Connecticut Conference on Natural Resources 2018 Program
Oral Presentation Abstracts

What's old is new: Managing nitrogen legacies

Janet R. Barclay, Ashley M. Helton, Martin A. Briggs, United States Geological Survey; J. Jeff Starn, United States Geological Survey

Current approaches to managing coastal eutrophication in the United States (USA) focus on surface runoff and riverine transport of nutrients, and frequently assume that groundwater-sourced N loads to streams are at steady state. This steady state assumption is not necessarily realistic, as terrestrial N inputs vary with shifts in land use and nutrient management practices. The implications of this simplification may be significant, as more than 50% of surface water in the USA is derived from groundwater; there is widespread N contamination in groundwater; and groundwater transport times can be decades or longer, creating a legacy N source that discharges to rivers years or decades after application to land surfaces. In addition, rates of N processing at the groundwater – river sediment interface vary widely, creating spatial variation in the resulting load. Managing legacy N requires a framework that accounts for the complex spatial and temporal factors affecting groundwater N loads to streams.

We developed a conceptual approach to managing legacy N that accounts for N inputs to terrestrial surfaces, subsurface transport (travel time, discharge rate and location), N removal in groundwater upwelling zones, and downstream processing in the river network. The framework identifies patterns of legacy N concerns and suggests relevant management actions. We will present our conceptual approach and preliminary results from applying that approach to the Farmington River Watershed. This management framework can be used to inform management of N loading from groundwater to coastal systems, such as the Long Island Sound.

Resilience Management for a Coastal Natural Area

Juliana Barrett, Helena Ives, Nancy Balcom, Beth Sullivan, Avalonia Land Conservancy
Roger Wolfe, CT Dept of Energy and Environmental Protection; MaryEllen Mataleska, Mystic Aquarium & Institute for Exploration

Dodge Paddock/Beal Preserve in Stonington, CT (3.68 acres) is owned and managed by Avalonia Land Conservancy. This site is located in a highly residential neighborhood in Stonington Borough and includes numerous high priority Long Island Sound Study habitats: tidal wetlands, coastal grassland, beach/dune habitat and rocky intertidal habitat which are under threat due to climate change. Avalonia Land Conservancy, Connecticut Sea Grant, Connecticut Department of Energy and Environmental Protection and Mystic Aquarium are partnering in the development and implementation of a resilience management plan for the site so as to incorporate climate change related factors such as sea level rise, marsh migration, increased heavy precipitation events, and increased shoreline erosion with more intense coastal storm events. Components of this resilience plan will be presented including: the need for a hybrid living shoreline approach to protect the tidal inlet and dunes from erosion and for the long term resilience of the tidal

wetlands; an area of currently cultivated gardens will be reclaimed and planted with native, salt tolerant vegetation as a tidal marsh migration buffer; and other upland areas will be cleared of brush and invasive plants and restored as coastal meadow/thicket. Resilience planning for this Preserve also presents an opportunity for outreach to neighbors, municipal officials and natural resource managers with regard to the impacts of climate change on natural resources and adaptation solutions.

Salt Marsh Vegetation Influence on Carbon-based Services

Aidan Barry, Sean Ooi, Ashley M. Helton, Chris S. Elphick, Blaire Steven, Beth A. Lawrence; University of Connecticut, Dept. of Natural Resources and the Environment, Storrs, Connecticut; University of Connecticut, Center for Environmental Science and Engineering, Storrs, Connecticut; University of Connecticut, Dept. of Ecology & Evolutionary Biology, Storrs, Connecticut; Dept. of Environmental Sciences, Connecticut Agricultural Experiment Station, New Haven, Connecticut

Coastal marshes are important "blue carbon" reservoirs that are increasingly threatened by sea-level rise and invasive species. Restoration efforts often aim to restore salt marsh vegetation composition, but it is unclear how vegetation shifts associated with restoration and sea level rise alter microbial respiration rates. In 2017, we surveyed 20 Connecticut salt marshes (10 tidally restored, 10 unrestored) and sampled plants and soils from three vegetation zones (*Spartina alterniflora, S. patens, Phragmites australis*). We quantified above- and below-ground biomass, a suite of sediment characteristics (pH, conductivity, soil moisture, % carbon, and several ion concentrations), soil respiration rates (SIR: substrate induced respiration; Cmin: carbon mineralization), and are in the process of sequencing sediment bacterial 16S rRNA genes. While none of our response variables differed between tidally restored and unrestored sites, we observed strong differences among vegetation zones. *P. australis* had greater aboveground biomass and lower root to shoot ratios than both *Spartina* zones. We observed higher rates of microbial respiration (SIR, Cmin) in the sediments of both *Spartina* zones than *P. australis.*
Our data suggest that *P. australis* sediments have higher carbon storage capacity than native *Spartina* sediments, and should be considered when preserving ecosystem function in coastal marshes.

A New Crowdsourcing Tool for Fisheries Resource Management

Julie Blum, Seasonal Resource Assistant; Deb Pacileo, Fisheries Biologist; Emma Heidtman, Seasonal Resource Assistant; Alice Colman, Seasonal Resource Assistant; Connecticut Department of Energy and Environmental Protection, Fisheries Division

Fishing is a common recreational activity in Long Island Sound (LIS). Ecologically productive areas where fishing is popular can be protected by making recreational fishing a priority when determining the placement of permitted activities within LIS. In order to preserve these areas for LIS anglers, the CT DEEP Fisheries Division first needs to locate and define them. A user-friendly interface that characterizes popular places to fish can educate anglers and inform spatial planning efforts. Using ArcGIS Online, a web application was developed as a means of plotting polygons that represent popular LIS fishing areas. Avid anglers are being recruited to delineate popular places to fish in LIS and list fish species that can be found in certain areas and seasons. The app facilitates the editing process by also allowing users to turn layers on and off, click on objects to view attributes, and filter preexisting polygons by species and season. As the editing process produces sufficiently robust data, the angler-generated fishing areas and filter tools will be added to the DEEP's Saltwater Fishing Resource Map (SWFRM). The SWFRM application was created as an online resource for anyone who wants to learn more about licensing locations, boating access, and fishing opportunities in LIS. As this process unfolds, the ultimate goal is to support and facilitate LIS fishing activity while spreading awareness of ecologically productive areas, guiding planning efforts, and increasing the capacity to safeguard fishing hotspots.

Invasive Aquatic Plants: The State of the State

Greg Bugbee, Summer Stebbins, Connecticut Agricultural Experiment Station

Connecticut's lakes and ponds are among the State's most important natural resources. They provide wildlife habitat, drinking water, irrigation, hydroelectric power, scenic views, recreation, and highly desired waterfront real estate. Revenues associated with boating, fishing, and other purchases aid the State's economy. Value-added real estate taxes provide working capital for towns. In recent decades, invasive aquatic plants have spread to Connecticut's lakes and ponds severely threatening their water quality, ecosystems and economic value. Since 2004, the Connecticut Agricultural Experiment Station Invasive Aquatic Plant Program (CAES IAPP) has assessed the severity of this problem through detailed vegetation surveys of over 250 water bodies. We have documented over 100 native and 14 invasive plant species. Approximately two-thirds of the lakes and ponds contained one or more invasive species. Eurasian watermilfoil (*Myriophyllum spicatum*), variable watermilfoil (*Myriophyllum heterophyllum*), fanwort (*Cabomba caroliniana*), curly leaf pondweed (*Potamogeton crispus*) and minor naiad (*Najas minor*) are the most frequently found invasive species. New arrivals to the State include; hydrilla (*Hydrilla verticillata*), Water chestnut (*Trapa natans*) and Brazilian waterweed (*Egeria densa)*. Statewide control efforts rely on prevention, detection and scientifically based management options. Our work has determined susceptible lakes based on water chemistry and tested novel control methods such as reduced risk herbicides, biological agents and targeted water level drawdowns.

Trophic dynamic of two top predators off the coast of Chile

Carlos Canales-Cerro, Sebastian A. Klarian, School of Ecology and Natural Resources. Universidad Andres Bello. Eric T. Schultz, Department of Ecology and Evolutionary Biology. University of Connecticut

In marine ecosystems, high trophic level predators can present high trophic plasticity, facilitating partitioning of resources among coexisting species and enhancing food web stability. Conversely, high overlap between top predators can indicate low resilience to environmental perturbations. In this research we analyzed the tropho dynamic of two open water high trophic level predators (*Isurus oxyrinchus* and Xiphias gladius) off the coast of central-north Chile through stomach content analysis and stable isotope analysis between 2011 and 2017. *I. oxyrinchus* showed annual diet shifts in their species composition, with a preference for fishes. On the other hand, *X.gladius* exhibited no change in their diet among years but had relatively high prey diversity, in which there was an similar contribution of cephalopods and bony fishes. Stomach composition and stable isotope analysis similarly indicated partitioning of diet between these predators. We conclude that low diet overlap and generalist feeding strategy of top predators in the pelagic zone confers a degree of stability in this ecosystem.

Free & Easy Smartphone Field Data Collection

Cary Chadwick, Dave Dickson, UConn Center for Land Use Education and Research (CLEAR)

The Geospatial Training Program at the University of Connecticut‘s Center for Land use Education and Research (CLEAR) has been teaching smartphone GPS workshops for over 5 years using a variety of mobile mapping apps. While these apps are useful for collecting geospatially referenced data for the average (non-geospatially skilled) person, they do not allow users to customize the type and format of the data they collect. A new app called EpiCollect5 helps to fill this gap and open up a wide range of field data collection and mapping possibilities. EpiCollect5 is a free and easy to use web and mobile application for creating and deploying web forms for field surveys and data collection. Sophisticated forms can be created using a web-based form builder and deployed to multiple mobile devices for offline data collection in the field by an individual, team, or the public at large. Epicollect5 provides free and unlimited hosted services that include data visualization tools (map, tables, charts) and allow data to be exported in various formats for use in other applications. This presentation will demonstrate the Epicollect5 mobile app and showcase how it is being used for various applications by participants in the Conservation Training Partnership program, part of the University of Connecticut’s Natural Resources Conservation Academy (NRCA).

Climate Change-induced Retreat from Flood Zones and Effects on Real Estate Values

Zhenshan Chen, Charles Towe, Stephen Swallow, Department of Agricultural and Resource Economics, University of Connecticut.

Retreat from the coastal zone with high flood risk is an effective way to mitigate the increasing flood risk, but giving up the valuable ocean-front homes is perceived as costly by municipalities, which causes much hesitation in making coastal management decisions. This study is exploring how the value of near shoreline, but not ocean-front homes (second-row homes), may change if oceanfront homes are to retreat or not rebuild after a major climatic event. The primary challenge of this study is to identify the value of coastal amenities (e.g., beach access, view) and disamenities (i.e., high flood risk). A rather primary analysis shows that being in the special flood hazard area increases (insignificantly) the property value by about 22,000 dollars, which is biased since high flood risk and good ocean view are strongly correlated. Thus, viewshed analyses entailing the ocean-front view is necessary to solve this omitted variable bias. We have collected comprehensive property and transaction data for 36,290 single-family homes within 0.6 mile from the shoreline, and we will utilize LiDAR data to analyze the value of coastal amenities with a hedonic approach. Then, building a counterfactual ocean-front scenario (where first-row homes have retreated or been removed) for the second-row homes, a counterfactual viewshed analysis will be implemented by removing the high-risk ocean-front homes from the elevation data. Based on the parameter estimates from the hedonic model and the coastal amenities from the counterfactual viewshed analysis, we will project the value of second-row homes when the ocean-front homes are displaced due to high flood risk.

Evaluating Changes in Exceedance Probabilities with Sea Level Rise: A Long Island Sound case study

Alejandro Cifuentes-Lorenzen, J. O'Donnell, M.M Howard-Strobel, T. Fake, Department of Marine Sciences, University of Connecticut, Connecticut Institute for Resilience and Climate Adaptation (CIRCA).

Here, we consider future sea level rise scenarios for the Long Island Sound (LIS) estuary. Model simulations in combination with long term in situ data were analyzed and completed for LIS, a highly dynamic coastal environment with a complex bathymetry and a fragmented coastline. Here we present changes to the probability of exceedance of maximum storm surge (a direct measure of the likelihood of extreme events) under future scenarios of sea level rise. Tide gauge records were used to explore the extreme value probability distribution functions across the estuary. The extreme value parameters where then used to randomly generate a thousand realizations of time series depicting potential extreme weather events under the assumption of a stationary level of storminess in the region under future climate change. Future sea level rise scenarios were complemented with these randomly generated records and used to evaluate the changes in the probability of exceedance (P_E) via the cumulative probability distribution functions

(F_X) of severe events under sea level rise. A numerical case study was performed using a hydrodynamic-wave coupled model. Numerical simulations of Superstorm Sandy (2012) under two specific sea level rise conditions were performed. Complementing the statistical approach with the numerical simulation for an observed extreme event in the region (i.e. Superstorm Sandy 2012) allowed for a quantitative evaluation of a change in risk under a specific sea level rise scenario, which was then constrained in time under the more probable [less uncertain] future projections.

Escherichia coli Source Tracking in Eastern Connecticut Streams

John C. Clausen, Michael Dietz, Rich Meinert, Anita T. Morzillo, University of Connecticut, Department of Natural Resources and the Environment, Jean Pillo, Eastern Connecticut Conservation District

Water quality standards in Connecticut's rivers and shellfish beds are not being met due to high bacteria levels. Several sources are believed to contribute to these pathogen levels, although direct linkages are often lacking. This project used multi-tiered bacterial source tracking techniques to identify and target critical areas for treatment approaches. Ten streams in eastern Connecticut were sampled in 2017 during stormflow periods. Stage-height samplers were maintained by volunteers from The Last Green Valley and the Eastern Connecticut Conservation District. Collected samples were analyzed for E. coli abundance. Filtered samples were analyzed by a contract lab for markers associated with different waste sources. *Escherichia coli* in fecal matter and water samples were sequenced to determine host-specific polymorphisms. Abundance of E. coli in all ten streams exceeded state standards for recreation. Bacteroidetes strains analyzed by a commercial lab indicated ruminant and human waste sources in some samples. Results are being used to target efforts to reduce bacteria in those streams.

Implementation of a Satellite Vessel Monitoring System for Shellfish Resource Management

Kristin DeRosia-Banick, David H. Carey, Connecticut Department of Agriculture, Bureau of Aquaculture

Connecticut's shellfish industry relies heavily on the relay of hard clams and oysters from growing areas classified as Restricted or Prohibited; these waters are often heavily impacted by human pathogens or industrial contamination. Management of relay and seed oyster activities in these impacted areas requires extensive oversight to ensure that contaminated product does not intentionally or inadvertently reach the consumer. Oversight of relay activities is jointly managed by both the Connecticut Department of Agriculture (DAG) and the Department of Energy and Environmental Protection (DEEP) and to-date has relied on a combination of specific licenses, mandatory daily call-in to the DEEP dispatch when performing any relay activity, and the use of random patrols and spot checks.

Increased utilization of the public natural seed oyster beds in Connecticut has necessitated the expansion of shellfish resource management by the Authorities in order to ensure sustainability of harvest effort and to protect stocks in these areas. Effective management of critical seed oyster resource requires knowing where seed oystermen are harvesting and the intensity of that effort. Resource management decisions may then be made in order to determine if an area requires the planting of shell or placement of spawning stock for recruitment purposes in order to maintain productivity.

The State of Connecticut implemented a pilot vessel monitoring system (VMS) in 2017 in order to provide more effective oversight of transplant activities in the Housatonic River prior to and during the Housatonic River navigational channel dredging project. More than 75% of commercial oyster seed harvested for market in Connecticut is initially gathered from these public natural beds, and monitoring technology will allow the State to better protect this critical natural resource while protecting public health.

A New Era Dawns for Low Impact Development in Connecticut

David Dickson, Amanda Ryan, Chester Arnold, Michael Dietz, UConn CLEAR

The newly revised General Stormwater ("MS4") Permit, now well into its first year of implementation, contains significant changes aimed at promoting and accelerating the adoption of Low Impact Development (LID) stormwater management practices. The permit, which covers 121 of the state's 169 municipalities as well as federal and state institutions, requires each town to revise its land use regulations to "remove barriers" to LID and establish it as the preferred approach to addressing runoff. In addition, it requires that towns and institutions determine the amount of directly connected impervious area (DCIA) in their town/campus and to develop a DCIA reduction program to disconnect 2% of these areas by 2022. Other aspects of the permit also support increased use of LID. In sum, these requirements could significantly shift the accepted approach to managing stormwater for new development and redevelopment, as well as catalyze retrofits to current stormwater management systems. However, getting there raises many questions. For starters, what is DCIA, how do you determine it, what must towns do, and how is this all this going to get done? UConn CLEAR's NEMO team, which is partnering with CT DEEP to provide support and assistance to MS4 communities, will focus in on the key LID-related parts of the regulation and discuss the tools and information available to help towns implement them. We will also discuss the challenges involved and what these changes could mean for the future of development and water protection in the state.

Can green infrastructure achieve water quality and quantity goals?
Michael Dietz, Chester Arnold, UConn Center for Land Use Education and Research

Design for flood control has typically been treated as a separate issue from protecting water quality. Flood control has primarily focused on maintaining predevelopment peak flow rates, usually through detention of large events. Recent efforts to protect water quality have focused on "low impact development" (LID) or green stormwater infrastructure (GSI) techniques such as rain gardens, pervious pavements, and green roofs, where smaller, more frequent events are used for design. Limited monitoring data from watershed-scale green stormwater infrastructure implementation has shown small but statistically significant peak flow reductions where GSI was used. Modeling studies have also shown encouraging results. One such study showed both significant peak flow reductions and a decrease in monetary flood loss estimates for watershed-wide LID implementation. Another study, focused on the UConn main campus, suggests that aggressive LID implementation can help to alleviate flooding from moderate events in Eagleville Brook. Enhanced system designs have been proposed that would allow for retention of larger events; evidence is presented showing that GSI can be used on a watershed-scale to provide peak flow mitigation for a 10-year, 24-hour event. Although the issue is far from settled, it appears likely that green infrastructure stormwater practices can be designed to both protect water quality and provide at least some reduction of flooding impacts.

Wetland plant traits and water quality effects on C fluxes
Mary Donato, Olivia Johnson, Beth Lawrence, University of Connecticut

Freshwater wetlands of the temperate north are exposed to a range of water contaminants that shift their function including salt intrusion due to sea level rise, road salt contamination, and nitrogen enrichment from agricultural and urban runoff. It is largely unknown how these drivers of change interact with different plant species to affect wetland carbon (C) fluxes. We utilized a factorial design of 64 experimental mesocosms (378.5L tanks) to investigate how four common eastern North American wetland plants (*Carex stricta, Phragmites australis, Spartina pectinata, Typha latifolia*) respond to four water matrices (fresh water, sea salt, road salt, nitrogen). During the 2017 growing season, we measured greenhouse gas fluxes (carbon dioxide (CO_2), methane (CH_4)) monthly using transparent chambers attached to a continuous real-time gas analyzer. At the end of the 2017 growing season, we quantified above- and below-ground biomass, root porosity, and pore water chemistry (NH_4^+, NO_3^-, SO_4^-, Cl^-, DOC). Preliminary results suggest sea salt decreased CH_4 emissions and nitrogen addition increased uptake of CO_2 across species. Both CH_4 emissions and CO_2 uptake increased over the course of the sampling season. Biomass production and root porosity differed among species, but not among water pollutants, with *Carex* producing the least above- and below-ground biomass, and *Spartina* having the greatest total porosity. Further analyses will investigate relationships among plant traits, water chemistry, and C

fluxes. Together, our findings will inform priorities for management of water pollutants and seawater intrusion in freshwater wetlands of the temperate north.

Urban Forestry Inventory and Analysis – What It Will Tell Us
Chris Donnelly, Urban Forestry Coordinator, CT DEEP Forestry

In 2018, the US Forest Service will initiate an Urban Forestry Inventory and Analysis (UFIA) program in Connecticut. This program is an urban version of the long-time FIA assessment, for rural forests. Like the FIA, the UFIA will provide an ongoing characterization of the state's urban forests. From this Inventory and Analysis, urban foresters and others should be able to better understand long-term trends in urban tree populations, including extent and composition, the factors affecting the health of this urban forest, including insect and disease pressures, and also see some of the effectiveness associated with urban forestry management efforts.

This session will briefly describe the current state of urban forest characterization and the methods that will be used in conducting the UFIA, along with an overview of how it is anticipated that the results of the Inventory and Analysis will be used.

Moving People to Action
Michelle Eckman, Connecticut Audubon Society

Conservation is an action term; it is what people do with what they know and the skills they have. The goal of environmental educators is to ultimately motivate people to take actions in their daily lives to reduce their impact on our natural resources. However, motivating people to action is a challenging task, but is absolutely necessary in our current society where facts matter less and less to the general public and people are more and more disconnected from the natural world.

In this interactive presentation, we will discuss the principles of communication and conservation psychology and how environmental educators can integrate strategies from these disciplines into their work.

A strategy for long-term conservation of tidal marsh birds
Chris S. Elphick, University of Connecticut, Bri A. Benvenuti, University of New Hampshire, Jonathan Cohen, State University of New York College of Environmental Science and Forestry, Adrienne I. Kovach, University of New Hampshire, Brian J. Olsen, Katharine J. Ruskin, University of Maine, W. Gregory Shriver, Liz Tymkiw**,**.University of Delaware.

Tidal marsh birds are declining throughout the Northeast and mid-Atlantic states, with extinction predicted for some species by mid-century. Effective conservation of these species will require a mix of traditional land conservation and novel management interventions. First, we need to identify and protect those marshes that have a high probability of maintaining higher elevation habitat over the long term. Much uncertainty exists over whether many marshes will survive projected rates of sea-level rise, but initial analyses have identified a small set of sites with a high chance of persistence and a larger set of sites that are unlikely to contribute to future bird conservation no matter what. Land protection alone is unlikely to suffice, though, suggesting that conservation will also require the use of innovative management methods that are largely untested. In the short-term, we need methods that will maximize reproductive success, primarily by limiting the frequency of tidal flooding events that cause widespread nest failure, or that help maintain marsh elevation relative to sea-level. The use of tide gates to limit the effects of spring tides during the nesting season and sediment additions to marshes offer potential examples. Over the longer term, management actions that facilitate the migration of marshes into upland areas or that increase sediment flow to estuaries are likely to be necessary. Given uncertainty over the effectiveness of all of these interventions, and potential risks of using them, experimental tests conducted in a common framework are needed to determine what will work over the long term.

So, you stopped using Sand

William Henley, Neal Hagstrom, Connecticut DEEP

About 10 years ago (2005-6) the Connecticut DOT discontinued its use of sand as a winter road maintenance tool. The literature suggests that enough time has elapsed that the deposits from winter sanding should have been flushed from the stream systems. During 1988-1994, the DEEP Fisheries division had done an assessment of stream substrate at approximately 1,100 sites as part of a more comprehensive study of streams in Connecticut. This pre-data allowed us to test for changes in stream substrate composition and embeddedness. During the summer of 2017, 30 sites below state road crossings, that have been previously evaluated, were revisited and the substrate and embeddedness were measured using the same methodology as the 1988-1994 study. Individual sites were tested for changes in the relative composition of each stream's substrates and for changes in the embeddedness of the substrate using Kruskal-Wallace tests. The general picture across all sites indicated very little change in embeddedness and only minor, inconsistent changes in substrate sizes. Stopping the use of sand on roads does not appear to have affected stream sediment composition except at a localized scale.

Roadside tree management: Attitudes across the landscape

Daniel Hale, Anita T. Morzillo, University of Connecticut

Trimming or removing vegetation near roadside power lines is necessary to prevent power outages, but can lead to dissention among the public. Little knowledge exists about resident attitudes toward vegetation management, and how these attitudes may vary across the landscape.

Our objective is to understand the social and landscape factors that influence attitudes toward roadside vegetation management. Surveys were mailed to Connecticut residents in two study areas along urban-rural gradients. Landscape factors (e.g., tree cover) were mapped and quantified at various scales around each respondent's location. We used the machine-learning algorithm random forest to evaluate how attitudes toward vegetation management were influenced by social and landscape variables. Results suggested that the majority of respondents perceived that those who do vegetation management are accountable, contribute to greater public safety, and minimize power outages. Respondents indicated that vegetation management for reliable power is important. These attitudes are influenced by social factors such as willingness to allow changes to roadside trees, prioritizing reducing outages, knowledge about trees, and patterns of basic beliefs about the environment. Results also suggested that demographic variables vary according to urban and rural places, but attitudes toward vegetation management may not be strongly predicted by landscape factors. This research offers insights on the complex factors linked with attitudes toward trees and their management across landscapes.

The Blue Plan: A Spatial Vision for Long Island Sound

Emily Hall, NOAA Coastal Management Fellow, Connecticut Department of Energy and Environmental Protection

The Blue Plan, created through Public Act 15-66, begins a marine spatial planning initiative for Long Island Sound (LIS). The ultimate goal of the Blue Plan is to protect ecosystem value and traditional human uses of Long Island Sound in the face of future environmental change and newly proposed projects.

The Blue Plan process begins with collecting and vetting data on the spatial distribution of natural resources and human uses in LIS. Ecological experts and stakeholder groups were asked if the collected data was accurate, relevant, and representative. Experts and stakeholders also identified if there were any gaps or additional suggested data and resources. The Blue Plan team is now tasked with compiling this information into an Inventory of LIS natural resources and human uses, which will form the basis for a spatial plan to guide future projects on the Sound's waters and submerged lands.

Based on the completed inventory, the Blue Plan will ultimately identify locations, performance standards, and siting measures for proposed activities, uses, and facilities in the Sound. The Blue Plan will not create new regulations; rather, it will be considered as a part of the State's decision-making processes within existing regulatory programs. The Plan will reflect all of Long Island Sound, but policies will only apply to Connecticut waters.

Using Landsat to Assess Forest Defoliation from Gypsy Moths

James Hurd, Chandi Witharana, Daniel Civco, University of Connecticut

The gypsy moth (*Lymantria dispar*) is an invasive insect first introduced in Massachusetts about 1869 and discovered in Connecticut in 1905. The larvae are well known in the northeast U.S. for the periodic damage they inflict on forest trees. During outbreak years, it is common to find the gypsy moth caterpillars have significantly defoliated large areas of forests. Remote sensing is an ideal tool with which to efficiently monitor and evaluate the extent and severity of defoliation in the forest landscape. Using Landsat 8 satellite imagery, researchers at ConnecticutView assessed the impact of gypsy moth caterpillars on the forests of eastern Connecticut during the recent 2016 and 2017 outbreaks. Imagery was collected during periods of pre-defoliation and post-defoliation for both years. Two vegetation indices (Normalized Difference Vegetation Index and Normalized Difference Infrared Index) were calculated for each date of imagery and used to evaluate changes in forest biomass and water content to identify the extent and severity of forest defoliation. Defoliation severity was calibrated using a forest stand survey at one of the state forests located within the impacted area in eastern Connecticut. Resulting products identify the extent and level of severity of forest defoliation for the entire study area, and assess the extent of leaf regrowth near the end of the growing season 2016 and 2017. In addition, statistics are derived identifying the town's most significantly impacted. This presentation will overview the analysis procedures and discuss the results.

Local Climate Adaptation: Survey Results on Municipal Needs

Bruce Hyde, UConn CLEAR, UCONN Extension, Juliana Barrett, CT Sea Grant, UCONN

Coastal municipalities are facing a significant number of challenges in planning for and adapting to changing weather patterns and climate change. Lack of resources and staff expertise make it more important than ever that research or other support designed to assist municipalities with resiliency planning and implementation be something they can actually use. From June 2016 to February 2017, officials from twelve municipalities in Connecticut counties impacted by Superstorm Sandy were interviewed to develop a list of their most pressing concerns and needs with respect to climate resiliency. Confirmation interviews were conducted with seven additional municipalities from May 2016 to July 2016. The purpose of this effort was twofold: to gain insight into the most common obstacles faced by Connecticut communities in planning for climate change, and to provide information to climate researchers, state agencies and others that might help in the development of practical solutions to municipal climate challenges. In addition, interviews sought to determine what standard of authority and data uncertainty municipal officials are willing to accept, in terms of research for sea level rise and floodplain mapping for inclusion in their planning and regulatory documents. This information will guide researchers and state agencies so they can provide results that municipalities find applicable and defensible when they are used.

This session will report on the results of this research and review the most pressing climate resiliency related needs as identified by Connecticut municipal officials.

Wetland carbon cycling response to invasive plant control

Olivia Johnson, Beth Lawrence, University of Connecticut, Shane Lishawa, Loyola University Chicago

Plant-soil feedbacks underlying wetland carbon (C) dynamics are well studied, but little is known about how invasive plant management affects these interactions. We leveraged a large-scale experiment to quantify how mechanical disturbance to a ubiquitous, Great Lakes region invasive (*Typha* × *glauca*) shifts plant-mediated C uptake, cycling, and release. During each growing season from 2015-2017, we harvested (i.e., cut above water surface and removed biomass), and crushed (i.e., ran over biomass), 60 x 60-m plots of *Typha*-dominated wetland and compared a suite of C-related parameters with unmanipulated *Typha*- controls. Harvest and crush had greater net carbon dioxide uptake than controls, suggesting these treatments shift the wetland toward greater primary production relative to respiration. Likewise, these techniques decreased *Typha* stem densities, but did not affect total aboveground biomass. Harvest increased surface water DOC one-year post treatment, but neither belowground biomass (roots, rhizomes) nor soil pore water dissolved organic carbon (DOC) shifted in response to treatments. Harvest decreased pore water concentrations of acetate, a common substrate for methane-production, while initial analyses suggest a different pattern in methane emission (control = harvest > crush). Our final analyses will test how abiotic factors (e.g., light penetration, water level variation) interact with mechanical disturbances to affect these mixed responses of wetland C pools and fluxes. Our results are of relevant scale and timeframe to assess consequences of invasive plant control practices, and to include critical wetland function of C storage in management decisions.

Saving Lakes One App and Website at a Time

Amanda Keilty, Johnson State College; Connie Trolle, Bantam Lake Protective Association; George Knoecklein, Northeast Aquatic Research; James Fischer, White Memorial Conservation Center

Bantam Lake experiences cyanobacteria blooms annually, but the bloom of 2016 was unusually intense and sustained. It ultimately resulted in beach closures and restricted lake usage when seasonal use was at its highest. As a result, incidence/crisis communication to stakeholders became the primary job for the Bantam Lake Protective Association. The BLPA decided that a proactive approach was necessary in 2017. They contracted Northeast Aquatic Research for weekly assessments of cyanobacteria activity (cell counts/ml) and other lake measurements to effectively manage the blooms. This data was also useful when informing stakeholders about the state of the lake. We developed *Bantam Lake Cyanos* as a communication portal that provides up-

to-date forecasts of cyanobacteria activity and other lake measurements via a website and smartphone app. The website also informs visitors of the health risks associated with blooms and the daily decisions they could make to reduce nutrient run-off, which aids in the bloom growth and formation. App users shared images of blooms, thereby turning them into citizen scientists and alerting lake managers of changes to the lake. We will review usage statistics for these communication portals that indicates their relevance to stakeholders.

Hunting Induced Spatial Variability in White-tailed Deer Abundance

Jennifer E. Kilburn, Tracy A. G. Rittenhouse, University of Connecticut;
Andrew M. LaBonte, Howard J. Kilpatrick, Connecticut Department of Energy and Environmental Protection

Managed public lands balance maintaining healthy wildlife populations and human recreation opportunities. Hunting, not only as a form of recreation but as a management tool, varies across land ownership. Previous studies have shown that during the hunting season white-tailed deer alter their behavior and reduce movements to avoid predation. However, little has been done to document how these shifts affect site level local abundance, especially in areas with a diverse patchwork of land ownership and amount of hunting. We used 50 wildlife cameras evenly divided between hunted and un-hunted properties in north-eastern Connecticut and N-mixture models in a Bayesian framework to estimate local site level abundance and detection probability before, during, and after the hunting season. We found that average site level abundance increased on un-hunted properties and decreased on hunted properties after initiation of the hunting season. Averaged across the entire study period, abundance was higher on un-hunted properties (2.5 does/31 ha (0.99,7.4)) as opposed to hunted properties (1.5 does/31 ha (0.51,5.60)). These patterns were not statically significant, but the abundance estimates and the change over time aligns with our expectation. Detection probability increased on hunted properties during the hunting season, which conflicts with previous findings but may result from behavior during peak rut. Understanding the relationship between local, site-level shifts in abundance in response to hunting pressure allows managers to understand deer availability during the hunting season and how that might impact attainment of management goals.

Sea Level Rise, Marsh Conservation and Road Flooding Management

David Kozak, CT Department of Energy and Environmental Protection; Juliana Barrett, Connecticut Sea Grant; Emily Wilson, University of Connecticut Extension, Center for Land Use Education and Research

Preliminary results of computer models used to predict the potential effects of sea level rise (SLR) on Connecticut's largest estuarine tidal marshes and nearby roadways indicate that that these

resources may not be capable of sustaining existing levels of ecological and public services without intervention. Therefore, CT DEEP, UCONN CLEAR and CT Sea Grant are investigating how a recently identified SLR rate of approximately 20 inches by mid-century in Long Island Sound could change the extent and composition of Connecticut's marshes and exacerbate flooding of nearby coastal area roads.

The presentation will provide an overview of the type of information this on-going investigation is expected to provide that's needed to develop strategies to respond to a changing tidal marsh landscape and increased flooding of roads adjacent to Connecticut's 20 largest tidal marshes. To better understand the complexities associated with responding to such challenges, an overview of Connecticut estuarine marshes will be presented, including a discussion of their origin and context within the coastal area. Building upon an improved understanding of what tidal marshes are and where they occur, we'll review how marshes respond to a rising sea, and how computer generated simulations of such responses can be used to prioritize marsh conservation and road-flooding mitigation investments.

Finally, other information that's expected to become available through this on-going investigation, such as the expected elements of a marsh conservation plan to be prepared for a marsh, will be presented. Presentation attendees will be challenged to consider how such information can be used to support the development of marsh conservation and road flooding mitigation strategies in their communities.

Decadal Changes in Water Quality in Connecticut Lakes: The Role of Anthropogenic Disturbance

Jason D. Lech, Michael R. Willig; University of Connecticut

Freshwater is an essential natural resource and home to 10% of global biodiversity and 35% of vertebrate biodiversity, despite covering only 0.8% of the Earth's surface. The ecosystem services and biodiversity that freshwater systems support are intrinsically linked with water quality. Nevertheless, increasing human demands have resulted in freshwater systems being among the most extensively altered ecosystems on the planet. Although temporal variation in water quality is a natural phenomenon of freshwater lakes, the rate and extent to which it is changing in Connecticut, particularly in the context of multiple forms of human disturbance, remain to be assessed comprehensively. We quantified decadal changes in water quality (alkalinity, pH, conductivity, and phosphorus) for 34 lakes in Connecticut. Using variation partitioning to disentangle independent and combined effects, we determined the extent to which four major forms of disturbance (watershed land use, invasive species, boating activity, and drawdown management) influenced changes in water quality between 2004-2005 and 2016-2017. We then evaluated how aspects of landscape composition and configuration influenced water quality in a hierarchical fashion, using (1) simple regression for each disturbance characteristic separately, (2)

multiple regression for each suite of covariates, and (3) multiple regression for all covariates. Environmental policy and conservation strategies often must consider multiple forms of human disturbance. Funds are always limited and priorities must be established in order to best mitigate the large-scale effects of concurrent forms of disturbance. Understanding the relative importance of each form of disturbance, as well as interacting effects, is critical for establishing priorities.

Shadow detection in high-resolution aerial imagery

Qian Lei, Thomas Meyer, Daniel Civco; University of Connecticut

High-resolution imagery is becoming increasingly available for use in land-cover mapping; however, a number of studies found that shadows in these data can cause substantial errors in land-cover classifications. Shadows are particularly problematic in areas with tall buildings (e.g. skyscrapers) or large numbers of foliated trees. Detection of these shadows can help improve accuracies in land-cover mapping. The goal of this research is to develop and evaluate methods of shadow detection in high-resolution aerial imagery.

Previous studies have developed a number of methods to detect shadow. Each method has limitations and studies have suggested that integration of multiple methods would provide more accurate shadow detection. In this study, we integrated a sun-geometry model with the ISODATA clustering algorithm to detect shadows in high-resolution aerial imagery. The sun-geometry model was used to mathematically predict shadow positions based on the sun's position at the time of image acquisition and a LiDAR-based Digital Surface Model (DSM). ISODATA clustering algorithm was performed to classify shadows based on spectral properties. Parallax in aerial imagery can potentially cause misalignments of shadows mapped by sun-geometry and spectral properties. Thus, we developed a roving window algorithm to shift the model shadows and align it with the spectral-based shadows; the aligned model shadows were then used to select true shadows from the map of spectral-based shadows and eliminate false shadows caused by water and low-reflectance materials. The performance of the integrated shadow detection approach was compared to the performances of the models based on spectral properties and sun-geometry alone.

Chloride in Connecticut Streams—Recent Increases in Concentrations

John R. Mullaney, U.S. Geological Survey; Christopher Bellucci, Connecticut Department of Energy and Environmental Protection

Preliminary analysis of trends in chloride for approximately 36 surface-water sites in Connecticut indicates that concentrations of chloride are increasing at a faster rate in the most recent 7 years (2010-2016) as compared to all previous decades. Increases in chloride concentrations have been attributed to increased use of salt for deicing, changes in deicing practices on public and private

paved areas, and changes in land use. Other sources of salts include wastewater discharge from municipal facilities and private septic systems, and agricultural activities.

Increases in chloride concentrations and loads were observed at sites in urbanized and undeveloped basins. Analysis of the data determined increasing chloride during runoff and base flow. High values of continuous specific conductance data (a surrogate for chloride concentrations) at selected sites indicated that chloride concentrations may be exceeding Connecticut water-quality standards, particularly during winter rainfall and snowmelt events.

The increasing chloride concentrations are of concern for stream ecosystem health, and for public water supplies, including reservoirs and groundwater. The increases of chloride along with historical declines in sulfate may be leading to greater corrosivity of the water, a potential challenge for water treatment, and the leaching of lead from plumbing systems.

Genetic evaluation of the Eastern Brook Trout Joint Venture patches

Lucas R. Nathan, Jason C. Vokoun, Wildlife and Fisheries Conservation Center, University of Connecticut; Amy B. Welsh, West Virginia University

Populations of stream fishes are often organized in patch-like networks due to a combination of anthropogenic habitat fragmentation and relatively low dispersal levels. Previous genetic studies of Brook Trout *Salvelinus fontinalis* have demonstrated dispersal among stream populations consistent with meta-population dynamics, which emphasizes the need to consider broad scale patterns in order to effectively manage stream populations. The Eastern Brook Trout Joint Venture (EBTJV), a region wide collaborative group, have delineating “patches” of putative genetic (meta-) populations based on historical stream survey data and physical barriers. In this study, we collected genetic samples from 49 of the EBTJV patches in Connecticut to 1) determine if the patches accurately predicted genetic patterns, and 2) model population-level genetic diversity as a function of patch-level riverscape variables. Based on a suite of genetic structuring tests, only two patches needed to be reduced in size due to high levels of genetic differentiation between populations within patches. Disagreements with a priori defined patches were likely the result of barriers not accounted for in the EBTJV delineation. Patch area and the percentage of coarse substrate (i.e. potential for ground water upwelling) were both positively related to population-level genetic diversity and percentage of impervious surfaces was negatively related to genetic diversity. These results support the use of the EBTJV patch layer and emphasizes the need to incorporate patch-level processes when developing management strategies for stream fishes. Expanding patches by reconnecting fragmented populations through management practices should be used to promote long term population viability and adaptive potential.

Roads, Marshes, Flooding, and Sea Level Rise in Coastal Connecticut

James O'Donnell, Michael Whitney, Kay Howard Strobel, Alejandro Cifuentes-Lorenzen; Connecticut Institute for Resilience and Climate Adaptation, and Department of Marine Sciences, University of Connecticut

Connecticut's coastal towns, and many of the roads that connect them, have developed around the inlets and marsh systems that characterize the shoreline. The exchange between Long Island Sound and many marsh systems has been already restricted to limit flooding and allow coastal development. Sea level rise will increase the annual probability of flooding and the protection of roads and buildings may negatively impact circulation in marshes. We report the development of a simple model of marsh hydraulics and observation obtained in two systems where road flooding occurs frequently. We show that the model can perform well in simulation of the periods of observations, and comment on the parameter values required to optimize the model performance. The model results highlight the value of preserving marsh area in a large system with tide gates on the protection of a coastal neighborhood from flooding during Super Strom Sandy. We then show how the expected flooding frequency (annual probability) will likely change and with rising mean sea levels. We also comment on how models can be used to guide road protection choices.

Corps of Engineers Coastal Resiliency Programs and Opportunities

Larry Oliver; U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers has long played a role in building projects intended to protect communities from coastal storm damages. The need to adapt to changes in climate and sea level rise places new demands on coastal resources. Increasingly, the Corps is responding to the desire for projects that protect communities and infrastructure while supporting ecosystem sustainability and resilience. For instance, the Corps Engineering With Nature (EWN) Program explores methods to enable more sustainable delivery of economic, social, and environmental benefits associated with water resources infrastructure. EWN is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaborative processes. EWN includes the use of natural and nature based features (NNBF). NNBF are either naturally occurring or engineered habitats that mimic natural conditions. Some examples are beaches and dunes, salt marshes, and oyster reefs. This presentation discusses the Corps' existing programs in flood risk management and ecosystem restoration, the program requirements, and how Corps programs can support ecosystem restoration, climate adaptation, and flood risk management.

Denitrification rates vary with salt marsh vegetation zones

Sean Khan Ooi, Aidan Barry, Beth Lawrence, Chris Elphick, Ashley Helton; University of Connecticut

Soil microbial denitrification is an important ecosystem function that reduces reactive nitrogen in coastal marshes and may vary with plant traits of dominant vegetation. Dominant zones of coastal salt marsh vegetation are shifting with sea-level rise and with tidal restoration. The goal of our study was to determine how potential denitrification rates vary among dominant vegetation zones in restored and unrestored coastal salt marshes in Connecticut. At 10 tidally restored and 10 unrestored sites, we quantified potential denitrification rates using denitrification enzyme activity assays (DEA) on sediment collected from vegetation zones dominated (>50% cover) by *Spartina alterniflora*, *Spartina patens*, and *Phragmites australis*. We also quantified a suite of plant biomass and soil chemistry parameters. The average potential denitrification rate in the *S. alterniflora* zone was significantly lower than both the *S. patens* and *P. australis* zones. These results suggest that as tidal restoration and sea-level rise facilitate the expansion of S. alterniflora zones, the capacity of coastal salt marshes to remove nitrogen via denitrification may decrease. Although tidal restoration is known to shift patterns of vegetation dominance, our preliminary results show potential denitrification rates are not significantly different between restored and unrestored sites. Further analyses will examine the mechanisms driving potential denitrification differences between vegetation zones by exploring relationships among potential denitrification, plant biomass and soil chemistry parameters. Because our results suggest denitrification rates vary with vegetation zones, incorporating shifting vegetation under sea-level rise and tidal restoration scenarios is critical for predicting the future of nitrogen cycling in coastal wetlands.

CT DEEP's Online Saltwater Fishing Resource Map Apps

Deb Pacileo, Fisheries Biologist; Julie Blum, Seasonal Resource Assistant; Emma Heidtman, Seasonal Resource Assistant; Alice Colman, Seasonal Resource Assistant; Connecticut Department of Energy and Environmental Protection, Fisheries Division

Recreational anglers of the Connecticut shoreline now have a convenient online resource to turn to when searching for a new spot to fish. Interactive resource maps using ArcGIS Online are available on the CT DEEP website. These maps show useful information for recreational anglers, including the locations of bait and tackle shops, places to get a fishing license, lists of captains or marinas where you can charter a boat, as well as boat launches with access to Long Island Sound (LIS). By clicking on the icons in the map, users can find more information for specific places. Perhaps the feature of most interest to recreational anglers is the "popular places to fish" section of the map. These areas of LIS are known as good fishing spots for anglers. Selecting a pink-shaded area will show what types of fish have historically been found there. For anglers searching for that perfect place to fish while on a fishing trip, the story map version of this resource is easily

accessible on a mobile device's web browser. The map also includes a link to the CT Anglers Guide, where information on fishing license requirements and catch limits are available, as well as a link to a summary of marine sport fishing regulations. Improvement of the information contained in these maps is an ongoing effort and CT DEEP is interested in obtaining input from anglers throughout the LIS vicinity. To facilitate this outreach effort, a crowd-sourcing app for acquiring new polygons was recently developed.

Coastal Zone Soil Survey

Donald C. Parizek; Soil Scientist, USDA- NRCS

Coastal Zone Soil Survey (CZSS) provides valuable information for planning and managing areas that have high urban and significant ecological values while exposed to high hazard potentials. Through the Coastal Zone Soil Survey, the Natural Resources Conservation Service (NRCS) is gathering valuable information to assist in predicting and explaining soil distributions and functions that can help identify healthy ecosystems, determine where to focus restoration efforts, and detect early warning signs of degradation. This vital work will assist all of us in making wise decisions concerning our coastal natural resources.

A coastal zone soil survey is a seamless data set of soils information that encompasses inland soils, tidal marshes, and shallow subaqueous and submerged soils.
As a member of the National Cooperative Soil Survey, NRCS is the lead Federal agency for mapping and interpreting our nation's soil resources, including in our coastal zone areas. NRCS supports rigorous scientific content from field data gathering and research; diverse and uniquely effective partnerships; and modern techniques to produce spatial and tabular seamless soil surveys as well as timely distribution of the data to all users.

The presentation will include information on completed, ongoing and future, CZSS projects within the region.

Oak Ecosystem Response to Adaptive Management

Jillian Pastick, Robert Fahey, University of Connecticut, Debbie Maurer, Lake County Forest Preserve Department, Lake County, IL

Oak woodlands are complex, fire dependent ecosystems, critical for supporting high biodiversity and carbon storage. However, throughout eastern North America, these previously oak-dominant systems have undergone shifts in species composition and structure, primarily as a result of human influences such as fragmentation and changes to fire regimes. Land managers face the challenge of restoring oak ecosystems and promoting oak regeneration in ex-urban and suburban natural areas, where high intensity Silvicultural treatments are often not feasible. To investigate

management alternatives, an adaptive management experiment was implemented in Lake County, IL in 2012, in which five thinning treatments of varying intensity, timing, and spatial pattern were replicated across three study areas. We monitored survival, growth, and morphology of planted oak seedlings, surveyed the groundlayer plant community, and quantified understory conditions at 120 plots. We found significant differences in understory light availability, soil moisture, and atmospheric temperatures across treatments. Analyses of groundlayer community data suggest differences in diversity, richness and spatial patterns between the control treatment and thinning treatments. Analyses of oak seedling data did not indicate a relationship between treatment and seedling survival or growth rates. These results suggest that implemented management may significantly influence groundlayer plant communities and understory microclimates, but may not encourage planted seedling survival and regeneration due to other influencing factors, such as deer browse or nutrient availability. These results will guide in evaluating the efficacy of thinning treatments that could be utilized for oak woodland management and restoration in natural areas throughout eastern US.

Long-term tidal wetland change at the Barn Island WMA

Ron Rozsa, Ashford, CT

Many wetland scientists point to sea level rise as a primary driver of biophysical changes in tidal wetlands. A careful examination of changes over eight decades reveal that the Barn Island wetlands are responding to the drastic alteration of tidal hydrology by the construction of mosquito ditches. Ditching depresses the height of high water to the extent that the once wide and continuous levees shrink over eight decades. This causes a shift of the dominant levee grass from *Spartina patens* to *Juncus gerardii*. In 1947 Dr. Frank Egler describes a dieback of the *Juncus* belt along the upland border and this dieback returns in 1963, 1983 and 2008. In 1976 and 2017, the *Juncus* belt has been replaced by forbs everywhere except for the one small natural marsh with levee and basin topography. Here the *Juncus* belt remains intact and therefore the dieback is the result of the altered hydrology from ditching and the tidal range fluctuations of the lunar nodal cycle. In 1976, the plant communities at several locations are mapped. Discovered in 2016 are Dr. William Niering's field notes describing four new transects on the Palmer Neck section. These transects were resurveyed in 2017 and 1976-2017 data set allow for a detailed description of vegetation change in the last 40 years. Not all changes are slow as evident at and adjacent to the 2008 dieback at Brucker Marsh. In several locations, the marsh is reverting to the equilibrium levee and basin topography.

New Data Layers to Support New Stormwater Rules & Beyond

Amanda Ryan, David Dickson, Cary Chadwick, Emily Wilson, Chet Arnold, Mike Dietz, UConn CLEAR

UConn CLEAR has compiled or commissioned several new geospatial data layers as part of it's partnership with CT DEEP to provide multifaceted support to municipalities subject to the updated Municipal Separate Storm System (MS4) General Permit. This includes a new high resolution (1ft) impervious cover data layer and unique 'stormwater' impaired waterbody layers that identify water bodies from the 2016 IWQR that are considered impaired by stormwater runoff. These layers and others are combined in CLEAR's MS4 Map viewer and available as a map services and downloads on HTTP://cteco.uconn.edu. These layers help MS4 towns plan their stormwater sampling programs and understand where most stormwater pollution is being generated and thus where they should focus certain stormwater management efforts. They also may be useful for other purposes beyond the MS4 program. This talk will provide background on these layers, how they can be accessed, and how they can be used to help towns meet their obligations under the new stormwater regulation.

Spatial analysis of movements of Protected Fish in CT waters.

Tom Savoy, Alice Coleman and Jacque Roberts; CT DEEP Fisheries Division

Life history patterns and known behavioral movements of these two sympatric species were thought to be well described. Shortnose Sturgeon are usually described as freshwater resident with little ability to tolerate high salinities. In contrast, Atlantic sturgeon, which should be considered the iconic US East Coast anadromous fish, are known to wander coastal waters for years to decades, occasionally enter non-natal waters. While inter-spawning periods for Atlantic Sturgeon can vary from annual to 5 or 6 years, overall life span is long (75 years) and multiple spawning seasons/events are possible. Between 1988 and 2017, 2,370 Atlantic Sturgeon and 2,615 Shortnose Sturgeon were collected in Connecticut waters. Of these, 162 Atlantic and 216 Shortnose Sturgeon had unique ultrasonic transmitters surgically implanted into the body cavity to track movements and determine preferred habitats. Transmitters had variable battery lives, ranging from 400 to 4,000 days and some transmitters had additional water pressure or water temperature sensors. Self-contained Vemco VR2W acoustic receivers were deployed throughout the CT River and LIS in CT waters. Numbers of receivers deployed varied annually and ranged from 20 to 45 per year, deployed for 4 to 12 months per year in various locations. Receivers recorded all ultrasonic transmitters fully decoded within an average of a 1 km radius, with a time date stamp. Spatial analyses are presented showing typical seasonal movement patterns and unique behaviors noted.

National Cooperative Soil Survey Needs You!
Debbie Surabian, State Soil Scientist CT/RI; U.S. Department of Agriculture

The National Cooperative Soil Survey (NCSS) is a nationwide partnership of Federal, regional, State, and local agencies and private entities and institutions. This partnership works to cooperatively investigate, inventory, document, classify, interpret, disseminate, and publish information about soils. NCSS standards are common or shared procedures that enhance technology transfer, data sharing, and communications among soil survey participants.

As a member of the National Cooperative Soil Survey, you are invited to attend this work planning session to learn about the current soil survey and make recommendations for future soil survey mapping, data collection, and interpretations.

Building resilience in Connecticut's water supply systems
Galen Treuer, Christine Kirchhoff; University of Connecticut

Climate change is expected to increase the frequency and intensity of storms and droughts in the northeastern United States as well as accelerate the rate of sea level rise. These climatic changes are likely to exacerbate the existing challenges water suppliers in Connecticut face, including making it more difficult to meet water quality standards and minimum stream flow regulations and to maintain aging infrastructure. Despite these looming threats, it is unclear how water systems are preparing, particularly hundreds of small community water suppliers – those who serve 500 or fewer people. Using a statewide survey of water systems, in-depth interviews with water managers in coastal counties, and system level information on Safe Drinking Water Act violations we assess Connecticut's water system resilience – the ability to absorb disturbance. We use this assessment to describe the "resilience gap" between what is currently being done and what more could be done to ensure safe and reliable water supplies. Results from this work highlight how evolving technology, regulations, and social factors interact to shape a system's ability to respond to extreme events. Preliminary recommendations for improving individual system and statewide resilience will be shared.

Emergency Watershed Protection Floodplain Easement Program
Kristin D. Walker, Civil Engineer and acting Floodplain Easement Program Manager, USDA-NRCS

The Natural Resources Conservation Service (NRCS) Emergency Watershed Protection Program, Floodplain Easements (EWPP-FPE) is a federally sponsored program through the United States Department of Agriculture designed to improve floodplain management by placing easements on

land impacted by natural disasters like Hurricane Irene and Sandy. The program aims to remove all physical obstructions from the easement, while improving flood capacity and drainage. Properties are either restored to the natural conditions they likely existed under prior to the land being developed or they are maintained and managed to continue to provide floodplain benefits. In previous years, this program has aided mostly farm land that experienced flooding, but as of recent, has been applied in urban settings.

Projects are currently underway in West Haven, Old Lyme, Darien and Milford to acquire additional easement lands and restore their natural flood storage and /or drainage. This presentation will include a synopsis of restoration work completed at Sheffield Brook as well as current efforts underway to place easements on valuable salt-marsh ground and heavily impacted city residential areas.

Impacts of road salt on forested wetlands in New England

Samantha Walker, Beth A. Lawrence; University of Connecticut, Department of Natural Resources and the Environment

Forested wetlands are ubiquitous throughout New England providing critical ecosystem services (i.e., flood mitigation, water quality treatment, biodiversity support), however increases in road deicing salt use (largely NaCl) and road fragmentation are threatening their ecosystem structure and function. To investigate the impacts of road salts, we surveyed 15 road-adjacent red maple (*Acer rubrum*; n = 9) and Atlantic white cedar (*Chamaecyparis thyoides;* n = 6) dominated wetlands in eastern Connecticut during summer 2017. We quantified soil parameters (Na^+, K^+, Mg^{2+} ,Ca^{2+}, pH, electrical conductivity, heavy metals, total N, soil moisture, C:N) at all sites and the vegetation community composition (ground, shrub, tree cover) at the red maple sites along transects extending 165 meters into each wetland. With increasing distance from roads, soil salinity (EC and Na^+) decreased and soil base cation (K^+, Mg^{2+}, Ca^{2+}) concentrations increased, potentially due to cation exchange (Na^+ displacing other base cations). Preliminary analyses of the vegetation data do not indicate strong spatial patterns with distance from road, as we observed no changes in invasive or native species abundance, diversity indices, species richness or evenness. It is feasible that the timing of salt-enriched runoff during winter and early spring thaw events (i.e., when plants are dormant) reduces plant exposure to high salinity levels, minimizing shifts in community composition. However, continued displacement of plant macronutrients may have long-term consequences on plant health. Together these data will improve our understanding of the impacts of road deicing salts on temperate forested wetlands and inform policy makers in the region.

Future Changes of Extreme Precipitation and Drought in CT

Guiling Wang and Christine Kirchhoff; Department of Civil and Environmental Engineering, UConn

On the one hand, observational data show significant increases in both the frequency and intensity of extreme precipitation events over the U.S. Northeast, leading to increased flood risks, a trend that is predicted to continue in the future. On the other hand, warming temperatures increase the atmospheric evaporative demand, which may increase drought risks and negatively influence drinking water supplies. Quantitative assessment of these changes is needed to guide the development of climate adaptation strategies at the local and state levels. Our study addresses this need with a comprehensive assessment of future changes of flood and drought risks in Connecticut based on downscaled and bias-corrected projections of future precipitation and temperature from six global climate models. These models were chosen to cover the full range of model uncertainties in projected future changes. In this presentation, changes in the frequency of extreme events defined based on 1-day and 5-day precipitation amount will be discussed as they reflect flood risks for small (1-day) and large (5-day) watersheds, respectively. Changes in drought risks will be discussed based on changes in the frequency of dry years defined by cumulative precipitation amount and by the difference between precipitation and potential evapotranspiration, respectively. Both one-year and two-year droughts will be considered consistent with the drought risk faced by most drinking water supply systems in Connecticut.

Building Coastal Resiliency through Bird Conservation

Aimee Weldon, US Fish and Wildlife Service, Atlantic Coast Joint Venture

The Atlantic Coast Joint Venture (ACJV) is a bird conservation partnership spanning the Atlantic Flyway from Maine to Puerto Rico. ACJV partners from state, federal, non-profit and academic organizations have recently committed to strategically advancing the conservation of coastal marsh ecosystems through a focus on three declining bird species – Saltmarsh Sparrow, Black Rail and American Black Duck. These species collectively represent the Joint Venture region, the many habitats within the coastal marsh ecosystem (e.g. low marsh and high marsh) and a set of priorities that will help to achieve coastal resiliency for birds and people alike. Joint Venture partners are taking a quantitative approach to achieving conservation goals by setting population and habitat objectives for each species and designing conservation plans to achieve those objectives. These objectives are supported by development of decision support tools that help partners determine the most important places to protect or restore and the types of projects that will be most effective in supporting these sensitive species. This presentation will provide an overview of the ACJV's coastal marsh conservation efforts to date, including priorities identified through the Black Duck and Saltmarsh Sparrow Decision Support Tools.

CT ECO: New Map Viewers, Data Layers and More
Emily Wilson, UConn CLEAR

The CT ECO website provides access to Connecticut's statewide natural resource geographic information, aerial imagery, elevation and more. Recent additions to CT ECO include the all new Advanced Viewer, Coastal Hazards Viewer and MS4 Viewer as well as new layers including statewide impervious surface, 1 foot contours, sea level rise scenarios, shoreline change, storm sandy layers and more aerial imagery. The presentation will demonstrate the new viewers and their tools as well as ways to view and access the new layers.

CT ECO (Connecticut Environmental Conditions Online) is a partnership between the Connecticut Department of Energy and Environmental Protection and the University of Connecticut Center for Land Use Education and Research.

History Repeated: Drain and Fill or Wetland Restoration?
Roger Wolfe, CT DEEP Wildlife Division; Wetlands Habitat and Mosquito Management Program

Historically, coastal salt marshes were a mosaic of vegetation, shallow pannes, creeks and pools. However, coastal wetlands have been drained and filled for various purposes since colonial times with long-lasting impacts considered by most to be detrimental to these ecosystems. Drying and oxidation of marsh peat changes the vegetative community and can result in subsidence, artificial ditch-side levees impound water and prevent sediment accretion on the marsh surface creating stagnant panels of open water. In Connecticut, routine ditch maintenance was discontinued in the early 1980's, allowing many of these wetlands to 'restore' themselves, but thousands of acres are still degraded. In many of the sediment-starved saltmarshes in the northeast, accretion rates are not keeping pace with sea level rise. Consequently, many of our coastal marshes are getting wetter, compounding the situation. But there is hope. Assuming various names, nuances of draining and filling are being used in a positive, integrated manner to achieve multiple marsh management objectives. Selective recleaning of ditches and excavation of shallow runnels can be used to drain excess sheet water which allows native plants to revegetate. In contrast, thin-layer filling of areas that have subsided can raise marsh elevations to a level that will support native vegetation. Since coastal marshes are dynamic by nature, these manipulations are not a one-time fix; future yet minimal management will be needed to maintain or enhance these coastal wetlands to sustain coastal resiliency. This presentation will discuss these techniques and how they are being used in Connecticut.