Connecticut Conference on Natural Resources

&

Connecticut Outdoor and Environmental Education Association

Joint Annual Conference

March 16th, 2020

Storrs, CT

Table of Contents

Oral Presentations

Workshops

Poster Presentations

Oral Presentations

9:00am - 10:00am

Greg Watson, Plenary Speaker

Sowing the Seeds of a Culture of Inclusion in Environmental Fields

Greg Watson is Director of Policy and Systems Design at the Schumacher Center for a New Economics. Greg has spent over 40 years learning to understand systems thinking as inspired by Buckminster Fuller and to apply that understanding to achieve a just and sustainable world. His work currently focuses on community food systems and an initiative to improve global systems literacy. Greg has worked in many areas related to natural resources and education, including organic and urban farming, aquaculture, wind-energy technology, passive solar design, and climate change policy. Greg served as the 19th Commissioner of Agriculture in Massachusetts and as Assistant Secretary in the Massachusetts Executive Office of Economic Affairs. He served as the first Education Director (and later Executive Director) of the New Alchemy Institute on Cape Cod, the Executive Director of the Dudley Street Neighborhood Initiative, and the first Executive Director of the Massachusetts Renewable Energy Trust (now the Massachusetts Clean Energy Center). Greg was also part of President-elect Barack Obama's U.S. Department of Energy transition team. In 2015 he founded the Cuba-U.S. Agroecology Network (CUSAN), which links small farmers and sustainable farm organizations in both countries to share information and provide mutual support. Along with Elizabeth Thompson (former executive director of the Buckminster Fuller Institute) Greg leads Fuller's World Game Workshop, a global simulation tool designed to help players discover the options for creating a world that works for 100% of humanity without compromising Earth's ecological integrity.

1:30pm - 2:30pm

Dr. Lesley Evans Ogden, Keynote Speaker

Media Myths and Misconceptions, Fostering Positive Connections with Science Journalists

Lesley Evans Ogden is a freelance science journalist based in the suburbs of Vancouver, British Columbia, Canada. Fascinated by the natural world and how it works, she writes about living things but also long dead ones like dinosaurs and mummies or non-living things like tornadoes and climate. She especially likes writing about quirky animal behaviour, ecology, conservation, environmental health, and the challenges of freelancing. She is fascinated by the intersection of science, human rights, and policy and is interested in projects in all media -- print, web, audio, video, TV. Lesley earned an MSc at York University, a PhD at Simon Fraser University and a postdoctoral research fellowship at the University of British Columbia. She later completed Science Communications and Investigative Journalism programs at the Banff Centre in Alberta. Her clients include Natural History, BioScience, New Scientist, Scientific American, Mosaic, Storyboard, BBC Earth, BBC Future, Science, Nature, CBC, Undark, Science News, Discover, Audubon, National Geographic & others. You can read more about her work on her website here.

Coastal Resiliency and Climate Change

10:50am - 11:10am

Connecticut Department of Energy and Environmental Protection Long Island Sound Ambient Water Quality Monitoring Program: Overview and Analysis of Program Data

PRESENTER:
Matthew Lyman, Connecticut Department of Energy and Environmental Protection

CO-AUTHORS:
Katie O'Brien-Clayton, Connecticut Department of Energy and Environmental Protection
Christine Olsen, Connecticut Department of Energy and Environmental Protection

The Connecticut Department of Energy and Environmental Protection (CTDEEP) is celebrating 30 years of monitoring the water quality of Long Island Sound (LIS). Year-round monthly sampling includes monitoring for nutrients, chlorophyll *a*, biological oxygen demand, and water column profiles of temperature, salinity, pH, turbidity and dissolved oxygen. Additional biweekly summer sampling at 25-35 stations provides data on the recurrent low dissolved oxygen condition known as hypoxia. The monitoring program has been expanded over the years to include monthly phytopigment, phytoplankton and zooplankton monitoring. CTDEEP staff strive to work with other local researchers to aid them in their research efforts on LIS by providing boat time or sample collections during scheduled surveys. Staff will provide an overview and general analysis of monitoring program data and discuss additional research projects and changes in program design over the years. An extensive long-term database exists and is available by request. The CTDEEP encourages the research community to make use of the monitoring program and the resultant data base as an aid to complementary research and assessment efforts in Long Island Sound and elsewhere.

11:10am - 11:30am

Connecticut's National Estuary Research Reserve

PRESENTER:
Allison Black, Roger Tory Peterson Estuary Center

CO-AUTHORS:
John Forbis, Roger Tory Peterson Estuary Center
Ralph Wood, Roger Tory Peterson Estuary Center

The Long Island Sound is one of Connecticut's greatest natural resources, contributing an estimated 7 billion dollars annually to the regional economy. The Sound and its estuaries are also some of the most imperiled areas, facing constant threat of development, pollution, invasive species, and the effects of climate change. The National Estuarine Research Reserve (NERR) system is a network of 29 U.S. coastal areas designed to protect and study estuarine systems. The reserves are a partnership between NOAA and coastal states, and each reserve is managed by a lead state agency or university, with input from local partners. Connecticut is currently in the process of achieving a NERR designation that stretches from Old Saybrook to Stonington, representing unique characteristics not found in neighboring states. It contains critical habitats for migratory and nesting birds, and is also a nursery and spawning area for numerous fish and invertebrates. This designation will help Connecticut build its defenses against rising sea level, provide protection for endangered species, strengthen pollution control, and encourage growth of the shellfish industry. It is important that this NERR is supported throughout this process by attendance and involvement of public meetings so that Connecticut can receive the benefits

that come with this designation. These include funding, guidance, and technical assistance dedicated to estuarine research, education, training and stewardship. Under the education component thousands of children and adults are served through hands-on laboratory and field-based experiences, while training equips local and state officials to be better informed in decision-making processes.

11:30am - 11:50am

Barn Island – the Fate of the Ditched Marsh

PRESENTER:
Ron Rozsa

Since the time of ditching (1932) the pattern of plant communities on the natural marsh and ditched marsh have been stable and unstable respectively. Rhizome analysis from peat cores confirm this. It is inferred from historic data that connecting the marsh basins to the creeks depressed the high tide levels in the creeks and levee flooding ceased. This resulted in a shift of the dominant levee grass from Spartina patens to Juncus gerardii. The initial drainage of the basins caused the contraction of the panne communities and allowed S. patens to become the dominant community. Post 1947 begins the expansion of the panne communities, with plant communities moving upslope as the marsh becomes wetter. Elevation surveys at Palmer Neck Marsh revealed that the levee and basin topography of the natural marsh is preserved and the contour intervals lie parallel to the creek. Communities form bands along the contour intervals. A 1976 plant community map reveals that the vegetation bands extend to the edge of the ditches. While the ditches remove surface flood waters, the ditches have minimal effects on soil processes such as soil moisture. The resulting hydroperiod in the ditched marsh is too short to capture the fine sediments contained in the flood water and this likely accounts for the fact that averaged elevations from the natural marsh are 10 cm higher than the ditched marsh. There is evidence to show that the ditched marshes are gradually reverting to the natural marsh.

11:50am - 12:10pm

Promoting Coastal Wetland Resilience using Dredge Material

PRESENTER:
Anna Puchkoff, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:
Beth Lawrence, Dept. of Natural Resources and the Environment, Center for Environmental Science and Engineering, University of Connecticut

Thin Layer Placement (TLP) of sediment is an increasingly used restoration method in coastal marshes to stimulate plant productivity, subsequently promoting soil accretion and resilience to accelerated sea level rise. However, few experimental field studies have investigated using dredged sediment for TLP in meso-tidal estuaries, and none holistically examine plant-soil carbon dynamics. Our goal was to investigate the feasibility of using dredge material for coastal salt marsh restoration in Guilford, Connecticut. Our objectives were to determine how different levels of sediment addition effect: (1) biomass allocation of the dominant low marsh plant, *Spartina alterniflora*, and (2) soil carbon cycling processes including decomposition and carbon mineralization. We conducted an *in situ* experiment by adding sediment to manipulate soil surface elevation (low: +5cm, medium: +10cm, and high: +15cm). We monitored plant traits (above and belowground biomass, stem height, stem density, leaf area, C:N) and soil chemistry parameters (conductivity, pH, redox, ammonium, sulfides, C:N, carbon mineralization, decomposition, bulk density). Preliminary analyses suggest low and medium treatments increased stem heights, but reduced stem density compared to controls. The high treatment had no stem growth, but had

similar root biomass to the medium treatments. These results demonstrate the ability of roots to penetrate the thickest sediment and may lead to increased belowground contributions and marsh resilience. Results from ongoing soil carbon analyses will elucidate relationships between sediment application, plant growth, and carbon cycling dynamics. Collectively, our work may guide wetland managers develop restoration specifications for protecting coastal marshes in the face of rising seas.

2:40pm - 3:00pm

Environmental Attitudes and Choices in the Face of Sea Level Rise: Effects of Demographics in a Diverse US City

PRESENTER:
Stephen K. Swallow, Dept. of Agricultural & Resource Economics, University of Connecticut

CO-AUTHORS:
Alicia Barriga, Dept. of Agricultural & Resource Economics, University of Connecticut

We explore the willingness to support saltmarsh expansion for wildlife habitat as part of actions taken for climate change adaptation, especially regarding low-income and low-education groups. We employed a choice-experiment approach and a Latent-Class Analysis based on sociodemographic variables to model the likelihood of choosing an adaptation plan given the levels of education and income of survey respondents. We also considered that individuals with similar socio-demographic characteristics tend to cluster in geographic locations. In our model we incorporated a set of self-reported zip codes associated with neighborhoods. We used probit models to relate the individuals' demographic identities to the probability of living in a particular neighborhood, and then we run a Latent-Class model to relate respondents' location with their willingness to support conservation of natural assets in addition to human built assets. Our results suggest that respondents in general support conservation actions, they value saltmarsh when it provides habitat for wildlife, relative to saltmarsh by itself. Our findings indicate that the role of education is significant for environmental attitudes. Individuals belonging to the low-income households and those who have completed more than middle-school education, are more likely to exhibit positive and significant willingness to pay (WTP) for conservation.

3:00pm - 3:20pm

Flood Zones, Elevations, Retreats, and their Effects on Real Estate Values

PRESENTER:
Zhenshan Chen, Dept. of Agricultural and Resource Economics, University of Connecticut

CO-AUTHORS:
Charles Towe, Dept. of Agricultural and Resource Economics, University of Connecticut
Nancy Bockstael, Dept. of Agricultural and Resource Economics, University of Connecticut
Stephen Swallow, Dept. of Agricultural and Resource Economics, University of Connecticut

We explore the willingness to support saltmarsh expansion for wildlife habitat as part of actions taken for climate change adaptation, especially regarding low-income and low-education groups. We employed a choice-experiment approach and a Latent-Class Analysis based on sociodemographic variables to model the likelihood of choosing an adaptation plan given the levels of education and income of survey respondents. We also considered that individuals with similar socio-demographic characteristics tend to cluster in geographic locations. In our model we incorporated a set of self-reported zip codes

associated with neighborhoods. We used probit models to relate the individuals' demographic identities to the probability of living in a particular neighborhood, and then we run a Latent-Class model to relate respondents' location with their willingness to support conservation of natural assets in addition to human built assets. Our results suggest that respondents in general support conservation actions, they value saltmarsh when it provides habitat for wildlife, relative to saltmarsh by itself. Our findings indicate that the role of education is significant for environmental attitudes. Individuals belonging to the low-income households and those who have completed more than middle-school education, are more likely to exhibit positive and significant willingness to pay (WTP) for conservation.

3:20pm - 3:40pm

Finding Localized Weather Trends in Connecticut for the Past 119 Years

PRESENTER:

Nicole Gigas, Dept. of Environment, Geography & Marine Sciences, Southern Connecticut State University

CO-AUTHORS:

Matthew Miller, Dept. of Environment, Geography & Marine Sciences, Southern Connecticut State University

In a time of global warming, research is heavily focused on understanding how earth processes, especially climate, function at the global scale. There are many examples of how weather data is utilized within global climate models to predict how much change is happening across the globe in aggregated terms. Climate literature discusses that there needs to be more of an emphasis on local climate scale analysis. The purpose of this study was to make comparisons temporally and spatially from Connecticut weather data that spans 119 years from weather stations across the state to see the trends. Five climate themes were explored: precipitation, snow, average, maximum, and minimum temperature, and the data was also split up into temporal decade blocks and by month. Ordinary kriging was used to perform a spatial interpolation for each theme to see how climate impacted Connecticut spatially over time. Finally, a raster subtraction was performed for each theme map by month for each decade block so that comparison from the early century and late century can be made.

3:40pm - 4:00pm

Nexus of Climate and Non-Climate Drivers of Food Insecurity

PRESENTER:

Dickens Molo, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:

R. O. Anyah, Dept. of Natural Resources and the Environment, University of Connecticut

The study examines the interplay between climate and non-climate stressors on food security over Greater Horns of Africa. It focusses on Ethiopia as a case study. This region is vulnerable to exogenous and endogenous shocks on the food production systems. These shocks arise directly or indirectly from climate extremes as well as non-climate factors, like health burden from diseases like malaria, displacements due to frequent civil strife and prolonged inter-tribal conflicts. We hypothesize that these none biophysical factors, interacts with climate change impacts and negatively exacerbate agricultural outputs resulting into greater risks of food Insecurity. Therefore, the responses to the impacts of climate change on food insecurity should incorporate both climate and non-climate drivers. The study

compares the criteria and models used by two major relief agencies involved in providing relief food in Ethiopia: United Nation Office for the Coordination of Humanitarian Affairs (UN-OCHA) and Famine Early Warning System-Network (FEWSNET). These two models emphasize on traditional approach based on how changes in the physical climatic factors can lead to vulnerability and food insecurity.

Different from OCHA and FEWSNET models, this study adopts a different comprehensive approach by incorporating both climate and non-climate factors like indices of droughts, impact of health due to prevalence of malaria, civil strife and inter-tribal conflicts in developing a model of food insecurity hotspots. This approach will improve on efficiency and accuracy for intervention strategies. We employ geospatial techniques and modeling to weigh and combine these factors and develop a suitability mapping of modified food insecurity hotspots in Ethiopia.

Fisheries & Wildlife Conservation

10:50am - 11:10am

The Young Forest Initiative: Successes and Challenges

PRESENTER:
Lisa Wahle, Wildlife Management Institute, Connecticut Department of Energy and Environmental Protection

Young forest and shrubland, and the wildlife species that depend on these areas have been in decline for many years due to anthropogenic development on natural lands and the normal maturation of forests. The designation of the New England cottontail (NEC) as a candidate species for protection under the Endangered Species Act (ESA) in 2006 provided an impetus for habitat management in order to avert ESA listing. A coordinated regional effort and comprehensive conservation strategy to restore NECs brought funding, staffing, on-the-ground management, research, monitoring and outreach. In 2015, the US Fish & Wildlife Service determined that listing the NEC under ESA was not warranted due to the demonstrated success of ongoing conservation efforts and the expectation they would continue. Habitat work was initially targeted in NEC Focus Areas and then expanded to a statewide initiative for American woodcock and other species. After nearly a decade of research, monitoring, habitat management and other conservation work, we are taking a look at how these efforts have paid off, old and new challenges to conservation, and where and how to focus our efforts in the future.

11:10am - 11:30am

Diet Estimates and Seasonal Variation in Bobcats (*Lynx rufus*) within an Intermixed Ecosystem

PRESENTER:
Kristen Beattie, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut

CO-AUTHORS:
Gideon Hartman, Dept. of Anthropology, University of Connecticut
Tracy A.G. Rittenhouse, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut

Urban landscapes, generally thought to be risky to wildlife due to proximity to humans, can provide enticing food benefits in the form of trash, synanthropic species, domestic livestock and pets, or feeding of wildlife such as bird feeders or bait piles. Urban carnivores may be attracted to more developed areas because of the prey abundance and exploitation of anthropogenic food sources. The urban landscapes in Connecticut is an intermixed ecosystem that contrasts greatly to the urban landscapes where bobcats forging ecology hasn't previously been studied. To understand how bobcat diet shifts throughout season and across housing densities we sample bobcats from 2017 to 2019 across a range of houses densities using stable isotope analysis of hair to estimate diet. Using MixSIAR, we created a hierarchical mixing model in a Bayesian framework to correlate potential prey species carbon and nitrogen isotope values to isotope values of bobcat hair. Rabbit and woodchucks comprise nearly 50% of bobcat diet across sex, weight, housing density, and season. Male bobcats consumed more deer (0.2) than females (0.15), while both larger male and female bobcats consume more deer than smaller bobcats. Bobcats consume more deer in suburban housing densities (0.25) than exurban housing density (0.15) and across season, the proportion of deer in their diet decreases throughout season (0.2 to 0.1). To properly manage bobcats, feeding ecology and eating habits across different housing densities must be better understood.

11:30am - 11:50am

Bobcat Movements within Human Development

PRESENTER:

Jason Hawley, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut

CO-AUTHORS:

Tracy A.G. Rittenhouse, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut

Following legal protections, bobcat (*Lynx rufus*) populations in North America are recovering and expanding into landscapes that are now modified by human development. The presence of bobcats in urban areas suggests that bobcats are more tolerant of human development than previously thought. We fitted 106 adult bobcats in Connecticut with GPS collars programmed to locate every 4 hours from 2017-2019. We collared bobcats along a gradient of development from exurban to urban. We used an integrated step selection analysis (ISSA) to detect spatiotemporal effects of development on movement and resource-selection of bobcats. We quantified how bobcat movements varied based on distance to buildings, wetlands and roads, as well as, step-lengths and turn angles. We ran an ISSA model for each individual, followed by a two-step conditional logistic regression in order to examine population level effects. Our results indicate that most bobcats avoid roads but prefer to be in close proximity to buildings. Step lengths and turn angles indicate that bobcats move more slowly and reverse directions more often when close to buildings. Bobcats also strongly select for close proximity to wetlands. A preference for buildings, along with slower movements and regular changes in direction near buildings, suggests that bobcats may be hunting in and near human development and its associated habitats. As exurban, suburban and urban development become more common throughout North America, an understanding of the effects of this development on bobcat behavior and movement could be useful in developing conservation and management strategies.

11:50am - 12:10pm

4-D Positioning with JSATS for Fish-Passage Efficiency Projects

PRESENTER:
Thomas H. Meyer, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:
Kevin P. Nebiolo, Kleinschmidt Associates

The US Department of Energy and the US Army Corps of Engineers developed the Juvenile Salmon Acoustic Telemetry System (JSATS) to monitor the survivability of juvenile salmonids as they transit fish-passage structures in hydroelectric facilities. With JSATS, smolts have acoustic transmitters (a.k.a "tags") surgically embedded into their dorsal fin region. The acoustic transmissions are detected by hydrophones mounted in the forebay of a hydroelectric dam. Proper synchronization of the transmissions allows the positions of a smolt to be determined in three spatial dimensions over time, resulting in a high-resolution track of a fish's loitering in the forebay and subsequent passage through the dam. Tags were implanted in 172 smolts of which 146 had successful position determinations producing a total of nearly 200,000 positions. The most problematic aspects of the research was correctly synchronizing the hydrophones' internal clocks and eliminating multipath receptions. The range of successful positions per fish ranged from four to 12,044. The positioning success percentages ranged from 27/1303 = 2% to 2961/3730 = 79%. Positions determined from within the convex hull of the hydrophones nearly always met or exceeded the one-meter precision specification as estimated from the nonlinear least squares estimator created for the project. The main technical advances presented are the hydrophone-clock synchronization scheme and the multipath rejection scheme.

2:40pm - 3:00pm

Stakeholder Perceptions of Black Bears and Their Management

PRESENTER:
Michaela I. Poppick, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:
Nicholas T. Yarmey, Dept. of Natural Resources and the Environment, University of Connecticut
Anita T. Morzillo, Dept. of Natural Resources and the Environment, University of Connecticut

As the number of human-wildlife interactions and conflicts increases globally, so does the need for management strategies that address stakeholder concerns. Stakeholder perceptions of a heightened risk associated with carnivores often exacerbates public concern about these animals, especially when a species population becomes reestablished in a location from where it was formerly extirpated. Connecticut is among the states with the highest rate of human-black bear (Ursus americanus) conflict complaints, with the number of conflicts reported in Connecticut tripling over an eight-year period. Our objective was to analyze Connecticut stakeholder perceptions about black bears and their management. To do this, we conducted qualitative semi-structured interviews and focus groups comprised of representatives of key stakeholder groups who have experienced conflicts with black bears in northwestern Connecticut. Interviews revealed that personal experience with and knowledge about black bears and their management influenced individual opinions and perceptions about the species, as well as individual preferences for management strategies. Participants generally expressed the need for more outreach and communication, especially in urban areas. Also revealed was an urban-to-rural gradient in

terms of levels of knowledge about black bears and their management, types of interactions that occur, and acceptance capacity for those interactions. Both intentional and unintentional failure to comply with management practices was frequently noted as a main cause of conflict, possibly resulting from deficiencies in communication. These findings can help guide management plans to simultaneously maintain human wellbeing and sustainable populations of wildlife species.

3:00pm - 3:20pm

Female Black Bear Body Weight and Reproduction in Northwest CT

PRESENTER:

Paul Rego, Wildlife Division, Connecticut Department of Energy and Environmental Protection

CO-AUTHORS:

Jason Hawley, Wildlife Division, Connecticut Department of Energy and Environmental Protection
Geoff Krukar, Wildlife Division, Connecticut Department of Energy and Environmental Protection
Melissa Ruszczyk, Wildlife Division, Connecticut Department of Energy and Environmental Protection

Habitat productivity can influence nutritional condition, reproduction and survival in wild animal populations. These relationships are particularly pronounced for black bears as a result of their ability to accumulate fat reserves in preparation for extended winter dormancy and winter birthing. We examined these relationships for female black bears in northwestern Connecticut. From 2002 through 2019 we inspected winter dens of over 50 radio-collared sows. We recorded the sows' weights and ages and the presence, number and sexes of cubs or yearlings. These provided estimates of litter sizes and age of first breeding. By inspecting individual sows den's in consecutive years we examined cub survival and birth interval and their relationship with sow weights and ages.

Female black bears in Connecticut had higher reproductive indices than reported for bear populations at more northern latitudes and in western states. Most sows reached weight thresholds to produce their first litter by age three. Inter-birth intervals were short, averaging close to 2 years. Cub survival was greater than 70 percent and highly consistent between years. Years of widespread reproductive failure were not observed. We believe the bear population was increasing in the study area during the years examined yet there was no indication of density-dependent decreased reproduction. We believe the amount and diversity of forest habitat, geography and possibly the availability of anthropogenic foods contribute to the observed high reproduction and survival of bears in Connecticut. Future reproduction and survival may be affected by changes in land use, climate and bear population distribution.

3:20pm - 3:40pm

Wildlife Response to Disturbance Events in Forested Wetlands

PRESENTER:

Daniel Wright, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut

CO-AUTHORS:

Chadwick Rittenhouse, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut
Katherine Moran, Connecticut Department of Energy and Environmental Protection

Thomas Worthley, Dept. of Natural Resources and the Environment**,** Cooperative Extension Service, University of Connecticut
Tracy Rittenhouse, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut

Insectivorous bats have been observed responding positively to changes in canopy structure in forested wetlands. The creation of canopy gaps through beaver activity improves foraging space for species of insectivorous bats. We are observing the response of bats and their insect prey to the artificial creation of canopy gaps in forested wetlands. In the winter of 2019, we felled trees in 3 forested wetlands with the objective of mimicking a natural disturbance, similar to one caused by beaver activity. In our treated wetlands, we felled trees in an area of approximately a quarter acre using chainsaws during frozen ground conditions. The following spring and summer we monitored bat activity and insect abundance in our 3 treated forested wetlands as well as 3 un-treated forested wetlands. Acoustic monitoring and insect sampling were conducted twice per wetland, once in mid-May and once in late-July/early-August. We monitored each wetland for 3 consecutive nights, with insect sampling conducted on the last night of monitoring. Insect samples were collected using a blacklight UV funnel trap, identified to order and measured at dry weight. We found greater bat activity in treated vs un-treated forested wetlands. We observed order specific insect response to treatment, but an overall trend was not apparent; an additional year of sampling may enhance our ability to describe the pattern. The results from the 1st of this 2-year study suggest active management in forest wetlands may enhance habitat for insectivorous bats.

3:40pm - 4:00pm

An Update on Eastern Equine Encephalitis in Connecticut

PRESENTER:

Roger Wolfe, Wildlife Division, Wetlands Habitat and Mosquito Management Program, Franklin Wildlife Management Area, Connecticut Department of Energy and Environmental Protection

Eastern Equine Encephalitis (EEE) is a serious mosquito-borne disease that is endemic in several species of songbirds in Connecticut. It can affect non-native games birds, horses, deer and other mammals including humans. In humans, EEE has a 30-40% mortality rate and most survivors experience permanent neurological impairment. The primary enzootic vector of EEE, Culiseta melanura, is a mosquito that inhabits red maple/sphagnum moss swamps and feeds mainly on birds. This habitat occurs throughout Connecticut but is mainly found in the southeast portion of the state and neighboring Rhode Island. When EEE virus and mosquito levels are high, the virus can spill over into bridge vector species that primarily seek mammalian bloodmeals. Historically, heightened activity occurs every 5-6 years in Connecticut. Other states in New England have had numerous human cases of EEE in the past. Connecticut's first human case was documented in 2013. In 2019, we experienced an unprecedented rise in EEE activity which resulted in 4 human cases (3 deaths), 6 horse cases and other bird and mammal impacts. Rhode Island reported 3 human cases (1 death) and Massachusetts reported 12 human cases (3 deaths) which prompted these states to aerially apply pesticides to reduce the vector mosquito populations. Connecticut responded with limited ground-level spraying however the sequence of events was such that aerial spraying was not warranted. This talk will discuss the events of 2019 and how the state's Mosquito Management Program is preparing for the upcoming year and beyond.

4:00pm - 4:20pm

Environmental Consequences of Light Pollution

PRESENTER:
Leo Smith, Northeast Regional Director, International Dark-Sky Association

Artificial Light at Night, referred to commonly as “light pollution”, has profound adverse consequences for both humans and the ecology that we all depend upon for our survival. Research has shown a strong link between light pollution and the “apocalypse” of insects, many species of which are responsible for pollination of plants needed for continued survival of our ecosystem. Over 10,000,000 birds die annually as the result of light pollution coming from high rise buildings – a result of birds confusing office window lights for the stars they use fo navigation during migration season. Moths, amphibians, bats, fireflies and bees are all adversely affected by light pollution. Light at night can adversely affect human health as well, including a significantly higher rate of breast cancer among third shift workers. Improved outdoor lighting practices can include dimming or shutting off lighting during off peak hours, limiting outdoor lighting to motion activated sensor controls, reducing the amount of light to the minimum light level necessary for the task, and eliminating the use of light in places where it may be replaced by other technologies.

Forest Change

10:50am - 11:10am

Implications of Recent and Predicted Forest Change for Carbon Dynamics and Climate Resilience

PRESENTER:
Robert Fahey, Dept. of Natural Resources and the Environment, University of Connecticut

Forests represent an important potential component of climate mitigation strategies and are increasingly being promoted as an important solution in addressing global climate change at local to global scales. However, although it is widely understood that trees and forests store carbon, patterns of forest carbon storage and sequestration in relation to forest change processes such as stand development, disturbance, and management activities are highly complex. Forest management or conservation decisions may represent trade-offs between carbon storage or sequestration and other services such as biodiversity, wood products, and ecosystem resilience or adaptation to future climate and disturbance regimes. Currently the forests of Connecticut are entering a period of rapid change in which a variety of factors such as invasive pests, exurban development, and successional transitions are affecting forest composition, structure, and functioning. This presentation provides a basis for understanding forest climate mitigation and adaptation as they relate to forest change (including stand development, forest management, and disturbance) and provides context on trade-offs that need to be considered in decision-making surrounding forest lands.

11:10am - 11:30am

Oak Mortality After Return of Multi-Year Defoliations

PRESENTER:
Jeffrey Ward, The Connecticut Agricultural Experiment Station

CO-AUTHORS:
Joseph P. Barsky, The Connecticut Agricultural Experiment Station

Repeated episodes of multi-year defoliations during the 1960s-1980s caused widespread regional oak mortality. Multi-year defoliations did not occur for decades following the unanticipated appearance of gypsy moth fungus (Entomophaga maimaiga) in 1989. This lulled many natural resource managers into believing that multi-year defoliations would no longer occur. However, gypsy moth populations exploded during the exceptionally dry spring months of 2015-2018. To assess the impact of the return of multi-year defoliations, we examined 3046 oaks on 27 study areas. Trees had been monitored since at least 2004, 11 years before the latest outbreaks. Mortality rates are per three years to directly compare pre- and post-defoliation levels. Pre-defoliation stand level oak mortality averaged 2% and did not differ between stands that had been managed and unmanaged, nor among stands with subsequent no-low, moderate (single year or less than 50% defoliation), and severe defoliations (two or more years of 50% defoliation). Post-defoliation mortality did not differ between managed and unmanaged stands, but was much higher in severely defoliated stands (32%) than in stands with moderate (4%) or low-no defoliation (1%). Management had no effect on individual tree mortality, and unlike most earlier studies, mortality did not differ by canopy position. In severely defoliated stands, mortality of white oak was higher for northern red, black, and chestnut oak. Mortality decreased with size, but increased with growth rate. Foresters should anticipate that oaks that had survived earlier multi-year defoliations may have high mortality rates in future multi-year events, possibly because trees are older.

11:30am - 11:50am

Connecticut Forests and our Changing Climate – what to expect and what to do

PRESENTER:
Andrea Urbano, Service Forester, Connecticut Department of Energy and Environmental Protection

Andrea Urbano, a Service Forester with CT DEEP, will discuss forest health concerns and expected changes to Connecticut's forests. She will discuss how and why to promote ecosystem resiliency in times of climatic change and uncertainty. Relevant resources for landowners and natural resources professionals will be provided.

11:50am - 12:10pm

Data-Driven Tools to Track Change in Northeastern Forests

PRESENTER:
James Duncan, Forest Ecosystem Monitoring Cooperative

The Forest Ecosystem Monitoring Cooperative (FEMC) is a seven-state collaboration among the USDA Forest Service, state natural resource agencies, non-profits and academic partners in New England and New York to monitor long term trends in forest ecosystem condition and coordinate the sharing of information and data for better management of our forest resources. The Cooperative has developed numerous tools for accessing data, assessing trends and sharing insights in key forest ecosystem processes, from broad-scale disturbances by forest pests and pathogens to detailed plot-level assessments of forest regeneration and browse impacts. Several of these tools have recently been

expanded to include data and information on Connecticut's forests, and will be introduced here, including: the Northeastern Forest Health Atlas, which aggregates aerial pest detection mapping across the region as far back as 1918 and provides repeat damage analysis and customized data downloads of geographic information on disturbance extent and timing; the Northeastern Forest Regeneration Data Network, which provides access to a methodological comparison and underlying data for over 100 forest regeneration monitoring projects in the Northeast; and, a region-wide assessment of ecosystem service values of urban forests at risk from invasive forest pests based on municipal tree inventories delivered in formats usable by planners and municipal entities for planning and advocacy. Examples of how to use these resources and key findings on patterns and trends over time will be given to provide a snapshot of the type of work FEMC engages in with its partners and how it might benefit practitioners, planners and land managers in Connecticut.

2:40pm - 3:00pm

Detecting Invasive Understory Plants Using Aerial Imagery

PRESENTER:

Nancy Marek, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:

Chandi Witharana, Dept. of Natural Resources and the Environment, University of Connecticut
Zhe Zhu, Dept. of Natural Resources and the Environment, University of Connecticut
John Volin, Dept. of Natural Resources and the Environment, University of Connecticut

Invasion by non-native plant species is a primary concern in forest ecosystem health and biodiversity. Despite extensive research on invasive species, fundamental questions remain on how to quantify the distribution of their populations accurately. Remotely sensed imagery at low altitudes during distinct phenological states can detect the spatial organization of understory invasive shrub species. This work presents a method of classification of two invasive non-native shrub species, Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*), using semantic segmentation techniques based on convolutional neural networks (CNN). All aerial imagery was captured at low altitude (40-50 m) over deciduous forest canopies during late March and early May in northeast Connecticut, USA. We chose three pre-trained CNN models - Deeplab v3+, ResNet50, and Inception-v3 - as benchmarks for our study. The training dataset consisted of over 7000 images, size 224 x 224, with hand-labeled pixels. Eighty percent of the samples were selected as the training dataset and twenty percent as the testing set. This dataset is the first public image dataset of two widespread understory invasive shrub species from New England. Preliminary results suggest that this method can be used for future invasive species occurrence maps, allowing natural resource professionals to monitor and subsequently manage invasive plants more effectively.

3:00pm - 3:20pm

Resident Attitudes Toward Utility Vegetation Management

PRESENTER:

Steven DiFalco, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:

Anita T. Morzillo, Dept. of Natural Resources and the Environment, University of Connecticut

Exurban landscapes are the fastest growing land use type, and a complex situation for natural resource management because of the consortium of stakeholders involved. Few studies have focused on socio-ecological dimensions within this land use. Within Connecticut's exurban landscape, utility vegetation management along roadsides aims to manage the roadside forest while mitigating storm-induced power outages caused by falling trees. Our objective was to integrate social and landscape data to understand resident attitudes towards roadside vegetation management across four areas of Connecticut. We collected data from residents using two mail surveys completed in 2017 and 2019 (n = 1962). From survey questions, three attitude variables were created focusing on perceptions of the vegetation management process and tradeoffs between maintaining trees and reliable power. Across all study areas, respondents with more favorable attitudes were more likely to have greater knowledge about trees, utilitarian value orientations related to trees, less concern about roadside aesthetics, and felt more strongly about reducing power outages than preserving trees. Social variables predicting attitudes differed among study areas for two of the three attitudes variables. This research demonstrates the diverse and spatially heterogeneous perceptions toward natural resources held by residents living within an exurban landscape. As a result, individual characteristics of residents and variation at the local level likely play a role in support or opposition to management strategies affecting the roadside forest.

3:20pm - 3:40pm

Use-Value Taxation Versus Purchase of Development Rights

PRESENTER:

Gabriel D. Marmolejos, Dept. of Agricultural & Resource Economics, University of Connecticut

CO-AUTHORS:

Stephen K. Swallow, Dept. of Agricultural & Resource Economics, University of Connecticut

Farms, forest, and open space (FFOS) distinguish the rural character, aesthetics, and tranquil living demanded by homeowners seeking a rural quality of life. However, FFOS lands continuously contend with the threat of residential and commercial development. In response, communities implement varied household tax relief policy tools like Use-Value Taxation (UVT) and Purchase of Development Rights (PDR) that slow or prevent development. We examine whether for a given program to conserve land there is a differential willingness to pay per acre between permanent conservation with potentially higher community tax burden (PDR) and temporary conservation with lower community tax burden (UVT) per acre. Understanding how homeowners view these tradeoffs can help identify policies that are more cost-effective or efficient for FFOS conservation. We employ a discrete choice experiment survey and latent class econometrics to examine homeowner's land conservation preferences in eight Connecticut towns. Heterogeneity in conservation choices reveal latent classes of respondents, wherein members of each class exhibit preferences for policy outcomes that are more similar within the subgroup than outside the subgroup. We observe three latent classes of Connecticut homeowners, each with distinct sociodemographic profiles, preferences for conservation attributes, and cost sensitivity. Class one members value UVT conserved acres $1.37 less than PDR acres, while class two and three members are not receptive to the tradeoff. Although past research has documented the willingness to pay for FFOS preservation, this study is the first attempting to distinguish the value of FFOS outcomes achieved through UVT rather than PDR

3:40pm - 4:00pm

Five Years of Tree and Shrub Health at the Plant Diagnostic Lab

PRESENTER:
Abby Beissinger, Dept. Plant Science and Landscape Architecture, University of Connecticut

From 2015-2019, UConn's Plant Diagnostic Lab received 3,306 samples for plant problem diagnosis, which represent an important snapshot of plant health throughout the region. Data from woody ornamental submissions (38% of the total samples submitted, the most frequently submitted type) were examined to understand urban and exurban forest health trends over the past five years. Submissions came from home gardeners, farmers, and other agricultural businesses in the green industry, all eight Connecticut counties, and several New England states. Diagnoses included plant diseases (caused by fungal, bacterial, viral, or nematode pathogens; 42%); insect damage (caused by arthropods; 21%) and cultural problems (caused by abiotic stress, cold injury, herbicide damage, nutrient deficiencies, etc.; 10%). Tree types most frequently submitted included maple (*Acer spp.*), spruce (*Picea spp.*), pine (*Pinus spp.*), elm (*Ulmus spp.*), and dogwood (*Cornus spp.*), and shrub types most frequently submitted included boxwood (*Buxus spp.*), rhododendron (*Rhododendron spp.*), rose (*Rosa spp.*), hydrangea (*Hydrangea spp.*), and lilac (*Syringa spp.*). The incidence of trees and woody ornamental submissions to the Plant Diagnostic Lab demonstrate their value (both economically and aesthetically) among home plantings and the green industry. Further, their plant disease, insect, and cultural diagnoses show a need for more urban and exurban forest health research when similar and/or repeated diagnoses are made across or within plant genera.

Water Resources

10:50am - 11:10am

CT Update: PFAS Monitoring in Surface Water

PRESENTER:
Meghan Lally, Connecticut Department of Energy and Environmental Protection

CO-AUTHORS:
Chris Bellucci, Water Planning & Management Division, Connecticut Department of Energy and Environmental Protection
Traci Iott, Water Planning & Management Division, Connecticut Department of Energy and Environmental Protection
Phil Trowbridge, Water Planning & Management Division, Connecticut Department of Energy and Environmental Protection
Pete Aarrestad, Fisheries Division, Connecticut Department of Energy and Environmental Protection
Mike Beauchene, Fisheries Division, Connecticut Department of Energy and Environmental Protection
Brian Eltz, Fisheries Division, Connecticut Department of Energy and Environmental Protection
Brian Toal, Environmental Health Section, Connecticut Department of Public Health
Sharee Ruznak, Environmental Health Section, Connecticut Department of Public Health

Per- and polyfluoroalkyl substances (PFAS) are a group of several thousand synthetic chemicals characterized by strong fluorine-carbon bonds. These bonds result in unique physical and chemical properties including extreme thermal and chemical stability, and oil, grease, and water repellency. The downside to these properties is that PFAS are both highly mobile in the environment and resistant to degradation; characteristics that have dubbed them, 'forever chemicals.' Since the 1950s PFAS have been widely used in industrial processes including wire manufacturing, metal plating, and the manufacturing of many industrial surfactants, resins, molds and plastics. The use of aqueous film forming

foams (AFFFs) for fire suppression, particularly at regional training locations and commercial airports, is another well documented source of PFAS release to the environment. Consumer products, including non-stick cookware, water-proof clothing, stain resistant carpets and upholstery, personal care products, and others, also increasingly contain PFAS-containing materials or ingredients. Due to their widespread use and a growing body of literature regarding their potential toxicity, concern regarding the potential negative environmental and health effects of PFAS has been mounting in recent years. In 2016, the CT DEEP Water Monitoring Group began working with the CT DEEP Fisheries Division and the Connecticut Department of Public Health to evaluate PFAS levels in Connecticut surface waters in order to inform local fish consumption advisories. In June 2019, an accidental release of AFFF to the Farmington River spurred the Governor to establish a statewide PFAS Task Force, which was charged with outlining a statewide PFAS action Plan by November 2019. Since this time, interest in PFAS has seemingly exploded in Connecticut. This presentation will provide an overview of monitoring efforts conducted to-date in Connecticut, as well as review the statewide surface water monitoring plan that has been developed in response to the 2019 CT PFAS Action Plan.

11:10am - 11:30am

Experimental Sales of Water Quality Credits and Co-Benefits

PRESENTER:
Pengfei Liu, Dept. of Environmental and Natural Resources Economics, University of Rhode Island

CO-AUTHORS:
Xiuping Chen, Dept. of Agricultural and Resource Economics, University of Connecticut
Stephen K. Swallow, Dept. of Agricultural and Resource Economics**,** Center for Environmental Sciences and Engineering, University of Connecticut

Carson and Groves (2007) discussed the conditions for stated preference surveys to be incentive-compatible, which requires that an elicitation affects only a single decision (outcome). We aim to introduce the study of future policy consequentiality and disentangle the details of the consequentiality. First, we separated consequentiality into immediate and future consequentiality. Regarding immediate consequentiality, we individually test the payment and policy consequentiality. We designed six experimental treatments that generate a range of intensity or likelihood that payment or policy attributes of a respondent's choice are consequential. The indirect utility of consumer i from purchasing product j is represented by

$$U_{ij} = \alpha \mathbf{X}_j + \beta c_j ,$$

where X_j represents the bundle of water quality credits for alternative j and the associated co-benefits; c_j denotes the cost of choosing alternative j. From our experimental context, the study also provides insights on the public value for environmental co-benefits generated as by-products of a water quality credit trading market. This study extends the framed field experiments of Liu and Swallow (2016). Our preliminary results suggest that the cost coefficient in a treatment without the future consequentiality is significant, while not significant in a treatment with future consequentiality. When policy consequentiality is present and payment consequentiality is absent, the cost coefficient is still significant. Regarding the willingness to pay for water quality credits, we anticipant confirming previous lab experiment results (Liu and Swallow 2016) that participants' willingness to pay increases when the co-benefits are integrated.

11:30am - 11:50am

Trade-Offs within a Watershed: Addressing Heterogeneity Among Respondents

PRESENTER:
Yin Ma, Dept. of Agricultural and Resource Economics, University of Connecticut

CO-AUTHORS:
Stephen Swallow, Dept. of Agricultural and Resource Economics, University of Connecticut

Impervious surfaces in developed areas, such as paved roads and roof-tops, block rainwater from permeating into the ground to recharge groundwater, create heated, fast-moving surface runoff which brings bacteria and pollutants to streams and makes stream flows become flashy, resulting in degradation of local water supply capacity and quality. The deducted groundwater recharge, however, has not drawn enough attention from economists and policymakers. Besides, existing economic research usually takes watershed as a homogenous land parcel and neglects the differences in groundwater recharge capacity. In this paper, we divide the Pomperaug River Watershed into different zones both by upstream-downstream and groundwater recharge zones and explore how do residents trade off economic benefits from development and its environmental outcomes. Using data from household surveys which are carried out in Bethlehem, Woodbury, and Southbury, we apply discrete choice modeling method and find the following results: (1) given the information of environment outcomes of development, residents concern more about development happens in sensitive groundwater recharge zones than that in other areas; (2) residents are willing to pay for groundwater protection; and (3) residents have heterogeneous preferences over environmental characteristics and can be separated into four groups based on their attitudes toward environmental protection and demographic categories. The results of this paper can inform researchers and policymakers of the characteristics of land management or environmental protection projects that reflect the watershed residents' preferences and values.

11:50am - 12:10pm

Collaboratives & Utilities: New Options for Municipal Stormwater Management

PRESENTER:
Amanda Ryan, Center for Land Use Education and Research, University of Connecticut

CO-AUTHORS:
David Dickson, Center for Land Use Education and Research, University of Connecticut

Options for funding stormwater management efforts in Connecticut are expanding. In other areas of the country, stormwater utilities are widely used to help cover the costs of installing and maintaining grey and green stormwater infrastructure. While our region has been slow to adopt this mechanism for raising funds for stormwater management efforts, that may be beginning to change. The state's first ever stormwater utility was approved by the City of New London in late 2018 which is one of just four Connecticut municipalities with legislative approval to establish a stormwater utility. This may change soon as there are efforts underway to introduce legislation that will extend this authority to all municipalities in Connecticut.

Stormwater collaboratives offer another way to gather more resources and funding for stormwater management. These too appear to be gaining steam in our region and state. Massachusetts now has at least six regional stormwater collaboratives and Connecticut's first one, the Eastern CT Stormwater Collaborative, kicked off in late 2018. Collaboratives provide a forum for member towns to share information, pool resources and share costs. Stormwater utilities and collaboratives are important tools that can help municipalities meet the expanding requirements to mitigate polluted stormwater runoff.

2:40pm - 3:00pm

Groundwater Flow and Discharge in Coastal CT Aquifers

PRESENTER:
Janet Barclay, New England Water Science Center, United States Geological Survey

CO-AUTHORS:
John Mullaney, New England Water Science Center, United States Geological Survey

Aquatic systems in and around Long Island Sound (LIS) provide a variety of ecological and economic benefits such as storm protection, water filtration, carbon sequestration, recreation, and habitat for commercially and recreationally important fish and bird populations. Some aquatic ecosystems in the LIS are degraded due to excess nitrogen (N) from sources such as wastewater treatment plants, septic systems, and fertilizer. A substantial fraction of nitrogen inputs to LIS are transported through the groundwater flow system. Because groundwater travel times (or residence times) in surficial aquifers are typically longer than one year, multiyear lags are introduced between inputs at the water table and discharge to receiving waters. Understanding the magnitude and spatial distribution of groundwater travel times is essential to planning and evaluating conservation efforts aimed at reducing N inputs to LIS. We developed a groundwater flow model of the Connecticut (CT) coast of LIS and adjacent areas of New York and Rhode Island to provide a regional tool for evaluating groundwater flow. The model serves as a framework for understanding the groundwater component of flow to the coastal watersheds of the LIS and for conducting more-detailed assessments of priority areas (for example, nitrogen loading to coastal embayments). Preliminary results suggest that travel times range from less than 1 year to more than 25 years across the study area and that groundwater discharge directly to coastal waters is substantial in some areas. We will present a summary of groundwater travel times and discharge rates for watersheds across Coastal CT.

3:00pm - 3:20pm

Physical Drivers of Groundwater Discharge Along Rivers

PRESENTER:
Kevin E Jackson, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:
Martin A Briggs, Office of Groundwater, United States Geological Survey
Janet R Barclay, New England Water Science Center, United States Geological Survey
Adam B Haynes, Dept. of Natural Resources and the Environment, University of Connecticut, Hydrogeophysics Branch, United States Geological Survey
Ashley M Helton, Dept. of Natural Resources and the Environment, University of Connecticut
Eric M Moore, Dept. of Natural Resources and the Environment, University of Connecticut

Groundwater discharge zones along river networks can serve as low flow stabilizers and thermal refuge for biotic communities while also act as conduits of legacy contaminants. Efforts to protect and manage groundwater-influenced/dependent stream habitats, however, are limited by our ability to characterize and predict their spatial distributions along river corridors. Characterization of groundwater distribution patterns requires contiguous and expansive yet finely resolved survey data in order to assess both localized (e.g. bank and hillslope), and broad, valley-scale drivers. To address these challenges, we conducted detailed bank side surveys of 5th order sections of the Housatonic River, MA, USA (12km),

and Farmington River, CT, USA (26km) in summer 2019 using handheld thermal infrared cameras to identify temperature anomalies indicative of groundwater discharge locations. We then performed a multi-scaled analysis on high resolution (1m) LiDAR-derived digital elevation models to characterize local (50-100m), and valley-scale (500-1000m) features (e.g., local: curvature, bank side slope; valley-scale: valley confinement, sinuosity) in order to assess the physical drivers of discharge zone spatial distributions. Features that best predict observed discharge will be identified through a multivariate analysis. On the valley-scale, initial findings suggest infrared surveyed river sections in partially-unconfined valley settings are associated with more extensive groundwater discharge zones than their unconfined and confined counterparts. On a localized scale, however, features such as steep bank side slopes and high curvature indicate groundwater discharge across a variety of valley-scale settings.

3:20pm - 3:40pm

Biogeochemistry of Groundwater Seeps in the Farmington River

PRESENTER:
Eric M Moore, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:
Martin A Briggs, Office of Groundwater, United States Geological Survey
Janet R Barclay, New England Water Science Center, United States Geological Survey
Adam B Haynes, Dept. of Natural Resources and the Environment, University of Connecticut, Hydrogeophysics Branch, United States Geological Survey
Ashley M Helton, Dept. of Natural Resources and the Environment, University of Connecticut
Kevin E Jackson, Dept. of Natural Resources and the Environment, University of Connecticut

Nutrient pollution in groundwater is widespread throughout the United States, in part because excess nutrients from land-use practices have infiltrated the groundwater system. As nutrients slowly travel along groundwater flowpaths, microbial communities within the aquifer often lack sufficient conditions to fully remove excess nutrients. Where groundwater flowpaths connect with surface water-interface sediments, the presence of diverse microbial communities and organic carbon allow biogeochemical processing that reduces nutrient loading to surface waters. Groundwater seeps are mapped using remote sensing techniques at a high spatial resolution using the natural temperature contrast between surface and groundwater temperatures in summer. In the summers of 2017 and 2019, we used handheld thermal infrared cameras to extensively characterize the locations of exposed bank and waterline groundwater seeps (n > 300) along 40km of river length in the Farmington River watershed. We sampled water from over 100 of these observed groundwater seeps for major anions, greenhouse gases, total carbon and nitrogen, and in-situ temperature to better understand spatial heterogeneity in groundwater seep biogeochemistry and its relationship to surrounding watershed properties. Using a principal component analysis, we found that variation in lateral groundwater seep chemistry was strongly associated with urban and agricultural land-use practices within the watershed. We used land cover data combined with modeled flow lines to calculate the weighted source area of land cover at our found groundwater seeps. Preliminary data suggest that groundwater seeps within majority forested land cover have homogenous biogeochemistry, while groundwater flow paths within mixed land cover have spatially heterogenous biogeochemistry.

3:40pm - 4:00pm

Spatiotemporal Patterns in Groundwater Seep Biogeochemistry

PRESENTER:
Adam B Haynes, Dept. of Natural Resources and the Environment, University of Connecticut, Hydrogeophysics Branch, United States Geological Survey

CO-AUTHORS:
Martin A Briggs, Office of Groundwater, United States Geological Survey
Janet R Barclay, New England Water Science Center, United States Geological Survey
Ashley M Helton, Dept. of Natural Resources and the Environment, University of Connecticut
Kevin E Jackson, Dept. of Natural Resources and the Environment, University of Connecticut
Eric M Moore, Dept. of Natural Resources and the Environment, University of Connecticut

Groundwater seeps along river banks connect hillslope and regional groundwater flow paths with surface waters. Groundwater flow paths that vary in length and residence time create complex groundwater seepage zones that are windows into groundwater quality. Our research aims to quantify the chemical and physical flux variability within observed river bank seeps over both space and seasons. We collected water samples from 40 groundwater seep locations located with handheld infrared camera surveys along two stream reaches (1- 1.5 km) in the Farmington River, CT, USA. Each reach contains two seepage zones consisting of 4-5 seepage 'facies', (i.e. spatially extensive discharge zones 10's of m in length along the riverbank). Hourly groundwater temperature signals were also collected with multi-depth (n=3) temperature profilers to model vertical groundwater fluid flux. Water chemistry (nitrogen, carbon, and chloride) was measured on three sampling dates between August and November 2019 to capture varying river flow conditions. Preliminary chemistry data shows varying degrees of spatially and temporal stability. One reach had a TN variance of 2.21 mg-N/L (range: 0.114 - 5.93 mg-N/L), indicating relative spatial stability, while the other had a much larger variance of 13.6 mg-N/L (range: 0.159 to 15.09 mg-N/L). The latter reach also exhibited temporal variation, with variance ranging from a high of 17.4 mg-N/L in September to a low of 8.19 mg-N/L in November. We plan to pair chemistry and water flux data to better understand the role of spatiotemporal variation in groundwater seepage zones in influencing surface water quality throughout river networks.

Innovative Environmental Education Approaches

10:50am - 11:10am

Environment Corps: Harnessing Undergrad Power to Help Towns

PRESENTER:
Chet Arnold, Center for Land Use Education and Research, University of Connecticut

CO-AUTHORS:
Marisa Chysochoou, Department of Civil and Environmental Engineering, University of Connecticut
Todd Campbell, Department of Curriculum and Instruction, University of Connecticut
John Volin, Office of the Provost, Department of Natural Resources & the Environment, University of Connecticut
Peter Diplock, Office of the Provost, University of Connecticut

The University of Connecticut (UConn) has a mission to develop and sustain meaningful, mutually beneficial engagement with the communities of the state. To this end, a faculty partnership that reaches across departmental and college lines is engaged in an NSF-funded project that seeks to enhance, expand and institutionalize a new model for community engagement at UConn. The "Environment Corps" focuses on using STEM disciplinary practices and knowledge to address

environmental issues at the municipal level. It combines the familiar elements of classroom instruction, service learning and Extension outreach in a unique way that provides “real world” experience for students as they prepare for the work force, while helping communities respond to complex environmental mandates. Students enroll in a semester of classroom instruction that focuses on the impacts and issues involved in an environmental problem at the municipal level. Case studies, news articles, guest lectures by practitioners, field visits, and group projects are used to provide a local framework for the class. Students can then choose to enroll in a practicum course during the following semester, where they form teams that work directly with municipal officials from Connecticut towns. The initial pilot effort, funded by an internal UConn grant, created the Climate Corps, now finishing its third year. It was joined in the following year by the Brownfields Corps, and the Stormwater Corps in Spring 2020. The challenge moving forward will be to institutionalize this approach at UConn by making it an attractive and viable option for instructors.

11:10am - 11:30am

Connecticut’s Blue Heritage Trail

PRESENTER:
Syma Ebbin, Department of Agriculture and Resource Economics, University of Connecticut

CO-AUTHORS:
Colleen Franks, Dept. of Marine SciencesUniversity of Connecticut

The Blue Heritage Trail (BHT) project, supported by the University of Connecticut Office of Public Engagement, National Park Service and Connecticut Sea Grant seeks to raise public awareness of the critical importance of the marine environment and maritime economy and culture in Connecticut and, indeed, everywhere. Connecticut’s maritime heritage is long and varied, encompassing the relationship of indigenous peoples’ to the marine environment, the development in the early decades of the United States and continuation of maritime commerce, as well as the many significant individuals and events that played a role in transforming this region. Public awareness and appreciation of this is critical in developing a holistic understanding of the value of the marine environment and maritime heritage in CT and the US. Most learning that occurs over the course of a person’s life occurs outside the boundaries of formal instructional settings, in informal situations, often outside of educational institutions. The BHT is designed to target life-long learners engaged in this type of free-choice learning. The trail is comprised of walking, car and boat tours, augmented by physical signage and virtual content hosted on our website and on the IZI travel app. We have assembled a BHT Advisory Board, partnered with the Thames River Heritage Park and continue to incorporate this project into UConn classes via service-learning, internships and independent projects. The BHT project aims to provide learning opportunities for residents and visitors, allowing them to locate, visit and enrich their understanding of maritime-themed attractions and events. This presentation provides an overview of these efforts.

11:30am - 11:50am

Creativity in Conservation: Saving Our Ocean through Art

PRESENTER:
Ren Bettencourt, Bow Seat Ocean Awareness Programs

Bow Seat Ocean Awareness Programs is a Boston-based nonprofit working to activate the next wave of ocean leaders through the arts, science, and advocacy. For the past 9 years, our Ocean Awareness Contest has invited teens worldwide to creatively explore the connections between human

activities and the health of our ocean, with a focus on humans' roles as both problem-makers and solvers. Through visual art, writing, music, and film, students learn about and engage with critical conservation topics such as plastic pollution, endangered species, and climate change. Since 2012, over 13,000 teens from 107 countries and all 50 U.S. states have participated in the Contest. For many of these students, our programs are a stepping stone into the world of environmental action. The artistic process is a means for them to investigate knowledge and feelings around issues; it shapes their attitudes about their own power to make a difference and helps them find and share their voice. 70% of students report that the Contest increased their knowledge of ocean issues, and 67% state that it impacted their worldview and behavior. 86% report that creating something (i.e., art, writing, music, or films) helped them personally connect with conservation topics. Perhaps most importantly, participants say that after creating something that expresses their feelings and visions for the future of our planet, they feel hopeful. In this presentation, we will showcase compelling student artwork and celebrate the success of the Ocean Awareness Contest in educating thousands of teens worldwide about ocean conservation issues.

11:50am - 12:10pm

Project Management and Intergenerational Co-creation

PRESENTER:

Jennifer J. Pagach, Goodwin-Niering Center for the Environment, Connecticut College

Representing Goodwin-Niering Center for the Environment at Connecticut College, Jennifer Pagach will share observations, insights and questions that arise from Center Sophomore service learning projects with Avalonia, a local land conservancy organization that results in intergenerational interactions. In this model, College sophomores learn the real world skills involved in project management and get involved in community level land conservation and management, an area desperately in need of involvement from newer generations. Attending this interactive presentation we will discuss how can one design or tweak programs and initiatives to harness unique co-creative opportunities for growth of all involved.

2:40pm - 3:20pm

CT Environmental Literacy Plan & Green LEAF

PRESENTER:

Susan Quincy, State Parks, Outreach and Education, Kellogg Environmental Center, Connecticut Department of Energy and Environmental Protection

ELPs are a tool for community organizations, governments and schools to use to increase environmental education impacts nationwide, spear headed by the EPA and North American Association of Environmental Educators. Then as now it is the goal to provide the framework for states to define environmental leadership and best practices related to their state's vision so that individuals and groups may move toward goals that increase healthy and sustainable actions in Connecticut. Environmental Literacy works to break the disconnect between what people know and what people do. An outgrowth of the ELP was the establishment of the Green LEAF school program which reflects this. We are now ten years later and time to revamp the plan to reflect the needs of the next ten years. Come learn about the elements, goals and use of the plan to help develop stronger partnerships and programs for environmental literacy in CT, how to bring this resource back to your schools, homes and organizations, and be part of the review and public comment process.

3:20pm - 3:40pm

Environmental Literacy through Experiential Learning

PRESENTER:

Kirsten Martin, Department of Biology, University of Saint Joseph

The importance of, and support of Environmental Literacy in K-12 education is well documented, but in order to promote careers in the environmental field, it is imperative that Environmental Literacy also be present in college curriculum. At the University of Saint Joseph, we have incorporated a variety of research projects into the curriculum. Throughout their career, our students encounter projects that help them understand their surrounding environment in novel ways. While minimal exposure to environmental topics is common in college biology curricula, we incorporate field projects across many courses that help students apply their knowledge. Projects occur each year and range from local environments (e.g. monitoring campus wetlands) to working in neighboring watersheds. The generation of long-term large databases then leads to more independent research opportunities for inspired students. The students gain a crucial new appreciation for and understanding of the environment. This simple or complex understanding leads to enhanced critical thinking, such asking if our food web on campus is sufficiently stable or under pressure from climate change. The data collection experience as part of a course provides real world experiences and context for the textbook knowledge. Our students acquire skills that go beyond the standard biology curriculum and are key for employability: expanded skills in independent problem solving, analyzing large quantities of data, teamwork, and oral presentations. In this presentation, we will share the successes and pitfalls experienced in our pursuit of incorporating more environmental literacy across our biology curriculum through valuable experiential learning.

3:40pm - 4:00pm

Civilian Environmental Journalist

PRESENTER:

Laura Modlin, President of Aspetuck Media, LLC & The Rescued Earth

One of the biggest parts of my environmental writing for newspapers and magazines has always been discovering the stories. It's not enough to just say that you want to write about a topic, you have to find the story you want to tell. And, in doing that discovery work, you need to focus, get to know the subject. To examine and connect. What is the story here? It's not just a list of facts. It's an essence and how you pull the reader in. People are hungry for what is real.

The process taught me about nature since I was examining it so closely, made me invested and interested. And I believe that by teaching this process to everyday people I can help connect them to nature and inspire them to want to protect the natural world. This is my mission. In my talks and workshops, I hope to show people a bit about the structure and mechanics of journalism as a way of exploring and investing in nature.

I have put my heart into every story I have written. I was a regular contributor to Hersam Acorn Newspapers from 2007-15, winning three Connecticut Agricultural Journalism awards for best feature, and wrote for Edible Nutmeg periodically during that time. My background also includes a MFA degree from New York University's graduate film program. This project is part of my response to people asking me what they can do to help.

4:00pm - 4:20pm

20 years of Environmental Education along the North Branch

PRESENTER:
Mary Rickel Pelletier, Director, Park Watershed

Twenty years ago, a diverse network of stakeholders constructed a Hartford Urban Outdoor Classroom and Nature Trail along the North Branch Park River. The project aimed to provide students, teachers, and urban communities greater access to local natural resources, and to cultivate interdisciplinary knowledge. A recently released environmental education report: 'Learning How to Conserve and Revitalize the North Branch Park River' (Oct 2019) summarizes lessons learned from that nature trail, and characterizes other educational programs along the 5.8-mile North Branch Park River (CT4404-00_01 and CT4404-00_02). Findings from this research, which was supported by a Watershed Assistance Small Grant, expose the challenges of maintaining a site-specific trail network across multiple school properties. Nine K-12 schools (public, magnet and private), as well as UConn School of Law, University of Hartford, and Hartford Seminary are located along the North Branch within Hartford city limits. In addition, cultural heritage institutions, such as Connecticut Historical Society, The Wadsworth Atheneum's Austin House and The Mark Twain House and Museum also own property along the North Branch. This cluster of institutional properties foregrounds the challenging relevance of campus landscapes to communicating science, and reveals how practical concerns, such as maintenance, weather, limitations of class-time, and appropriate attire for outdoor activities, can minimize effective educational stewardship of local natural resources. This presentation will summarize report findings as well as describes ways in which new technology is engaging students and teachers in the development of scientific information that is relevant to a broader audience.

Mapping (GIS) Data & Applications

10:50am - 11:10am

From Maps to Apps: Accessible Tech for Field Scientists and Citizen Scientists Alike

PRESENTER:
Cary Chadwick, Center for Land Use Education and Research University of Connecticut

CO-AUTHORS:
Dave Dickson, Center for Land Use Education and Research, University of Connecticut

Fieldwork is a major component of just about every geoscience discipline and typically requires specialized instruments or equipment to measure and monitor an array of geophysical phenomena. Despite the level of sophistication inherent in these instruments, scientists often still need flexible and adaptable data collection tools to meet experimental or monitoring needs. Additionally, advancements in data collection technology has made it easy to leverage sensors in smartphones and tablets including cameras, GPS, accelerometers, gyroscopes, as well as more advanced sensors that can be connected to these devices through Bluetooth. This opens doors for citizen science projects which are typically limited in scope by a user's knowledge and ability because these apps can increase the accuracy and dependability of crowdsourced data. This presentation will provide an overview of the movement toward mobile data collection apps, briefly showcasing a few of the well-known and lesser known options on the

market and providing examples of how apps can be used as stand-alone tools for scientific data collection.

11:10am - 11:30am

Statewide Lidar Elevation Points in Interactive 3D

PRESENTER:
Emily Wilson, Center for Land Use Education and Research, University of Connecticut

Lidar is a remote sensing technique to map elevation using a laser sensor on an airplane. The result is millions of points (or more) which are often used as input to other datasets such as digital elevation models (DEMs) which show the surface of the bare ground. It has been more difficult to work with and visualize the actual points due to their 3D nature and overwhelming numbers, especially on a statewide extent. But that was then, the statewide 3D Lidar Interactive Viewer is now.

The new 3D Lidar Viewer is a proof of concept for publishing statewide colorized Lidar points in a 3D ArcGIS Online web scene. It was created with the help of Esri's Living Atlas Team using ArcGIS Pro and published to ArcGIS Online. It is available on the CT ECO website which is a partnership between UConn CLEAR and CT DEEP.

The Viewer contains the 2016 statewide Lidar points which were colorized using summer aerial imagery (NAIP). This means that the points have color corresponding to what is on the ground at that location. Also included in the viewer are points showing detailed building roofs and bridges, points colored by intensity as well as elevation, a pilot area of 3D buildings and trees (including tree height and diameter measurements) along with existing shaded relief, contours and impervious surfaces.

We are just beginning to explore the many applications. Check it out at http://cteco.uconn.edu/projects/lidar3D/.

11:30am - 11:50am

Communicating Trail Data through the Connecticut Trail Census

PRESENTER:
Laura Brown, Department of Extension, University of Connecticut

CO-AUTHORS:
Charles Tracy, Department of Extension, University of Connecticut
Emily Wilson, Center for Land Use Education and Research, University of Connecticut

The Connecticut Trail Census is an innovative statewide volunteer-based data collection and education program that encourages data informed decision-making and promotes active citizen participation in multi-use trail monitoring and advocacy. The Trail Census includes trail use counts recorded by infrared pedestrian counters, trail user intercept surveys administered by trained volunteers, and public education programs including a GIS based data visualization portal. Over the past three years the project has documented thousands of trail uses and analyzed over 3,000 intercept surveys from 20 multi-use trail sites across Connecticut. The project is statewide and serves community leaders and decision makers including local elected officials, planners, economic development professionals, trail advocates, trail maintenance professionals, environmental, health and outdoor activity advocates, as well as the general public.

Mini-symposium “Teaching Science Through Immersive Experiences”

10:50am - 11:10am

The Flipped Science Fair

PRESENTER:
Richard B Crouse, Yale Science Diplomats

The Flipped Science Fair is an annual event hosted by the Yale Science Diplomats where middle school students engage with cutting edge science by judging how well early stage scientists present their research. In preparation for the event, undergraduates, graduate students, and postdoctoral fellows participate in workshops over the course of several weeks to learn how to distill their research message and create intuitive and effective graphics, focusing on the big picture and keeping it exciting. In groups of 3-4, the middle school students rotate through poster presentations that have been specifically tailored for them. The students are encouraged to ask questions throughout and after each presentation they quantitatively evaluate the presenters using a judging sheet. Poster sessions are broken up by a hands-on demonstration session and the day concludes with an award ceremony for top scoring presenters. Over the last two years, a vast majority of students enjoyed the event overall and presenters found it a valuable addition to their scientific training according to post-event surveys. The Flipped Science Fair is a cost-effective framework that can be effectively transferred and scaled up at virtually any institution to improve the communication skills of current scientists and inspire the next generation.

11:10am - 11:30am

Program Approaches to Promote STEM Learning through Community Conservation Efforts

PRESENTER:
Laura Cisneros, Dept. of Natural Resources and the Environment, Institute of the Environment, University of Connecticut

UConn’s Natural Resources Conservation Academy (NRCA) uses an innovative leadership framework that crosses age and ability boundaries to support the implementation of environmental solutions. First, teen and adult community partners receive training in conservation science and geospatial technology during a hands-on field experience. Then each teen-adult partnership designs and implements a project that addresses a real community environmental need, leveraging their new technological and conservation toolkit. Through our iterative experiences at improving this place-based environmental action program, we developed design principals and communication pillars that facilitate this type of environmental action programs and teen-adult conservation partnerships’ community and environmental impacts.

Collectively, 232 community conservation projects have been carried out by over UConn NRCA teen-adult partnerships statewide. Participant projects addressed a range of environmental topics and had diverse and significant environmental and community outcomes. We identified 4 design principals and 6 communication pillars that were critical to facilitate teen-adult volunteer conservation efforts that made significant environmental and community impacts. Providing research-informed environmental training to conservation volunteers of all ages is essential, as land management decisions are largely

carried out by volunteer-based commissions and land trusts. The guiding principles we propose will help enhance these citizen-driven community and environmental outcomes.

11:30am - 11:50am

College Field Courses: Using Curiosity To Learn About Science

PRESENTER:
Gustavo Requena Santos, Connecticut Outdoor and Environmental Education Association

In this presentation, I will describe how my experiences as a student, a mentor and a coordinator of college Field Courses have touched and inspired me. Students apply the scientific method into practice through a series of ecology field projects. Mentors stimulate them to (i) observe nature, (ii) identify an unknown problem or question about their observations; (iii) create their own hypotheses for such problem/question, (iv) discuss and implement the appropriate methods to test their hypotheses, and (v) interpret their data regarding the problem and hypotheses posed. These experiential activities train students' observation skills and stimulate their curiosity about the natural world, as well as their creativity, critical thinking and argumentation skills. But their more general goal is to facilitate opportunities for students to learn the fundamentals of science reasoning and the scientific method by doing science. Seeing students eager to explore the unknown has been a truly rewarding experience and has nourished my passion for science education for people of all ages and backgrounds. The distrust in facts has been surprisingly growing recently, and science literacy and critical thinking are extremely powerful approaches that hold the importance of evidence to a higher standard. I will discuss a few ideas of education programs for general audiences that promote science literacy. These programs should create awareness of the importance of evidence-based decisions to our everyday lives and, ultimately, stimulate participants to become science advocates themselves.

11:50am - 12:10pm

Seedlings Summer Workshop: Re-inspiring & Supporting Teachers

PRESENTER:
Katy Botta, Seedlings Educator Collaborative

CO-AUTHORS:
Leslie Gill Long, Seedlings Educator Collaborative

The Seedlings Educators Collaborative provides professional development, ongoing support and resources to Connecticut educators from diverse school environments. The Seedlings Summer Workshop is a five-day gathering where public, independent, and parochial educators teaching Pre-K through Grade 6 gain inspiration and new techniques to support them throughout their careers, and leave with renewed energy and passion that first brought them to teaching. This workshop brings teachers together to work in small grade-level groups and, with the guidance of community leaders and experts from several fields of Science, Technology, Engineering, Arts, and Mathematics (STEAM), collaborate to create engaging curriculums that align with what students will experience later in life, value integration across disciplines and meet state and national standards. One of the most important aspects of the workshop is the recognition of the fundamental role of child development during the process of building inquiry-based, hands-on STEAM programs that encourage students' natural curiosity and creative problem solving. Moreover, collaboration is a main tenet of the week and like-minded educators bond through shared

conversations and activities that enrich the experience for all. In 2017, Seedlings launched a fellowship program for workshop alums that had showed particular interest and aptitude for full STEAM integration, and a willingness to lead and mentor other teachers in their schools and communities. Fellows act as resource liaisons, STEAM mentors, and help with outreach so more teachers, curriculum specialists, and school administration become aware of and excited about the unique offerings Seedlings provides for educators, and in turn students.

Integrating Climate Change Science into Curriculum

2:40pm - 3:00pm

Modernizing Visual Representations of Climate Change

PRESENTER:
Kaleigh Rusgrove, Fulbright U.S. Student Program, Western Sydney University

CO-AUTHORS:
Michelle Catanzaro, Western Sydney University

Despite a significant shift in public awareness of and concern for climate change, the imagery associated with the climate crisis relies upon tired tropes. These 'stalled' images – polar bears on thin ice, billowing smokestacks, etc. – do little to inspire the public due to overuse, and in some cases have even been found to have a negative impact on viewer engagement. If we wish to inspire change and better educate the public we must modify the imagery associated with climate change. This presentation will cover qualitative research and visual analysis of this issue and related imagery conducted in Sydney, Australia throughout 2019.

Further research on this topic is currently underway, as the recent Australian bushfire season saw a massive worldwide public response. The types of images made in Australia over the last six months are similar to those we called for in our initial findings. However, it should be noted that despite early signs of strong reactions to newly published images, the visual expressions of climate change remain of great concern, as this suggests that the greatest response to visual stimuli comes at the cost of ecological devastation.

3:00pm - 3:20pm

Survival by Degrees: Local Climate Impacts in the Classroom

PRESENTER:
Ken Elkins, Audubon Connecticut

Audubon CT, in partnership Danbury Public Schools, are developing a new project-based learning unit for 6th grade science classrooms that will use Audubon's Survival by Degrees Report as the catalyst of their learning. Audubon scientists took advantage of 140 million observations, recorded by birders and scientists, to describe where 604 North American bird species live today—an area known as their "range." They then used the latest climate models to project how each species's range will shift as climate change and other human impacts advance across the continent. Students will utilize the tools of Audubon's Birds and Climate Vizualizer to study the local impacts of climate change that will spark interest to investigate pragmatic solutions the students can advocate and participate in. Final elements of the curriculum are still in development for May 2020, but we're excited to share the tools we've developed

that students across the state could use to guide them through the website and begin to develop their understanding of the impacts of climate change on their own neighborhoods.

3:20pm - 3:40pm

Translating Climate Science to High School Audiences

PRESENTER:
Beth Lawrence, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:
Kimberly Williams, Smithtown High School, NYS Master Teacher Candice Cambrial

High school education is an essential piece of the puzzle as society decides how to address the changing climate, and teachers are the means by which todays' students will become tomorrow's informed citizens. Inquiry-based teaching promotes understanding of scientific phenomena and the nature of science; thus evidence based, student-centered instructional materials related to climate change that align with national educational standards such as the Next Generation Science Standards (NGSS) and Ocean Literacy Standards (OLS) are needed. Regionally relevant case studies in particular can engage students and show how global issues impact their local environment. To fill this need, we created a week-long, inquiry-based climate change module for high school students that aligns with NGSS and OLS, focused on sea level rise effects on salt marshes of the Long Island Sound (LIS). The module centers on how scientists in the region are studying the various impacts of climate change on salt marsh habitat and includes an interactive EdPuzzle, a case study exploring the ecological and socio-economic aspects of rising seas in the LIS, and a Mystery Scientist activity. The module includes five days of interactive activities designed to be easily modified and delivered to different skill levels and audiences. The module is now publically available (https://climate.uconn.edu/tools-assistance/teachers/) and we aim to encourage awareness of this new resource to regional educators.

3:40pm - 4:20pm

Teaching the Human Dimensions of Climate Change

PRESENTER:
Diana Payne, Connecticut Sea Grant, University of Connecticut – Avery Point Campus

An understanding of climate change – its causes and effects – goes beyond the realm of climate science. As perhaps the greatest threat to humanity in the 21st century, climate change is cross disciplinary and encompasses many of the NGSS Crosscutting Concepts, as well as the fundamentals of human geography and history. In this hands-on session, the presenter will focus on putting the science in a social perspective by examining the trends over the past 200 years that correlate to climate change (population growth, fossil fuel use, industrialization, changing land use) as well as climate change impacts (sea level rise, severe weather and threats to habitats/ecosystems). The presenter will introduce curricular materials to use in the classroom or environmental education center. She will engage participants in a group activity that helps students to analyze and make connections among different visual data items (graphs, infographics, articles and satellite imagery) to better understand climate change causes and impacts on our shared environment and human communities. Participants will receive access to a password-protected website of teaching activities.

Workshops

10:50am - 12:10pm

Erosion Control & Stormwater Management for Ground Mounted Solar

PRESENTER:
Steven Trinkaus, PE; Trinkaus Engineering, LLC

CO-AUTHORS:
Deb Moshier-Dunn, #SmartSolarCT

Connecticut has experienced many environmental issues with large solar arrays causing adverse environmental impacts during and after construction. Many people consider these projects benign from an environmental impact as the panels are mounted above the ground. The reality is far different. These projects are just like large commercial development projects and need to be designed in a similar fashion from an erosion & stormwater perspective.

Forests are clear cut and prime farmland are used for these large projects. Discharges of turbid runoff into wetlands and streams during construction have fouled pristine aquatic systems. High runoff volumes after installation cause stream channel erosion & sedimentation. This workshop will show by case studies the how and why these impacts are occurring.

The reasons behind these issues will be presented, both from a design and implementation point of view. Designers make invalid assumptions during the development of erosion and control plans when evaluating both vegetative cover and soil conditions. Contractors do not follow the plans approved by the Connecticut Siting Council leading to failure of erosion and stormwater systems in the field.

Methodologies and approaches to address these issues will be explained in detail to prevent these environmental impacts from occurring.

2:40pm - 4:20pm

The Forest Ecosystem Monitoring Cooperative: Creating a CT State Partnership Committee to Direct FEMC Work

PRESENTER:
Robert Marra, The Connecticut Agricultural Experiment Station
James Duncan, Forest Ecosystem Monitoring Cooperative

The purpose of this workshop is to introduce the Forest Ecosystem Monitoring Cooperative (FEMC), and to facilitate the formation of Connecticut's State Partnership Committee (SPC) for involvement in the FEMC. The FEMC began in Vermont, soon expanded geographically to include New York, New Hampshire, Massachusetts, and Maine, and is now expanding to include Connecticut and Rhode Island. The mission of the FEMC is to serve as a hub for forest monitoring and research in the northeast, allowing researchers and practitioners from a range of disciplines and institutions to synergistically collaborate on monitoring and assessment of forested ecosystems at scales ranging from state-specific to regional. The FEMC synthesizes and aggregates data and information, providing partners access to data archives and tools for understanding data. Each state's SPC contributes to the

development of regional work plans through participation with the FEMC Steering Committee, serving as a state-level body of expertise to guide the work of the Cooperative.

Poster Presentations

10:00am - 10:45am (All posters)

Complexity as a Mediator of Post-Disturbance Productivity

PRESENTER:
Brandon C Alveshere, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:
Thomas E Worthley, Dept. of Natural Resources and the Environment, University of Connecticut
Jeff W Atkins, Dept. of Biology, Virginia Commonwealth University
Robert T Fahey, ,Dept. of Natural Resources and the Environment, University of Connecticut

Canopy structural complexity (CSC) is an important functional characteristic of forests that describes variability in physical locations of canopy structural elements. CSC influences numerous physical processes within the canopy, including radiation transfer, wind penetration, and gas diffusion rates, which may affect Net Primary Productivity (NPP) and its response to disturbance. Observational studies suggest NPP response to disturbance is mediated by CSC, but further research is needed to separate the specific effects of pre-disturbance conditions, disturbance severity, and disturbance induced changes in CSC as drivers of NPP response. We addressed this need by designing and implementing a replicated field experiment in which stands similar in initial composition and structure were explicitly manipulated to different levels of CSC. Digital scans were collected from 12 temperate forest plots using a terrestrial laser scanner (TLS), and then combined into point clouds representing baseline forest structure in each plot. Point clouds were manipulated to alter CSC based on canopy rugosity, which was calculated for pre- and post-manipulation point clouds using the forestr package in R. Plots were then managed according to the digital templates to increase, decrease, or maintain CSC through removal of approximately 20% of the initial plot basal area. Measurements of bole diameter are collected on an annual basis to determine wood increment, and results will be combined with region- and species-specific allometric equations to evaluate the role of CSC in determining NPP response to forest disturbance. Ongoing monitoring will provide insights into CSC-disturbance-productivity relationships useful in silviculture and forest ecosystem model parameterization.

Legacy Vegetation Data Matters

PRESENTER:
Nels Barrett, Natural Resources Conservation Service

CO-AUTHORS:
Kim Stafko, University of Connecticut
Michael Margo, NRCS-12TOL FO
Kenneth Metzler, Consulting Ecologist, Willington, CT

Ecological sites described by the Natural Resources Conservation Service are fundamental land units relating vegetation, soils, and land use across the local landscape. Conceptually, ecological sites

provide a consistent framework to represent nature's landscape complexity in terms of integrity and dynamics which serves as context for conservation-based management. Key to the characterization of ecological sites is the geographic representation of soils, the expression in the dynamics of associated plant communities, and some knowledge of site history. The purpose of this project is to revitalize "legacy" (i.e., historic hardcopy) vegetation plot data in support of describing the plant community-types used for determining ecological sites. Major challenges in processing legacy vegetation is data recovery, updating, and management. A small set of legacy vegetation data was compiled from contributing area ecologists. Sites were georeferenced based on known coordinates or plot locale. Plant nomenclature was updated to current standards in the USDA NRCS PLANTS database. Floristic plant communities portrayed in the plots were then ascribed to conform to the National Vegetation Classification standards. All site and floristic information were digitally entered into a simple "PLOTS" database (MSAccess). The resulting modernization of legacy vegetation data into a localized geographic database allows for exploratory data analysis, as well as tailored data exports to other data repositories such as the NRCS' National Soil Information System (NASIS) and Ecosystem Dynamics Interpretive Tool (EDIT), and VegBank, the national vegetation plot database.

The Role of Vegetation Analysis in Ecological Site Landscapes

PRESENTER:
Nels Barrett, Natural Resources Conservation Service

CO-AUTHORS:
Greg Schmidt, NRCS-12GRR-FO
Angelique Lopez, University of Connecticut
Michael Margo, NRCS-12TOL FO

Relative to NRCS' Ecological Site Program, interest in a nested hierarchical scheme of ecological land classification as a means to organize nature's spatial and functional complexity has expanded, and with that, a need to examine the role of vegetation analysis at various hierarchical scales. Because the nature of environmental factors controlling the vegetation pattern varies with the scale of observation, it follows that, at different levels of integration, different vegetation properties or metrics can be used to describe and map vegetation patterns at different scales. At the local scale of the fundamental ecological site, vegetation analysis contributes most by recognition of individual vegetation-types (associations and dynamic phases within various states of land conditioning). Immediately above the level of ecological site, at higher spatial integration and greater heterogeneity, vegetation analysis will be explored to determine the relationships among plant community complexes and or regionally-dependent vegetation patterns using gridded land unit boundaries, soils, and vegetation.

Shifts in Dynamic Characteristics of Trees After Management

PRESENTER:
Amanda Bunce, Dept. of Natural Resources and the Environment, Fahey Forest Ecology Lab, University of Connecticut

CO-AUTHORS:
John C. Volin, Office of the Provost, Dept. of Natural Resources and the Environment, University of Connecticut
Jason R. Parent, Dept. of Natural Resources Science, University of Rhode Island
David R. Miller, Dept. of Natural Resources and the Environment, University of Connecticut

Mark Rudnicki, College of Forest Resources and Environmental Science, Michigan Technological University
Thomas E. Worthley, Dept. of Natural Resources and the Environment, University of Connecticut
Robert Fahey, Dept. of Natural Resources and the Environment, University of Connecticut

In southern New England, roadside forest presents a risk to utility infrastructure during storm events. It is estimated that 90% of power outages in storms are caused by trees, and cost is in damage, economic losses, and risk to public safety. Climate change projections suggest storm events will become more frequent and severe. Forest, however, is vital to the southern New England socio-ecosystem. Management of roadside forest could mitigate the risk it poses.

Research suggests that trees with a higher sway frequency are less susceptible to wind damage. We monitored the sway motion of forty-one trees in three edge sites in Connecticut for one year before thinning the sites, and for several years after. Residual trees were healthy, well-formed, and expected to respond well to the opening of space around them. In addition, greater wind penetration into the forest was expected to stimulate the increase of sway frequencies. In this preliminary look at the long-term data, we see frequency increasing in the majority of trees. Comparatively, trees in unmanaged control areas experienced lesser and more variable changes. To study the amplitude of sway, we mapped the area reached by a tree as it sways in ten-minute periods. The area of the map, for a given wind condition, appears to be decreasing, suggesting the tree displaces to lesser distances. This roadside forest management method has the potential to increase the wind firmness of residual trees, and if implemented landscape-wide, could significantly mitigate the risk to infrastructure and protect the forest.

Outdoor Education Coaching for Family Child Care Educators

PRESENTERS:
Monica Edgerton, All Our Kin
Angela Cusicanqui, All Our Kin

All Our Kin is a Connecticut based non-profit that supports and sustains family child care (FCC) educators so that children and families have the foundation they need to succeed. Working with over 500 FCC educators in New Haven, Bridgeport, Stamford, and the Bronx, All Our Kin's unique coaching model is based on building strong relationships between skilled education coaches and home-based educators to achieve high quality early learning environments.

In line with our core value of equity and inclusion, we recognize that children who may have the least access to nature often need it the most. In this poster session, All Our Kin's Outdoor Education Coaches will share how we partner with FCC educators to create a high quality environment for children ages 0-5 where they can learn through nature.

We believe it is never too early to for children to absorb information through their sense of wonder and curiosity. Together with FCC educators, we select developmentally appropriate ways to teach science to very young children and cultivate their love of the natural environment through gardening and other outdoor educational activities.

Through story and pictures, conference attendees will learn how innovative FCC educators have overcome barriers to facilitate developmentally appropriate place-based outdoor educational experiences, creating a long-lasting impact on children and communities.

Thermal Regimes Downstream of Dams Across the United States

PRESENTER:
Ashley M. Helton, Dept. of Natural Resources and the Environment, Center for Environmental Sciences and Engineering, University of Connecticut

CO-AUTHORS:
Danielle Hare, Dept. of Natural Resources and the Environment, University of Connecticut
Adam Haynes, Dept. of Natural Resources and the Environment, University of Connecticut
Kevin E. Jackson, Dept. of Natural Resources and the Environment, University of Connecticut
Eric M. Moore, Dept. of Natural Resources and the Environment, University of Connecticut
Samantha Dow, Dept. of Geosciences, University of Connecticut
Andy Fallon, Dept. of Geosciences, University of Connecticut
Peter Grundy, Dept. of Natural Resources and the Environment, University of Connecticut
Christopher J. Sullivan, Dept. of Natural Resources and the Environment, University of Connecticut

The goal of this study is to evaluate the thermal regimes of rivers downstream of dams across the conterminous United States. We synthesize publically available water temperature datasets for 563 river locations, including 391 locations downstream of dams and 172 reference locations, that have greater than 3 years of temperature records over the last 20 years. Study locations span nine climatic regions, a wide range of watershed sizes (< 20 to > 15,000 km2), and a variety of dam purposes, types, and sizes. Our objectives are: 1) to quantify how dams affect downstream annual thermal regime metrics in rivers, and 2) to determine how dam-induced changes to the annual thermal regimes vary with climatic region and dam properties. We characterize annual thermal regimes with 15 metrics that represent the magnitude, duration, frequency, timing, and rate of change in average daily water temperature over the year. Initial results suggest significant differences in 12 of 15 thermal metrics for reference versus dammed sites. All five metrics associated with magnitude were higher in dam sites across most climatic regions, suggesting widespread warming caused by dams across the thermal signal (ie increases in minimum and maximum daily temperatures). Significance and direction of change (increase or decrease) in other thermal metrics for dam relative to reference sites varied with climatic region. Our next steps are to expand the number of both reference and dam sites, and to use hierarchical clustering and multivariate analysis to evaluate how environmental, watershed, and dam characteristics may create distinct annual thermal signals downstream of dams.

Outreach Approach to Managing Housatonic River Public Access Sites

PRESENTER:
Lindsay Larson, Housatonic Valley Association

CO-AUTHORS:
Michael Jastremski, Housatonic Valley Association

In recent years, communities along the Housatonic River have seen an increase in the number of visitors at informal river access sites (e.g., public access areas provided by energy companies). High visitor density at these sites can have negative environmental effects, including excess litter and human waste, bank erosion, and wildlife disturbance. To address this, the Housatonic Valley Association (HVA) initiated the River Information & Outreach (RIO) program in 2018. The goal of RIO is to preserve the natural beauty and environmental health of the Housatonic River, while ensuring the availability of a

variety of public river access options. The RIO program consists of HVA seasonal staff (River Stewards) traveling among priority river access sites along the Route 7/Housatonic River corridor (Gaylordsville to Falls Village, Connecticut) each weekend throughout the summer months. River Stewards engage with site users, outline the Leave No Trace site rules, and ensure that large groups have a plan for garbage removal. River Stewards also collect data through site assessment forms and interviews. Results from the first two years indicate that the total number of visitors increased at several sites, yet the litter collected by HVA staff (measured as number of trash bags) decreased. As RIO enters its third year, HVA continues to collaborate with local communities and key stakeholders to refine the program for increased effectiveness in reducing litter and avoiding site closures.

Investigating the Effect of Edge Structure on Roadside Forest Soundscapes

PRESENTER:
Kerste Milik, Dept. of Natural Resources and the Environment, University of Connecticut
CO-AUTHORS:
Robert Fahey, Dept. of Natural Resources and the Environment, University of Connecticut

Anthropogenic noise pollution is a widespread phenomenon that can be harmful to both humans and wildlife, with effects such as hearing loss, stress, and masking of animal communication. One of the most pervasive sources of noise pollution is road traffic, which accompanies extensive development and forest fragmentation worldwide. In Connecticut, 43 percent of forests are within 500 feet of a road, necessitating further study into the noise exposure of these valuable habitats. Trees are known to provide noise attenuation effects, but few studies have examined this relationship in the context of exurban roadside forest management strategies. We are developing a study that will use acoustic monitoring tools on an edge-to-interior gradient at a variety of southern New England roadside forest sites with conditions that represent the landscape as a whole and a range of potential forest or tree management outcomes. Using soundscape ecology metrics, we will assess how noise intensity and acoustic diversity (an indicator of biodiversity) relate to forest edge structural characteristics as well as road characteristics. Our analyses will help determine which forest edge types are most effective at attenuating noise pollution while continuing to provide wildlife habitat. This valuable information can be used to evaluate forest management strategies and ensure that ecosystem services are maintained or enhanced through management. With acoustic monitoring emerging as a cost-effective tool for assessing anthropogenic noise and biodiversity levels throughout the world, this study will contribute to a valuable growing collection of data on soundscapes.

Tide Propagation in a New Hampshire Tidal Marsh Regulated by Road Crossings

PRESENTER:
Gopal Mulukutla, Institute for the Study of Earth, Oceans, and Space, University of New Hampshire

CO-AUTHORS:
Jennifer Hale, Department of Public Works, Hampton, NH

Tidal water bodies in coastal New England are at the frontlines of the region's challenges associated with climate change including sea level rise and increasingly intense storm events. The timing and magnitude of tide propagating through a tidal marsh is an important indicator of the mechanics of flow within these marshes and how they will respond to these challenges. Many of these water bodies are crisscrossed by road crossings that at times regulate the hydrologically complex bidirectional flows seen

in marshes. This work summarizes an ongoing study to understand the timing and magnitude of tide propagation at the Meadow Pond tidal marsh in Hampton, NH that drains into the Hampton-Seabrook estuary via Brown's River. Eight CTD (conductivity, temperature and depth) sensors were installed, including three pairs upstream and downstream of three road crossings. 10-minute data of tidal depth, salinity and temperature was collected at each station. Initial results show that while tidal water depth in the marsh is dictated by prevailing tide in the estuary there is a higher lag in low tide than high tide suggesting that some of the road crossings may be constraining the rapidly declining flows. Furthermore, salinity gradient in the marsh is dictated by freshwater inputs to the Mill Pond reservoir, and the closest road crossing to this reservoir is vulnerable to inundation from high tide events during intense rain events. Future work includes the development of a tide propagation model for the marsh.

The Role of Timing in Forest Disturbance Interactions

PRESENTER:
Danielle N. Tanzer, Dept. of Natural Resources and the Environment, University of Connecticut

CO-AUTHORS:
Robert Bagchi, Dept. of Ecology and Evolutionary Biology, University of Connecticut
Audrey Barker Plotkin, Harvard Forest, University of Massachusetts – Amherst
James Hurd, Dept. of Natural Resources and the Environment, University of Connecticut
James Mickley, Dept. of Ecology and Evolutionary BiologyUniversity of Connecticut
Keenan J. Rivers, University of Connecticut
Chandi Witharana, Dept. of Natural Resources and the EnvironmentUniversity of Connecticut
Robert T. Fahey, Dept. of Natural Resources and the EnvironmentUniversity of Connecticut

Climate change has the potential to increase the frequency and severity of forest disturbances, likely resulting in an increase in disturbance interactions. These interactions can intensify disturbance effects on factors such as tree mortality, stand growth, and future forest resiliency. More research is needed to understand the influence of temporal patterns on forest disturbance outcomes. This study assesses how timing and severity of the interaction between recent drought and gypsy moth defoliation in southern New England influenced tree mortality and stand growth. We collected tree cores from over 900 trees across 30 temperate forest sites in eastern Connecticut and central Massachusetts, where oaks are the primary host species of gypsy moths. Samples include gypsy moth preferred and non-preferred host species and both live and dead trees. Using dendrochronological analysis, we are analyzing the patterns of disturbance and resulting effects on growth and mortality. The analysis considers severity of both disturbances and temporal patterns of defoliation including number of years a site was defoliated and amount of time between the start of drought to the onset of defoliation. Preliminary results show overall and oak-specific mortality rates vary with patterns of defoliation ($p = 0.024$ and $p = 0.002$, respectively) with greater mortality rates in sites experiencing multiple years of defoliation. By studying this disturbance interaction, we aim to increase our understanding of compounding disturbances and shape disturbance monitoring programs.

Bat Activity in Regenerating Forest Stands

PRESENTER:
Daniel Wright, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut

CO-AUTHORS:
Chadwick Rittenhouse, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut
Katherine Moran, Connecticut Department of Energy and Environmental Protection
Thomas Worthley, Dept. of Natural Resources and the Environment, University of Connecticut
Tracy Rittenhouse, Dept. of Natural Resources and the Environment, Wildlife and Fisheries Conservation Center, University of Connecticut

Harvesting trees to increase landscape heterogeneity is commonly used to assist wildlife populations who use young successional habitat. The morphological characteristics of insectivorous bat species allow for a range in foraging strategies in regenerating forest stands. Understanding how the activity of bats changes as forests transition in successional stage can increase efficiency of forest management actions designed to assist bat populations. We measured activity of bats and their insect prey in forest stands regenerating from harvests with treatment dates ranging from 2007-2018. We selected twenty-seven sites, which consisted of a regenerating stand and paired control stand in adjacent interior forest. Acoustic monitoring was conducted from 5 May – 9 September, 2019. We monitored each site for a minimum of 2 consecutive nights, with available prey biomass quantified on the last night of monitoring. Insect samples were collected using a blacklight UV funnel trap, identified to order and measured at dry weight. Across all bat species identified, we found activity was significantly higher in regenerating stands versus control stands. Age of the regenerating stand significantly affected Eptiscus fuscus activity, which was higher in stands < 8 years old, reaching peak activity 6 years post-harvest. A strong relationship between insect abundance and bat activity was not apparent, yet an additional year of sampling may enhance our ability to describe the pattern. This study demonstrates that there is a relationship between bat activity and time since harvest in a 12-year period, and that bat activity is higher in regenerating stands within a heterogenous forest.