to eliminate maternal effects. Plants were then grown and measured at two temperatures (20 ºC and 28 ºC) to assess potential adaptation in morphology, photosynthetic physiology, and phenology. Above and belowground biomass differed significantly with respect to heat treatment, LST, and city of origin ($p<0.05$), while leaf traits such as specific leaf area (SLA) and leaf dry matter content (LDMC) did not. Initial flowering occurred later in the heat treatment ($p<0.05$), while bud initiation occurred earlier in dandelions from cooler cities and LSTs ($p<0.05$). Lastly, A-Ci curves reveal that the heat treatment suppressed photosynthetic activity in dandelions from all cities except for Los Angeles, CA. Overall, there is some evidence of UHI adaptation in dandelions based on whole-body morphology, photosynthetic capacity, and flowering

date, while commonly used leaf-level metrics do not capture this adaptation, and that some of these adaptations are unique to each city.

Urban Wildlife Conservation in the U.S. Fish & Wildlife Service

Ela-Sita Carpenter, US Fish and Wildlife Service

10:30-10:40 Break

10:40-11:55 Session 5 (Nancy Sonti, moderator)

Deployment of a high-density sensor network to quantify stream thermal regime in Dead Run watershed, Baltimore County, MD

Claire Welty, UMBC;, Mary McWilliams, UMBC; Andrew J. Miller, UMBC

To gain insight into the impacts of stormwater facilities versus land cover on stream thermal regime, in 2021-2022 we deployed Onset Tidbit MX2203 sensors every 100 m along 16 km of a stream network Dead Run watershed. Data are recorded every 5 minutes, with continuous data collection intended for 2 years across all flow regimes. Sensors are secured to the stream bed through a system of rebar, snap hooks, and zip ties. Data are retrieved from the sensors via Bluetooth technology, where sensors need to be removed from the stream for download. Evaluation of initially-downloaded data has revealed dramatic spatiotemporal behavior of storm runoff as well as influences of groundwater on thermal responses. Heat pulses generated from piped areas draining stormflow can be tracked as they move downstream and the response times for heating and subsequent cooling throughout the stream network can be calculated. At times when the groundwater temperature detectably differs from that of surface water, pulses of groundwater can be observed pushing into the stream at the onset of a storm before an upstream heat wave passes through a stream reach. Particularly interesting are thermal signals at night, when heated storm runoff is due to conduction of heat from hot impervious surfaces and when canopy effects are not present. Statistical analysis is ongoing, as well as development of video renderings of mapped thermal signals superimposed on the stream network. This work is sponsored by Chesapeake Bay Trust.

Ecosystem consequences of urban design from local to macro scales

Rebecca Hale, Smithsonian Environmental Research Center

A Flooded Future for River Chub (Nocomis micropogon)? Future impacts of climate change and urbanization on reproduction of a keystone native fish species

Stanley Kemp, University of Baltimore

Predicted impacts of climate change in the eastern United States include increased precipitation and frequency of heavy precipitation events. This will potentially lead to increased flooding frequency and magnitude. The River Chub Nocomis micropogon is an important keystone species in the Eastern United States, primarily through its mutualistic nesting behavior. River Chub nests are vulnerable to high flows caused by excessive precipitation and by urbanization of watersheds. Published thresholds linking River Chub nest disruption with stream discharge were used to interpret fine- scale predictions of downscaled climate models, using a stochastic weather generator (SWG) calibrated to climate change scenarios. This was done for a case study watershed, Big Elk Creek, in Maryland. The amount of River Chub nest disruption was compared between present day observations (2010- 2021) and simulated data for 2061- 2080 under the 'worst-case' RCP85 and the 'probable- case' RCP45 scenarios. Significantly elevated nest disruption under both RCP45 and RCP85 scenarios over observed current conditions was found under status quo watershed characteristics in the form of more disruptive events, more disrupted days, and shorter disruption free days during the River Chub nesting season. Increased nest disruption projected by the HadGEM2-ES models was moderate, and far below the level of nest disruption observed in urbanized streams like the Gwynns Falls that have lost or may have lost River Chub populations in the region. The impacts of increased flooding from climate change will interact with projected growth in population and urbanization projected for the Big Elk Creek watershed.

Virtuous Cycles and Research for a Regenerative Urban Ecology: The case of urban wood systems in Baltimore

Morgan Grove, USDA Forest Service

The field of urban ecology has progressed since the mid-1990s through four major phases: an ecology in, of, for, and with cities. This progression reflects an interest to address the complexity of urban systems with social-ecological approaches. Further, this progression signifies an interest to address societal issues by co-designing and co-producing research in collaboration with diverse stakeholders from government, non-governmental organizations (NGOs), businesses, and community associations (Pickett et al. 2021). What remains unaddressed in this progression is a research mission orientation. While there may be a range of goals for an ecology with cities, a focus on regenerative urban ecologies is crucial. Regenerative ecologies may be seen as an endpoint along a continuum from degenerative ecologies to sustainability to regenerative ecologies (Wahl 2016). Regenerative ecologies rely upon feedback loops, similar to coral reefs and climax forests. In urban systems, these feedbacks in social-ecological systems may be considered virtuous cycles that create reinforcing, positive

benefits for people and nature over time. Virtuous cycles or feedbacks are often conceived as a singular, positive feedback loop. However, virtuous cycles may be most impactful, adaptive, and resilient when they contain multiple positive and negative feedbacks and synergies. Research has several important roles in advancing virtuous cycles and regenerative urban ecologies. In this paper, we use our urban wood systems project in Baltimore as both a case study and model to illustrate an approach and lessons learned for regenerative ecologies, virtuous cycles, and the role of research. We conclude with lessons learned and consider opportunities and constraints for virtuous cycles, research, and regenerative urban ecologies in Baltimore and to other urban systems.

Effects of race and wealth on perceived ecological outcomes in Baltimore

Meghan Avolio, Johns Hopkins University, Kelsey Coates, Johns Hopkins University, Amy Vasquez, Johns Hopkins University

Concluding Remarks **Meghan Avolio**

The BES 24th Annual Meeting was organized by

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Meghan Avolio, Johns Hopkins University
Claire Welty, UMBC
J. Morgan Grove, USDA Forest Service
Nancy F. Sonti, USDA Forest Service
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