Bia Dias, Ph.D. student, Wildlife, Fish, and Conservation Biology

Title: A marine ecosystem perspective of the anadromous forage fish role

Abstract: Anadromous forage fish loss over the last few decades has left the species belonging to alosine group (*Alosa pseudoharengus*, *A. aestivalis* and *A. sapidissima*) close to the brink of ecological extinction. Caused by a range of anthropogenic factors such as connectivity loss and fishery pressure, bycatch caps and moratoria on harvest were introduced to reverse the decline. Little is known about the impact of the biomass loss on marine food webs. However, historical reports indicate that alosines were once an abundant resource. We used Ecopath with Ecosim (EwE 6.5) simulation tool to analyze management strategies that focused on anadromous forage fish and increased connectivity between watersheds and ocean. We investigated how these strategies affected the relative biomass of alosine and other higher trophic level species. We ran our simulation from 1992 to 2050, accounting for the impact of alosine by-catch in Atlantic herring fisheries and the virtual increased connectivity as the means of biomass increase. We found that only with fishery reduction alosine relative biomass increased by 0.8. While the combination of fishing effort reduction and increase of habitat connectivity drove a 3.5 relative biomass change on the end of our simulation period. Forage fish species undergo natural population fluctuations, that can be amplified by fisheries. Thus, the augment of forage base biomass from species that occupy this niche, with distinct life history traits enable a more resilient food web, as apex predators are not relying in one unique resource, that is already target by fisheries.

Javzansuren Norvanchig, Master's student, Water, Wetlands, and Watersheds

Title: Modeling sustainability of water resources in Tuul River watershed in Mongolia

Abstract: In many parts of the world, freshwater source is getting depleted due to extensive rise in demand for water for agriculture, industries and growing urban and rural population. With climate change and land use alterations, sustaining of water resources is a major challenge. There is a need for watershed scale assessment and planning to address this problem. Watershed models are useful tools to investigate effects of hydrologic responses at various scales under climate change conditions, and to simulate effects of the management decisions in order to support sustainable water management. The main objective of this study is to evaluate ecohydrological processes at subbasin scale for sustainable water management using physically based Soil and Water Assessment Tool(SWAT) for the Tuul River Basin in Mongolia. This watershed is an important region for social and economic development of Mongolia and undergoing rapid depletion in water resources due to overexploitation of groundwater resources and uncertainty of climate change. We use SWAT model to simulate ecohydrological processes influencing water resources and see the potential effect of different management practices. Based on the assessment of water supply and demand dynamics, a water sustainability index is calculated using water supply-demand metrics for each subwatersheds and then ranked for sensitive areas. The sustainability index is used to evaluate and prioritize most vulnerable subwatersheds to support decision makers and identify optimal management practices to sustain water resources in the watershed.

Ashleigh Novak, Master's student, Marine Science and Technology

Title: Broad- and fine-scale movement ecology of yellowtail snapper *Ocyurus chrysurus* within a marine protected area in the U.S. Virgin Islands

Abstract: Acoustic telemetry data is well suited to network analyses, which can elucidate movement behavior, habitat preference, and connectivity between individuals and the environment. The integration of positioning systems can generate an even finer understanding of daily movements and intraspecific habitat partitioning. For this study, 15 yellowtail snapper *Ocyurus chrysurus* were tagged with acoustic transmitters in Buck Island Reef National Monument (BIRNM), a marine protected area in the U.S. Virgin Islands. The array consisted of 111 passive acoustic receivers, with 28 of those nested in a VEMCO Positioning System. Network analyses, for the 9 individuals with the most robust detection histories, indicated a strong association of most fish to the area of the array where the VPS was placed. Fine-scale movement analyses showed distinct space use patterns between fish, reduced movement at night, and evidence of habitat selectivity. Understanding the movement dynamics of yellowtail snapper is an important step towards determining adequate spatial protection and therefore the overall effectiveness of BIRNM.

George LoCascio, Master's student, Wildlife, Fish, and Conservation Biology

Title: Plant sperm kills parasite in bumble bee guts

Abstract: Declines in several pollinator species are due to a variety of factors, including pathogens and lack of foraging habitat. Incorporating pollinator-friendly plant species provides nutritional benefits, but could also help manage bee health if certain food sources also provide medicinal benefits of reducing pathogens. Previous research demonstrated consistent, dramatic medicinal effects of one domesticated sunflower cultivar (*Helianthus annuus*) on the gut pathogen Crithidia bombi in the common eastern bumble bee, Bombus impatiens. To ascertain the breadth of this medicinal trait and determine whether a range of domesticated and native sunflowers might provide medicinal benefits, we tested whether pollen from ten *H. annuus* cultivars, three populations of wild *H. annuus*, two Helianthus congeners, and two Solidago species, reduced Crithidia infections in B. impatiens compared to mixed wildflower and single-species control pollen. Bees were experimentally infected and fed their respective pollen diets for a week before dissection to assess infection. Because previous work only used honey bee-collected pollen, we also compared hand-collected pollen (i.e., pollen only) with honey bee-collected pollen (which contains nectar) to assess whether medicinal effects are due to nectar or pollen. All Helianthus species and Solidago pollen significantly reduced Crithidia cell counts compared to both controls, regardless of how pollen was collected. In both types of collection methods these results suggest that medicinal pollen may be widespread in Helianthus and potentially broadly in the Asteraceae, since Solidago are from a different tribe than Helianthus. Thus, these results provide guidance for

specific plants that aid in pollinator health management plans and provide options on which plants to use to promote pollinator habitat.

Carolyn Gorss, Master's Student, Water, Wetlands, and Watersheds

Title: Performance of floristic quality assessments in Massachusetts wetlands

Abstract: Freshwater wetlands provide ecosystem services that benefit the health and integrity of aquatic systems. In order to combat the loss of valuable wetland functions and services, US state governments alongside the EPA need to be able to accurately assess and monitor the current condition of wetland ecosystems. One particular method of wetland assessment, Floristic Quality Assessment (FQA), has been growing in popularity among states since its creation in the 1970's. FQA relies on plants as indicators of human disturbance, utilizing vegetation species richness calculations to assess the overall condition of the ecosystem. Despite its rapidly rising popularity, few studies have rigorously tested the performance of FQA, especially in New England. This study seeks to address some of the concerns with FQA's subjectivity and uniform performance in multiple locations. I use the Conservation Assessment and Prioritization System (CAPS), a coarse-scale wetland assessment method developed in Massachusetts, as a basis for evaluating FQA's performance in Massachusetts forested wetlands. I will explore the relationship between the performance CAPS and FQA along a linear condition gradient, the subjectivity of FQA calculations, and the variation between FQA equations among states and ecoregions in New England. The purpose of this research is to evaluate and identify opportunities to improve the use of FQA with particular focus on its application to New England wetlands.

Erin Coates-Connor, Master's student, Forest Resources and Arboriculture

Title: Assessing effectiveness and response of native plant communities to different garlic mustard (*Alliaria petiolata*) eradication methods

Abstract: The eradication of the invasive biennial herb garlic mustard (*Alliaria petiolata*) and the restoration of invaded forest habitats present important linked challenges to land managers in North America. Garlic mustard is able to successfully invade the interiors of undisturbed forests. Root and leaf litter exudates from garlic mustard contain fungitoxic secondary compounds that may interfere with root colonization by mutualistic mycorrhizal fungi for a number of native tree and understory forb species, thereby impacting growth and recruitment. Removing garlic mustard by hand and by glyphosate herbicide application have both been used as eradication strategies. Both methods have advantages and disadvantages and can take many years of treatments to diminish garlic mustard's seed bank. There is need to better understand both garlic mustard population responses and native plant community responses to these methods within multi-year eradication efforts in order to inform effective garlic mustard management practices. In this study, we established experimental garlic mustard eradication plots with pulled and sprayed treatments, as well as invaded and uninvaded control treatments, in four temperate forests in the Northeast. We conducted baseline and annual vegetation surveys each spring for five consecutive years and

applied annual eradication treatments starting in the second year. We will assess whether garlic mustard populations decrease with annual eradication treatments and whether one treatment is more effective than the other. Further, we will explore differences in plant community diversity between treatments and across time to consider how plant communities respond to garlic mustard removal.

Benjamin Padilla, Ph.D. student, Wildlife, Fish, and Conservation Biology

Title: Is there a general decision framework for quantifying urbanization gradients?

Abstract: The field of urban ecology has grown out of decades of increasing interest in how urbanization shapes ecological processes. As our understanding improves, the focus has now shifted towards identifying the mechanisms underlying biological responses along urban gradients, and a desire to test the generality of emerging predictions across space and time. Unfortunately, methods used to define urbanization and produce landscape gradients vary widely, making it challenging to compare across studies and reach general conclusions. Based on a review of 255 papers published between 2007 and 2017 that used a landscape gradient approach to examine the impacts of urbanization on an ecological process, we developed a general decision framework for defining urban gradients. In each study analyzed, we identified key common features including (1) the type of landscape classification (e.g. continuous or categorical), (2) the spatial scale of landscape analysis (e.g. site or landscape level), and (3) the definition of urbanization used (e.g. impervious surface or population density). Despite some patterns in the data, there was substantial variation in the rational and types of decisions made steps, differences that significantly influence results. The general decision framework we develop here describes the key steps for defining urban gradients, taking into consideration the spatial scale, landscape analysis methods, and definition of urbanization, and offers guidance on making context specific choices within this framework allowing for critical comparisons with other studies.

Mariela Garcia Arredondo, Master's student, Water, Wetlands, and Watersheds

Title: Rhizogenic weathering impacts on deep soil carbon

Abstract: Plant roots reshape the soil environment by releasing approximately 25-40% of their photosynthetically fixed carbon (C) as root-derived compounds. While root-derived organic compounds are recognized as an important source of soil C, their role in promoting weathering reactions has been overlooked. Root-driven weathering may generate mineral-organic associations, which protect up to 91% of deep soil C for centuries to millennia. In contrast, root-driven weathering may also cause mineral transformations, potentially disrupting mineral-organic associations. Hence root-derived C may not only initiate C accumulation in deep soils, but also diminish C stocks through disruption of mineral-organic associations. Yet, the cumulative impact of root-driven weathering on mineral-organic associations is largely unknown. Therefore, our overarching goal was to examine root-promoted transformations of mineral-organic associations, and related changes in C storage, in deep soil. To accomplish this goal, we examined root impacts

on soil C residence time and chemistry, mineralogy and mineral-organic associations across the Santa Cruz Marine Terrace chronosequence (65ka-226ka). As soils aged, and rhizogenic weathering increased, we observed a gradual change from predominantly root-derived to microbially-derived organic matter via mass spectrometry. Msbauer and sequential extractions showed amorphous Fe (and Al) complexes formed during initial weathering, whereas crystalline (hydr)oxides dominated later weathering stages. X-ray spectro-microscopy revealed strong spatial associations between C and Fe during initial weathering stages, indicative of protective mineral-organic associations. In contrast, later weathering stages showed weaker spatial relationships between C and Fe. We conclude that initial root-induced weathering creates metal-organic complexes, protecting root-derived C from decay. As root-driven weathering proceeds, minerals transform into more crystalline phases that retain lower amounts of microbially-derived C. Our results suggest that root-induced weathering reactions are primary drivers of the formation and disruption of mineral-organic associations, and are thus critical for future predictions of the vulnerability of deep soil carbon to climate change impacts.

Evan Kuras, Master's student, Environmental Policy and Human Dimensions

Title: Connecting to nature in and out of school

Abstract: As cities expand throughout the world, urban residents face decreasing access to green environments and associated biodiversity. For children, vanishing opportunities to interact with nature may have lasting consequences for health, well-being, and environmental identity. This "extinction of experience" concerns conservationists who fear that disconnected populations will not support biodiversity protection policies. Environmental education (EE) counters this trend by intentionally bringing students to parks and green spaces. There, students learn about the environment and in the process, gain positive attitudes towards nature and promote interest in repeating nature-based activities. Successful programs build on children's familiarity with nature, are easily repeated in accessible places, and are reinforced by the participant's community. To understand how social and environmental contexts shape the value students gain from EE, I surveyed ~400 elementary school students that participated in the ECOS program in the city of Springfield, Massachusetts. ECOS activities are biodiversity-centric, age-appropriate, and well-known throughout Springfield, providing an opportunity to explore how features of the activities and conversation around them may impact program outcomes. I found that ECOS is most successful at boosting confidence around outdoor activities and those that are more active outdoors are more likely repeat ECOS activities and to talk about them. Students enjoyed the biodiversity-centered activities but identified barriers that prevented repetition. The survey yielded useful information for ECOS teachers regarding framing and barrier reduction. More broadly, this research may help educators and conservationists improve their efforts to combat the extinction of experience and better connect the world's youth with nature.

Kadambari Devarajan, Ph.D. student, Quantitative Ecology

Title: Study design and statistical inference in multi-species models: The story so far

Abstract: Advances in technology along with easy access of relevant technologies to researchers, wildlife managers, policy makers, and the general public have resulted in a dramatic increase in the deployment of tools such as camera traps for wildlife monitoring in the past decade. While classical methods such as those involving point counts, transects, mist nets, and pitfall traps continue to be in use for monitoring populations involving birds, reptiles, and amphibians, camera trapping is gaining traction as the preferred method for monitoring mammals. There is also increasing interest in studying entire communities simultaneously, paving the way for multi-species or community models in ecological research. Until recently, monitoring studies have focused on single species, but the tools used for wildlife monitoring frequently result in the detection of several species, that can be thought of as 'monitoring by-catch'. Given the practical and applied importance of such multi-species models, it is imperative to understand how sensitive statistical inference is to study design, especially when studies are designed for a focal species but can give insights about a community landscape. Here, we review the community modeling literature to evaluate current best practices for focal-species and community-focused monitoring study design.

Michael Roberts, Master's student, Water, Wetlands, and Watersheds

Title: The Women's Action: Narrative constructions of hegemonic power and resistance

Abstract: Urban sprawl is ongoing in many parts of the world which can negatively impact cultural and natural resources in rural and semi-rural communities. In this narrative ethnography, I explore how rural and semi-rural communities outside Albuquerque, NM are resisting proposed urban development in order to protect their land, water, and culture. Drawing on traditional ethnographic methods of participant observation, open-ended interviews, and secondary data collection, this paper focuses on a specific event: the Women's Action. In May of 2015, a group of women and children disrupted a Bernalillo County Commission Hearing to protest a proposed 14,000-acre development called Santolina. I use a critical lens to illustrate how six participants of the Women's Action use storytelling to construct and invert hegemonic spaces that are obscured in institutional processes. I add my voice to a growing consensus in the field of Narrative Inquiry that views space and time as semiotic resources which are constitutive of narrative structure. Situating these stories within the broader theoretical understanding of resistance narratives from the field of legal sociology, I argue that individuals employ spatial-temporal constructions of relationships to power to make meaning of individual acts of resistance.

Donovan Drummey, Master's student, Wildlife, Fish, and Conservation Biology

Title: Estimating American marten density in New Hampshire

Abstract: The American marten is a medium-sized carnivore found across the boreal ranges of North America. Historically, their range included much of the northeastern United States.

However, extensive trapping and deforestation led to their decline and extirpation in several states in the 1800s. Through a combination of natural dispersal from remnant populations and reintroduction projects, marten have recolonized some of their historic range in New Hampshire. Though the species has recently been removed from the state's Endangered Species list, the Department of Fish and Game needs more information in order to effectively manage the species. Information on habitat requirements is vital to understanding which habitats and areas are likely to be inhabited by marten. If there is a measure of how much appropriate habitat is available, it is possible to estimate total population sizes. Estimates will be generated using two different methods. In the first, camera traps were used to identify individual marten by their unique throat patches. Because the cameras are spread over a large area, it is possible to track individual movement and determine population densities using Spatial Capture-Recapture methodologies. For the second, mustelid scat samples were collected across the White Mountain National Forest. DNA will be extracted from these samples, and microsatellites will be used to determine which samples were marten and which were their close relative, the fisher. Once the species has been determined, occupancy models will be used to isolate habitat characteristics that predict their presence.

Kate McClellan Press, Ph.D. student, Marine Science and Technology

Title: Response of juvenile lemon sharks, *Negaprion brevirostris*, to electric fields produced by an experimental submarine power cable across a tidal creek, Eleuthera, The Bahamas

Abstract: Elasmobranchs (sharks, skates, rays) possess an extremely sensitive electrosensory system that enables them to detect electric fields in their environment. Their electrosensory system provides critical functions, including detection of prey, conspecifics, and predators, and orientation in their environment. However, elasmobranchs are also sensitive to electric fields from anthropogenic sources, and interaction with them may cause negative behavioral responses. To determine whether interactions with power cables could alter elasmobranch spatial behavior, the movements of ten juvenile lemon sharks, *Negaprion brevirostris*, were tracked with acoustic transmitters and time-lapse video inside tidal creeks in Eleuthera, The Bahamas. An experimental power cable was placed across one creek, creating an electric field barrier. Shark detection and movement directions will be compared before, during, and after cable activation at the experimental creek and a nearby control creek. Previous studies on juvenile lemon shark electrosensitivity suggest that sharks will show some behavioral responses to the active power cable, ranging from biting to avoidance. Understanding potential behavioral and spatial changes are especially important given that 1) elasmobranchs are declining globally and there is a lack of critical biological information to inform decision making for their conservation and 2) the offshore renewable energy industry is growing exponentially and is associated with large networks of power transmission cables that emit electric fields.

Jill Fleming, Master's student, Wildlife, Fish, and Conservation Biology

Title: Spatial design considerations for a method to monitor the prospective indicator species, the red-backed salamander

Abstract: Indicator species are valuable tools for signifying change in environmental gradients of interest to natural resource managers. For decades, researchers studying the red-backed salamander (*Plethodon cinereus*) have suggested that the species can serve as an indicator of forest health. However, the term "forest health" is vague, and exactly what the species indicates and how is not well understood. Currently, there are insufficient data available for characterizing the red-backed salamander's ability to indicate important forest qualities, and range-wide monitoring is necessary for this to occur. The Salamander Population and Adaptation Research Collaboration Network (SPARCnet) is a recently developed network for monitoring the red-backed salamander with partners throughout the species' range. SPARCnet employs artificial cover object (ACO) arrays, a widely accepted method for generating mark-recapture data in terrestrial salamanders. The arrays are sampled on multiple occasions and the resulting capture data, which are inherently spatial, allow for the estimation of true density using spatial capture-recapture (SCR) analysis. In order to understand whether the spatial design of ACO arrays impose bias in population estimates via biological or physical phenomena (i.e., territoriality, habitat availability, respectively), I have installed three geographically separated replicates of five array designs differing in sampling area and ACO density in Wendell State Forest (Wendell, MA). In using SCR analysis, density estimates of red-backed salamanders were not influenced by ACO array design. These results support the use of ACOs for terrestrial salamander monitoring, and suggest this method is therefore useful in assessing their utility as a forest health indicator.

Lian Guo, Ph.D. student, Organismic and Evolutionary Biology

Title: Measuring otolith growth to infer river herring physiology

Abstract: In the management of ecologically and economically valuable species, it is essential to have reliable estimates of population health (e.g. relative abundance, growth and mortality rates). River herring (blueback herring, *Alosa aestivalis* and alewife, *Alosa pseudoharengus*) are two such species for which juvenile growth rates are calculated from otoliths. It has been shown in some fish species that the reliability of otolith-derived growth rates can change across environmental conditions. In particular, otolith increment width has been shown to follow more closely with metabolic rate than somatic growth, leading to a temperature-driven decoupling effect where otolith growth is greater than expected at high temperatures. Changes in growth and metabolic rate have significant physiological implications and could yield improved resolution on population health if both can be reliably measured using otoliths. To test the relationship between otolith growth and somatic growth in river herring, otoliths and fish lengths/weights were examined in larval blueback herring and juvenile alewife exposed to a range of temperatures (larvae: 9°C, 15°C, 21°C, 27°C; juveniles: 21°C, 25°C). Differences in growth rate were used to estimate metabolic rate and determine if otolith growth followed somatic growth or metabolic rate more consistently. Understanding how otolith growth relates to physiology serves as a foundation for future work

assessing how changes in river herring physiology relate to differential population success along the Eastern United States.

Rossana Salazar, Ph.D. student, Wildlife, Fish, and Conservation Biology

Title: Indigenous women healers: Traditional health practice at risk

Abstract: The United Nations Environment Program has indicated that Latin America has approximately 70 percent of the species in the world, 23 percent of the forest, and 31 percent of the fresh water resources, UNEP(2010b). Unfortunately, Latin America is losing biodiversity, forests, water, and soil due to global warming, and lack of program support. To promote and protect environmental policies, UNEP(2010b) has recommended the incorporation of indigenous women and other minority groups be supported in efforts to save, maintain, and recover species at risk by promoting an environmental culture. Indigenous women are familiar with the forest environment, being responsible for gathering food, water and fuel and being community healers.

Grace Casselberry, Master's student, Marine Science and Technology

Title: Exploring temporal changes in the spatial use of a Caribbean marine protected area by four shark species (*Negaprion brevirostris, Ginglymostoma ciratum, Galeocerdo cuvier, and Carcharhinus perezi*)

Abstract: Marine protected areas (MPAs) are becoming an increasingly popular marine conservation tool, particularly for elasmobranchs. Although Buck Island Reef National Monument (BIRNM), St. Croix, United States Virgin Islands, is one of the oldest MPAs in the US, information on the movement ecology of sharks in its waters is lacking. From June 2013 - May 2017, nurse (*Ginglymostoma cirratum*; n = 10), lemon (*Negaprion brevirostris*; n = 5), tiger (*Galeocerdo cuvier*; n =6), and Caribbean reef (*Carcharhinus perezi*; n = 12) sharks were tagged and monitored using a passive acoustic telemetry array within BIRNM. Network analyses were used to evaluate the extent to which tagged sharks utilized the MPA, including habitat selection and seasonal changes in array use. Spatial networks for individual sharks displayed behavioral differences among species and individuals. The results of this study indicate that BIRNM provides varying degrees of protection for all species tagged, with many individuals exhibiting high, yearlong residency within BIRNM. Individual spatial networks revealed that most individuals used the array widely throughout the duration of the study, with individualized core use areas and overlapping general use areas. While individuals of every species were detected outside of the MPA boundaries, in certain months, core use areas for tiger sharks were located outside of the MPA. This indicates that tiger sharks spend extensive time outside of the MPA, and may be exposed to fishing pressures more frequently than the other species in this study.

Joseph Drake, Ph.D. student, Wildlife, Fish, and Conservation Biology

Title: Graph-theoretic approaches to connectivity and dynamic spatial processes

Abstract: Landscape fragmentation and the resulting loss of connectivity among wildlife populations is a longstanding conservation concern. Within the emerging research area of spatial ecology, many methodological advances have been made in modeling and quantifying landscape connectivity, including with the promising application of graph theory. Initially used to measure structural connectivity between habitat patches, this method has quickly developed to incorporate species and location specific information, such as dispersal, into a wider connectivity modeling framework. Compared to least-cost paths and other connectivity frameworks, graph theory applications are less data intense, allowing for the pragmatic analyses of real landscapes and alternative management scenarios. Graph theory has promise in diverse applications, such as predicting invasive species spread and directing habitat conservation, yet it is still unclear how these graph-theoretic metrics compare against established connectivity measures when used to model spatial dynamics. Here we present a brief overview of graph connectivity modeling and then demonstrate the value of graph theoretic approaches for inferences in a spatially structured population of water voles (*Arvicola amphibious*) in the Scottish Highlands. Specifically, we compare the use of biologically motivated graph-theoretic metrics to more traditional distance-based connectivity metrics in their applicability to patch occupancy models. This application explores the use of graph theory to do more than show pattern, but help expand knowledge of processes such as long-term colonization-extinction in metapopulation dynamics.

Aaron Grade, Ph.D. student, Organismic and Evolutionary Biology

Title: Non-lethal effects of predation: An experimental test of House Wren nesting across an urban-to-rural gradient

Abstract: Avian species in urban areas tend to produce smaller and lighter offspring than their rural counterparts. This can lead to reduced fledgling survival in areas with high human-development. In addition, urban areas often have higher densities of potential predators. A species can be negatively impacted by predators through either direct predation or non-lethal effects (NLEs). NLEs are any change in an individual's behavior caused by "fear" of predation. Birds often adjust activities such as nestling feeding rates on short time scales in response to changes in perceived predation risk. These patterns indicate that NLEs may be an important mechanism of lowered nestling condition with urbanization. We are investigating the interaction of NLEs and urbanization by monitoring House Wren (*Troglodytes aedon*) nests in backyard nest-boxes across an urban-to-rural gradient. By experimentally altering predation risk environments through playbacks, we aim to measure the effect of NLE's on nestling growth. Our preliminary data have surprising results: House Wrens that nest in more urban areas and have a higher threat of predation produce larger and heavier nestlings. Why is this, and what implications do these results have on urban birds?

Tierney Bocsi, Master's student, Forest Resources and Arboriculture

Title: A breakeven point: The costs and benefits of planting street trees

Abstract: The benefits of trees are widely discussed, especially in the context of the urban environment, where green infrastructure if often limited and challenged. Offering a host of ecosystem services that are well-known, such as carbon sequestration and stormwater mitigation, urban trees also contribute to energy savings and increase property values in urban settings. Researchers have not only quantified these services in terms of, for example, pounds of carbon and liters of water, but they have begun to quantify the benefits of street trees in dollar values. Software programs like i-Tree have allowed municipalities, city planners, and managers to analyze and quantify the benefits of their urban forests through adaptable, peer-reviewed tools. Here, we review the literature behind i-Tree and implement the software to determine the value of the ecosystem services offered by street trees in South Amherst, Massachusetts. We then calculate a breakeven point, assessing the costs for planting and maintenance, along with the benefits (in US dollars) that these trees provide.

Carolyn Anderson, Ph.D. student, Water, Wetlands, and Watersheds

Title: Controls on soil carbon cycling in a dynamic floodplain system

Abstract: Floodplains cover only 1% of the global land area but have been suggested to account for nearly 10% of global soil organic carbon storage. However, because we do not know the mechanisms that stabilize soil carbon, we cannot predict how floodplain systems, and the carbon stored therein, will respond to climate change. Alpine watersheds are particularly hydrodynamic systems, where spring snowmelt delivers pulses of dissolved and particulate organic matter, containing both carbon and nutrients. The fate of this carbon and nutrients depends on how the organic matter interacts with floodplain soil and sediments, which can vary in texture, carbon content, and oxygen status. In this project, we investigate how snowmelt events and associated flooding impact carbon dynamics in alpine floodplains, through interactions with both minerals and microbes. Using a combination of field site monitoring data and high-resolution soil and microbial characterization techniques, we aim to improve our knowledge of the chemical and biological mechanisms that control soil carbon cycling in dynamic floodplains. Such information can improve our predictions of how sensitive alpine systems respond to climate change.

Meghna Marjadi, Ph.D. student, Organismic and Evolutionary Biology

Title: Pokémon Go Outside: Does outdoor gaming influence environmental perceptions?

Abstract: Pokémon Go is an augmented reality (AR) game in which players use smartphones to capture Pokémon (fictitious monsters) in real-world outdoor locations. Since its release in mid-2016, news media reports suggest the game prompts social interactions, promotes walking habits and park visits, and improves users' mental or emotional health. Empirical investigation is needed to elucidate the outcomes of the Pokémon Go phenomenon and evaluate these anecdotal claims. Our study addressed this knowledge gap by examining Pokémon Go's influence both on players' attitudes towards nature and connectedness with the environment. Although there is evidence indicating a positive relationship between nature exposure and conservation interest, most studies

presuppose interest in nature among participants (i.e., citizen science, outdoor recreation). By bridging technology, gaming, and nature, Pokémon Go may encourage people who typically do not engage with nature, thus providing a unique opportunity to explore this relationship without assumptions. We conducted a pre- and post-survey of 747 and 343 Pokémon Go players to elicit their environmental attitudes and feelings of connectedness with nature before and after they began playing the game. After game play, participants reported visiting more parks and developing stronger interests in natural areas. We examine these results in relation to player characteristics like location, playing habits, and demographics. Findings begin to illustrate the widespread impacts of Pokémon Go, contribute to our understanding of people's attitudes and perceptions towards nature in relation to technology, and can inform educational and recreational programs.

Nischal Neupane, Master's student, Environmental Policy and Human Dimensions

Title: Short messaging services as effective energy usage feedback mechanism

Abstract: Household level energy use is a major contributor of Global Greenhouse gases (GHGs) in the United States. Existing policies and interventions to curb household level energy use have focused on slow-acting technical and policy level interventions and have failed to incorporate the role of human behavior in energy use. Alterations in human behaviors through planned interventions have shown to help reduce consumption of energy in household levels. Feedback on energy use, usually provided through mail and emails, is one of those interventions. The energy sector, however hasn't explored the efficacy of Short Messaging Services (SMSs) as feedback mechanism to alter household energy behavior yet. In my study, I plan to examine the efficacy of SMSs in providing feedback on energy use to households at North Village Apartments in Amherst, Massachusetts through an experimental setup. A treatment group will receive feedback about its energy use through SMS, mail and email whereas the other group will only receive their feedback through mail and email. I expect significant energy usage reduction in groups that receive their feedback through SMS compared to groups that don't. The results from this study could be a stepping stone towards testing the role of SMSs as feedback mechanisms to reduce energy use in larger and more diverse populations. Increased use of SMS in providing feedback may help reduce energy consumption in households in the US.