US-IALE

Landscape Change

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FINAL PROGRAM

ABSTRACTS

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Presenter: Abdel Moniem, Hossam M

Title: Landscape genetics of a pollinator longhorn beetle [Typocerus v. velutinus (Olivier)] on a continuous habitat surface

Authors: Hossam M Abdel Moniem (Purdue University);Brandon J Schemerhorn (USDA-ARS & Purdue University);Andrew J DeWoody (Purdue University);Jeffrey D Holland (Purdue University);

Session: Genetics

Abstract: Landscape connectivity, the degree to which the landscape structure facilitates or impedes organismal movement and gene flow, is increasingly important to conservationists and land managers. Metrics for describing the undulating shape of continuous habitat surfaces can expand the usefulness of continuous gradient surfaces that describe habitat and predict the flow of organisms and genes. We adopted a landscape gradient model of habitat and used surface metrics of connectivity to model the genetic continuity between populations of the banded longhorn beetle [Typocerus v. velutinus (Olivier)] collected at 17 sites across a fragmentation gradient in Indiana, USA. We tested the hypothesis that greater habitat connectivity facilitates gene flow between beetle populations against a null model of isolation by distance (IBD). We used next-generation sequencing to develop 10 polymorphic microsatellite loci and genotype the individual beetles to assess population genetic structure. Isolation by distance did not explain the population genetic structure. The surface metrics model of habitat connectivity explained the variance in genetic dissimilarities 30 times better than the IBD model. We conclude that surface metrology of habitat maps is a powerful extension of landscape genetics in heterogeneous landscapes.

Presenter: Abernathy, Heather N

Title: Examining the effects of historic hydroclimate on current songbird abundance

Authors: Heather N Abernathy (The University of Georgia);Jeffery Hepinstall-Cymerman (The University of Georgia);John Maerz (The University of Georgia);

Session: Avian I

Abstract: In the last 25 years the southeastern US has undergone precipitation variability changes with an increase in extreme precipitation events and an increased instance of droughts. Precipitation patterns bring about ecosystem changes which manifest differently at various trophic levels. Forest trophic dynamics are altered first by shifting plant communities,

which in term affect insect abundance and type; and as a result insectivorous songbirds are affected due the loss or gain of food resources. Thus, our objective was to measure breeding songbird occupancy and abundance as well as their food resources across a precipitation gradient to quantify songbird responses. To assess songbird community abundance and habitat quality, breeding songbird point count, vegetation, and lepidopteran larvae surveys were conducted in select watersheds in relation to a historic precipitation (2003-2012) gradient across the Coweeta Basin in Macon County, North Carolina. It was found that songbird communities exhibited a strong relationship with historical precipitation patterns, particularly among insectivorous species. Species of particular interest that exhibited a correlation with precipitation patterns and, are of particular interest, include Black-throated Blue Warblers (Setophaga caerulescens), Veerys (Catharus fuscescens), and Canada Warblers (Cardellina Canadensis). Mountains in western North Carolina, are the southernmost breeding range for these species and, because future precipitation trends are expected to increase in variability, this effect may create islands of suitable habitat for these species.

Presenter: Adams, Bryce T

Title: Examining independent effects of habitat amount and fragmentation on a Neotropical migrant songbird

Authors: Bryce T Adams (School of Environment and Natural Resources, The Ohio State University);Kaley J Donovan (School of Environment and Natural Resources, The Ohio State University);Stephen N Matthews (School of Environment and Natural Resources, The Ohio State University);

Session: Fragmentation

Abstract: Habitat loss and fragmentation are considered primary causative agents for the decline of many imperiled species, but discerning their relative contribution has remained elusive as fragmentation usually occurs through a process of habitat loss. Understanding relative influences of spatial pattern, that is all habitat and matrix types present (landscape composition) and their spatial arrangement (landscape configuration), will help managers to better conserve wildlife. We examined independent effects of landscape composition and configuration on the distribution of a Neotropical migratory forest songbird of high conservation concern in the Appalachian Foothills Region of Southeast Ohio using a species-centered approach. This quantitative method uses species distribution models (SDM) to measure landscapes. We used boosted regression trees, environmental variables obtained through remote sensing, and occurrence data from 304 point count locations from May-July 2015 to predict cerulean warbler (Setophaga cerulea) breeding habitat suitability across our study area. We developed four hypotheses, translated them into statistical models, and

evaluated their relative support under an information-theoretic approach using AIC and our SDM. We found support for our habitat (habitat and matrix composition) hypothesis (wi = 35%) and fragmentation (landscape configuration measured as patch density) hypothesis (wi = 21%). By controlling for species-specific perceptions of landscapes, we detected some level of sensitivity to landscape configuration, and suggest conserving large, connected patches of cerulean warbler habitat (identified in our SDM) as a management tool. These results demonstrate how an appreciation of species-specific habitat distributions may help improve our ability to conserve forest-dependent wildlife in the Appalachian Foothills Region.

Presenter: Adams, Alison B

Title: 30 years of forest conversion in the Northeast: historical patterns and future projections

Authors: Alison B Adams (University of Vermont, Rubenstein School of Environment & Natural Resources);Gund Institute for Ecological Economics) (University of Vermont, Rubenstein School of Environment & Natural Resources);Jennifer A Pontius (University of Vermont, Rubenstein School of Environment & Natural Resources);

Session: Landscape Dynamics I

Abstract: Land use and land cover across the northeastern United States has changed dramatically over the past century. While these changes are highly visible to land managers and planning professionals on a local level, regional information on the nature and extent of these changes has been limited. Thanks to the wealth of historical satellite imagery that has recently become freely available, we are now able to look, with sufficient temporal resolution (5 year intervals from 1985 to 2015), at the patterns and rates of land cover change across the Northeast. Recently-developed maps of land cover for the region include spatial estimates of relative abundance for the most common northeastern forest species. In this study we utilized these maps to quantify changes in the landscape over the past thirty years, not only to and from forest, but also in tree species abundance. This information is critical to inform adaptive forest management in the face of converging stress agents across the region. Using Dinamica EGO, a sophisticated spatial modeling platform, we identified significant drivers of historical change and simulated future changes in land cover and forest composition. Here we present historical and projected changes in land use and land cover for the northeastern US from 1985 to 2045.

Presenter: Airey Lauvaux, Catherine T

Title: Fire and drought across forest types in a northern Rocky Mountain landscape

Authors: Catherine T Airey Lauvaux (Penn State University);Alan H Taylor (Penn State University);

Session: Wildland Fire I

Abstract: Knowledge of historical fire-climate interactions is valuable to efforts to predict and plan for how fire regimes may respond in a changing climate. However, little is known about fire-climate relationships in high elevation whitebark pine, Pinus albicaulis, forests or about how fires occurred in relation to lower elevation forest fires. We collected fire history and forest structure data across a vegetation gradient from lower elevation Douglas-fir, Psuedotsuga menziesii, to high elevation whitebark pine forest. Our fire history results from Douglas-fir forests indicate that fires occurred, on average, every 34 years. Superimposed epoch analysis shows that widespread fires burned across forest types in very dry years about every 100 years. Based on the Douglas-fir forest fire patterns, we hypothesize that during especially dry years, climate-fire interactions connected lower elevation Douglas-fir and high elevation WBP forests as a result of dry fuel connectivity whereas during wetter periods, fires were smaller and patchier. However, after 1850, as a result of settlement activities including livestock grazing and mining, ground fuels became discontinuous and fire connectivity between low and high elevation forest declined.

Presenter: Aisu, Megumi

Title: Landscape vulnerability to non-native plants in Interior Alaska

Authors: Megumi Aisu (University of Alaska Anchorage);E Jamie Trammell (University of Alaska Anchorage);Matthew L Carlson (University of Alaska Anchorage);Frank Witmer (University of Alaska Anchorage);

Session: Poster

Abstract: Non-native plants are rapidly filling the empty niches in interior Alaska. Potential ecological threats of non-native plant invasion include changing the nutrients and moisture in soil, encroachment of rare plants, reduction of native species density, and changing the pollination pattern. Although several studies have been conducted to predict the distribution and potential impacts of non-native plants in Alaska, a comprehensive model that predicts ecological impacts of all non-native plant species that are already observed in Alaska based on all three factors that potentially affect non-native plant distribution (climate, habitat condition,

and anthropogenic infrastructure) has not been made. The objective of this study is to identify (1) which factor or combination of factors among 10 climate, 2 habitat, and 5 anthropogenic variables makes the landscape ecologically vulnerable to plant invasion in interior Alaska, and (2) where the areas are that are most at risk for plant invasion currently and in the future (2020s and 2060s). These objectives were addressed by constructing a decision tree (CART model) that classifies a multitude of climate, habitat, and anthropogenic variables based on how they interact with the current non-native plant distribution. The model suggested that anthropogenic land use is the single, most influential factor, making the eastern Alaska more vulnerable to the plant invasion. Non-native plant distribution is predicted to shift toward the western Alaska as the human population is projected to expand westward by 2060s.

Presenter: Allington, Ginger RH

Title: Mapping dynamic processes in arid rangelands: A new paradigm for land cover classification

Authors: Ginger RH Allington (University of Michigan);Daniel G Brown (University of Michigan);

Session: Mapping spatiotemporal pattern and process: re-imagining arid grassland mapping from local to global scales

Abstract: Classifications of land cover/land use, and land cover change have been useful for documenting forest loss, urbanization and habitat conversion. However, the current global land cover data products are insufficient for arid grasslands for two reasons. First, current classification products have poor performance in arid systems and are extremely unreliable. Second, these classifications are discrete characterizations of dynamic systems and do not provide any information about grassland degradation, or relative condition; rather grassland is classified as a singular static state. Combined, these limitations mean that our ability to discern any information about landscape change in rangelands with current land cover mapping approaches is extremely limited. In our project, we will create and implement a new ontology for grassland classification that incorporates spatio-temporal patterns to incorporate land-cover dynamics, land-use history, and grassland condition, based on known and hypothesized alternate stable-state dynamics drawn from the literature on grassland ecology. To do this we are utilizing the full time series of Landsat data via the Google Earth Engine, a cloud computing environment that allows us to access and process all available Landsat scenes. The end product of this research will be an entirely new system of characterizing and tracking grassland area and status that will be useful for arid systems research, land use land cover change detection, as well as monitoring and management of rangelands. This work engages a multi-disciplinary perspective that is novel, drawing insights from ecology, rangeland science, remote sensing, and GIScience.

Presenter: Anderson, Elsa C

Title: Evaluating historic, local, social, and landscape drivers of species diversity in vacant lots in Chicago, IL, USA

Authors: Elsa C Anderson (University of Illinois at Chicago);Emily S Minor (University of Illinois at Chicago);

Session: Urban III

Abstract: Vacant lots represent a relatively large area of under-tended land in dense cities, and are also a confluence point of ecological and social processes. As such, vacant lots offer a unique study system for understanding the ways in which numerous variables across a socio-ecological spectrum influence urban biodiversity. During the summer of 2015, we visited 35 vacant lots in Chicago. In each lot, we measured plant diversity and other local factors, including human influence in the form of trash, footpaths, dumping, and parking. We combined this in situ data with current and historic parcel data and current census data for each neighborhood. We used generalized linear models to help determine the relative strength of four different drivers of plant diversity in vacant lots: (1) historic land use factors (2) socio-economic factors (3) local environmental factors, and (4) landscape-level environmental factors. Our results indicate that urban plant communities are influenced by many drivers and are highly heterogeneous across the landscape. This knowledge contributes to understanding and conservation of urban biodiversity by identifying management activities that can increase plant biodiversity and the ecosystem services plants provide to urban residents.

Presenter: Anderson, Mark G

Title: Mapping landscape permeability to facilitate range shifts under climate change

Authors: Mark G Anderson (The Nature Conservancy);Melissa C Clark (The Nature Conservancy);Arlene Olivero Sheldon (The Nature Conservancy);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: As climates have changed around the earth, species have made shifts in their ranges. In Eastern North America, most species expanded their ranges northward in the last 12,000 years in concert with glacial cycles, and many species are already shifting northward and upslope in response to current climate change. However, human development has radically altered the landscape, causing fragmentation of natural land and creating many likely barriers to dispersal. How do conservationists ensure that the landscape remains permeable enough to allow such large-scale range shifts, particularly by populations that disperse slowly and in a variety of ways? In this spatial study we identify places that may facilitate range shifts in the Northeastern USA using a minor adaptation of the CIRCUITSCAPE model that allows for the creation of continuous omnidirectional connectivity maps. The methods aim to approximate population movement over time, and to illustrate flow paths and variation in ease of movement over a large study area. We specifically identify areas where northward and upslope movements may become concentrated due to roads and development patterns. These were modeled using a resistance grid that incorporates a 30-m landform model along with anthropogenic features. Second, we identify riparian corridors that channel high levels of current flow, contrast sharply with their surrounding landscape, and span modest temperature gradients. The results highlight linkages at a variety of scales that may be appropriate for conservation action.

Presenter: Anderson, Mark G

Title: Managing sites to increase climate resilience

Authors: Mark G Anderson (The Nature Conservancy);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: Natural environments have a host of mechanisms that allow for the persistence and evolution of biological diversity and ecological processes through a range of climates. Land stewards, faced with rapid climate change, can capitalize on these mechanisms to develop management practices that increase a site's inherent resilience. We propose a framework that focuses first on the enduring geophysical stage and maps how a site's physical resources and available environments are distributed irrespective of climate. Management practices are then developed that tie directly to climate resilience using treatments that increase options, sustain processes, or nurture sources of renewal. Increasing options refer to practices that enhance the microclimatic variation of a site through manipulating vegetation structure and local hydrology, provide continuous cover connecting topographically diverse areas, or spread risk by increasing the heterogeneity of the site's ecological or biotic components. Sustaining processes refers to limited interventions that kick start a disrupted natural processes with the goal of

reestablishing self- sustaining processes appropriate to the climate. Retaining sources of renewal refers to the conservation of on-site biotic materials (e.g. woody debris, seed banks) essential to the recovery of the system after catastrophic disturbance. Several case studies illustrating how these principles have been put into practice at sites owned or managed by the Nature Conservancy in Eastern North America will be presented.

Presenter: Anderson, Tavis K

Title: Ecological restoration and qualitative community stability determine parasite establishment and persistence

Authors: Tavis K Anderson (National Animal Disease Center, USDA-ARS);

Session: Landscape Change and Infectious Disease Ecology: Applications to Public Health

Abstract: The establishment and persistence of complex life cycle parasites may be regulated by free-living host diversity and their trophic interactions. In this study, I test the prediction that stable trophic interactions within host communities are a requirement in the establishment and persistence of parasites with complex multi-host life cycles. Using salt marsh food webs representing a gradient in time since major ecological restoration, level of urbanization, and community stability, I document the colonization of naïve killifish by parasites with complex or direct life cycles. These data demonstrate that parasite diversity was uncoupled from ecological restoration: the unrestored, and the 10- and 20- year restored marsh sites had similarly high measures of parasite diversity and richness. Food web stability, assessed using community food web matrices, explained the paradox of how a low diversity, highly invaded salt marsh (unrestored) had the same parasite community as highly diverse restored marsh sites (10 and 20 yrs). Above a community stability threshold, complex life cycle parasites were able to establish, and it appears that restoration efforts may perturb community stability with a consequence of curtailing parasite transmission. I extend these analyses to statistically defined “modules” of free-living species within food webs and show that stable modules are five times more likely to host a diverse parasite community. These results suggest a role for community stability in parasite community assembly, and support the idea that stable trophic relationships are required for the persistence of complex parasite life cycles.

Presenter: Anderson, Barbara J

Title: Urban sustainability measures as evidenced in climate change action plans

Authors: Barbara J Anderson (Iowa Environmental Council);

Session: Urbanization and Landscape Change: Socioeconomic Drivers and Ecological Consequences

Abstract: Cities around the globe show leadership with their implementation of climate change action plans. This paper examines these plans and resulting practices in selected large, mid-sized and small cities and particular neighborhoods within the large ones. Criteria examined include sustainability measures, effectiveness of changes, and water, electricity, and funds saved. Take-aways include a rating of sustainability indicators' usefulness, best practices experience, and an international perspective on urban sustainability measures.

Presenter: Andrew, Margaret E

Title: Detecting climate refugia in semi-arid landscapes with time-series remote sensing

Authors: Margaret E Andrew (Murdoch University);

Session: Arid Landscapes

Abstract: Climate refugia are sites with stable, high-quality habitat within landscapes characterized by dynamic environmental conditions driven by climate variability. There is considerable interest in the potential of these refugia to provide climate change resilience to landscapes and to biodiversity. Although attractive conceptually, there is yet little guidance on how to identify climate refugia, in order to study and protect them, and few evaluations of the value of these sites to biodiversity have been conducted. This study used time series of landsat image data to map candidate climate refugia across four conservation stations in a semi-arid woodland landscape northeast of Perth, Western Australia. At every pixel, a harmonic model was fit to the vegetation index phenology of the wettest years in the landsat TM archive. This model was then used to predict the phenological cycle of the driest years at that pixel. Candidate refugia were defined to be those pixels with (1) high vegetation activity in dry years and (2) highly predictable phenologies that are consistent regardless of the weather conditions experienced in a given year. Spatial relationships between candidate refugia and landscape features associated with elevated moisture availability (thought to drive climate refugia in these semi-arid landscapes) were assessed. The mapped candidate refugia show great promise and are now being used to establish a new long-term faunal monitoring program targeting climate change indicator species, in order to empirically demonstrate the importance of climate refugia to native wildlife.

Presenter: Arakwiye, Bernadette

Title: Albertine Rift endemic bird's habitat suitability and protection status

Authors: Bernadette Arakwiye (Clark University);Florencia Sangermano (Clark University);

Session: Conservation Biology I

Abstract: The Albertine Rift region in East Africa is globally recognized for its high biodiversity richness and high species endemism. Landscape change following increased population density and conversion of natural habitats threatens the survival of these unique species. Furthermore, many species in the region lack information on their current distribution due to the region's remoteness and poor local monitoring capacity. Therefore it is challenging to assess the impacts of landscape change on biodiversity and to develop sound conservation and management plans. This study uses maximum entropy algorithm in Maxent software to relate seventeen Albertine rift endemic bird species' location records from the Global Biodiversity Facility to bioclimatic environmental variables and vegetation quality data within the region. Results show that temperature seasonality, precipitation seasonality and precipitation of the driest quarter contributed the most to the models, thus suggesting that distribution of Albertine rift endemic bird species is susceptible to seasonal climatic changes. Spatial analyses also showed that current protected areas fragment highly suitable habitats and fail to cover more than 60% of species rich areas. Habitat suitability maps developed in this study reveal priority areas for ground truth fieldwork for researchers and protected area managers and may serve as baseline information against which to assess future landscape changes. This study highlights the need to revise protected areas zoning in the Albertine rift region in order to improve suitable habitat connectivity and focus conservation activities where they are relevant.

Presenter: Armenteras, Dolors

Title: Changing patterns of fire occurrence in NW Amazon: Effect of spatial and social hetereogeneity?

Authors: Dolors Armenteras (Universidad Nacional de Colombia);Joan S Barreto (Unal);Javier Retana (CREAF);

Session: Wildland Fire II

Abstract: Despite the importance of fire occurrence in the Amazon, little is known about the effects of the existing heterogeneity within the basin that is shared amongst different countries with sometimes contrasting biodiversity and climate change policies and different economic or infrastructure development. Climatically, north western Amazonia is one of the wettest tropical rainforest regions with ca. 3000 mm of rain per year and holds a shorter/weaker dry season than south west, south east or central Amazonia . Outside Brazil, little is known regarding factors that might be influencing the dynamics and patterns of amazonian fires in the Ecuador, Peruvian, Colombian and Venezuelan parts of the Amazon In this study we analyze the dynamics and patterns of fires in the Northwestern part of the Amazon basin to contribute to highlighting regional differences. We focused on analyzing the differences in spatial and temporal patterns of fire occurrence between countries sharing NW Amazonian territory.

Presenter: Armenteras, Dolors

Title: Quantification of degradation by burning in riparian forests-savannah edges

Authors: Dolors Armenteras (Universidad Nacional de Colombia);Xavier Corredor (Unal);Federico Sanchez (Unal);

Session: Wildland Fire II

Abstract: The use of fire for management purposes by human often causes disturbances to tropical forests affected. Fires affect forests in terms of structural changes, tree mortality and thus biomass and C depletion, a part from affecting local biodiversity. Fires are also strongly influenced by climate and neotropical savanna fires in the northern hemisphere experience a typical drought season associated fire peaks that also vary year to year in association with climate interannual variability . These savannas are associated to riparian forests that extend for over in the Colombian part of the Orinoco basin. The fire regime for this region is not well understood although some burned area estimates existe, however the spatial recurrence of fires and how the transition between the savanna area and the forest edge is affected is totally unknown. We quantified fore recurrence and edge effect for the whole region. Here we present the first quantification of the degradation effects of fire on riparian forest for this region over the last 15 years. We also provide some figures of the effect on soil organic C in the edge between these two ecosystems.

Presenter: Arodudu, Oludunsin Tunrayo

Title: Spatio-temporal assessment of agro-bioenergy systems-a Human appropriation of net primary production (HANPP) approach

Authors: Oludunsin Tunrayo Arodudu (Leibniz Centre for Agricultural landscape);Katharina Helming (Leibniz Centre For Agricultural Landscape Research);Hubert Wiggering (Leibniz Centre For Agricultural Landscape Research);Karlheinz Erb (Institute of Social Ecology, Vienna, Faculty for Interdisciplinary Studies);Alexey A Voinov (ITC, Faculty of Geoinformation and Earth Observation, University of Twente, Hengelosestraat 99, Enschede, Netherlands);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: Previous sustainability assessments of agro-bioenergy systems do not account for several sustainability impacts over space and time within a single frame. Consequently, this study explored the combination of the human appropriation of net primary production (HANPP) framework and life cycle assessment (LCA) based frameworks (namely the energy return on energy invested-EROEI, greenhouse gas balance-GHG and water footprint-WF frameworks) for sustainability assessment of agro-bioenergy systems across three broad agro-ecological zones (namely tropics, sub-tropics and temperate), and over future time scales (namely 2030, 2050 and 2070), using maize ethanol and biogas production systems as case studies. While the HANPP framework accounts for the biophysical and socio-economic flows of biomass, the LCA based frameworks accounts for the energy, greenhouse gas and water flows involved in the energetic appropriation of the three different HANPP components relevant for agro-bioenergy production (namely the harvested grain-HG, the extracted residue-ER and the unextracted residue-UnE). This study estimated the HANPP components relevant for bioenergy production, using data outputs from the GAEZ model (1960-2000) and recent studies for baseline setting, and data outputs from the EPIC model (2000 to 2030, 2050 and 2070 respectively) for the spatio-temporal assessment of nutrient flows that may influence the system under future extreme climate change scenarios (RCP 2.6 and 8.5). Results suggests that cascade use (or reuse) of extracted residue will help maximize biomass for agro-bioenergy production with reduced environmental impacts (in terms of water usage and greenhouse gas emissions), higher energy gains and efficiencies without conflicting with food security and biodiversity conservation concerns.

Presenter: Axel, Anne C

Title: Spatio-temporal movements of livestock in tropical dry forests in southern Madagascar

Authors: Anne C Axel (Marshall University);

Session: Arid Landscapes

Abstract: Livestock are an integral part of the economy in the communities around Beza Mahafaly Special Reserve in semi-arid southern Madagascar, and local herders utilize the land in and around the Reserve for livestock fodder, forage, and shelter. Based on intimate knowledge of the landscape and the resources available at any given time, herders move livestock through the landscape to take advantage of seasonal resources. These forests are also home to a rich biota including lemurs, birds, and reptiles. I began a study of two livestock herds to 1) document spatio-temporal patterns of livestock movements in reserve forest; 2) identify frequently utilized paths and resources; and 3) identify areas where animals spent long periods of time. The goal was to document pastoralist's use of the forests and to identify potential factors driving this use. Monthly maps of livestock movements were created in R using the T-LoCoH (Time Local Convex Hull) package. Movement of each herd varies by seasonal availability of crop residues, grasses, water, and forest resources, with both herds rotating through forest areas, although not necessarily in the same seasons. GPS monitoring over 7 years detected shifts in livestock movements during 2013, a period of intense cattle rustling activity driven by actors from outside the region. Livestock movement can help reduce impacts on forest environments by spacing impacts across time and space. However, when rustlers are present (especially armed rustlers), herders reduce the distance they travel from their corrals thereby increasing tree coppicing and livestock browsing activity in nearby forests.

Presenter: Ayon, Abel G

Title: The effect of bird diversity on human psychological wellbeing on the neighborhoods of Charlotte Metropolitan Area

Authors: Abel G Ayon (UNCC);Sara Gagne (UNCC);

Session: Poster

Abstract: The purpose of this research project is understand the interactive relationship between biodiversity and human well-being in low-income and high-income neighborhoods of Charlotte, North Carolina on its metropolitan area. This project is developed through a empirical research of social and ecological dimensions to comprehend the influence of biodiversity on human well well-being in nine neighborhoods of Mecklenburgh county, NC with low income and high income characteristics. To complete part of our research objectives, we will use avian diversity and psychological wellbeing as indicators of biodiversity and human well-being. The interaction between nature the people of neighborhoods it will measure using demographic variables and two different human subject survey Attentional Function Index and Visual stress Analogue. For the avian diversity we will quantify bird community structure using

around 252 raster points and conducted through a bird survey at each site during the spring of 2015 the methods will conform to the North American Breeding Bird Survey. This study expected a potential social and environmental outcome, where its main goal is understand and analyze the dimensions of human well-being and bird diversity in the Mecklenburg County.

Presenter: Baldwin, Robert F

Title: East-west linkages need on the ground action in human-dominated mountain regions

Authors: Robert F Baldwin (Clemson University);Paul B Leonard (Clemson University);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: Linkages that traverse mountain and valley systems connecting linear strips of montane habitat are particularly valuable, especially in long-settled landscapes. The Central and Southern Appalachians of the Eastern United States have had human occupation in valleys for millennia, and now are densely populated, used for agriculture, and criss-crossed with roads of every size. Using a circuit theory algorithm optimized for supercomputing, we mapped potential gene flow for the Black Bear, in the 15-state region making up the Appalachian LCC. We used connectivity to build internally integral cores at region and local scales, and also used connectivity to find linkages among those cores. We mapped linkages at two spatial scales serving two linkage functions: 3 regional linkages and 4 east-west/ridge-valley linkages. One ridge-valley linkage in particular stood out as it did not, unlike the others, follow a riparian trajectory. The Cumberland-Interior Low Plateau linkage provides a case for a strong, on the ground effort, influenced by social factors. Poverty rates in this region are high and represent opportunity to solve social problems through conservation investment. We strongly recommend for conservation action such mapped areas of high connectivity that traverse human-dominated parts of the matrix, and do so without the benefit of already-protected watershed areas as is likely along southern riparian systems.

Presenter: Baldwin, Robert F

Title: Prerequisites of conservation design: understanding the past drivers of spatial distribution of conservation lands

Authors: Robert F Baldwin (Clemson University);Paul B Leonard (Clemson University);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: The problem in conservation that landscape-scale planning seeks to solve, is that the current distribution of conservation lands is inadequate both in coverage and spatial representation of biodiversity pattern and process, including change. Protected areas are known to be “high and far”, and poorly represent centers of diversity. In the Appalachians of the United States we found public land distribution to follow the global trend, and conservation easements (N=4813) to follow different, even opposite rules. Compared to random locations, easements were more likely to be found in lower elevation in areas of greater agricultural productivity, farther from public protected areas, and nearer human features. NGOs were more likely to have easements nearer protected areas, and of higher conservation status, while local governments held easements closer to settlement, and on lands of greater agricultural potential. Logistic interactions revealed environmental variables having effects modified by social correlates, and the strongest predictors overall were social (distance to urban area, median household income, housing density, distance to land trust office). In the Appalachians, public lands were established during the last century to heal historical land abuses. Today, people are investing conservation dollars in what is near, what they know and love. Knowing more about this can help us turn conservation design into action.

Presenter: Baltensperger, Andrew P

Title: An ecological niche model for Alaskan marten (Martes americana): Using interactions among prey, landscapes, and climate to inform machine-learning predictions

Authors: Andrew P Baltensperger (Gates of the Arctic National Park);Grant RW Humphries (Stony Brook University);Falk Huettmann (University of Alaska Fairbanks);

Session: Machine Learning and Data Mining Applications in Land- and Seascape Ecology: What it is, Why it matters, and Where the Progress Still Sits

Abstract: Climate change is acting to reallocate biomes and shift the distribution of species in Alaska, where many animals exist near their thermodynamic limits. Machine-learning-based niche models that account for landscape characteristics and changes in climate have been effective tools for mapping shifts in wildlife distributions over time. Bioclimatic models have often been criticized for failing to include interspecific interactions and adaptive capacity into predictions of species distributions. Here we address the first of these shortcomings by including the previously-modeled distributions of 18 species of small mammal prey in addition to 33 environmental predictors to develop a statewide distribution model for American marten (Martes americana) in Alaska. We used a set of public, online, occurrence records as training

data in RandomForests to create a niche envelop model for marten in 2015. We also used IPCC (Intergovernmental Panel on Climate Change) A2 scenario climate forecasts and future small mammal distributions to predict marten distribution in 2100. Temporal models were contrasted in order to identify regions of marten distribution expansion and contraction over the coming century. Additionally, we explored the magnitude and importance of variable interactions in determining final model outcomes and performance. Incorporating the interactive influence of prey and environmental variables in order to improve distribution change projections should aid wildlife and land managers in developing adaptive strategies for conserving dispersal corridors, biodiversity, and ecosystem function into the future.

Presenter: Bartuszevige, Anne M

Title: Using landscape design and human dimensions to inform strategic playa wetland conservation

Authors: Anne M Bartuszevige (Playa Lakes Joint Venture);Alex Daniels (Playa Lakes Joint Venture);Kyle Taylor (Playa Lakes Joint Venture);Michael Carter (Playa Lakes Joint Venture);

Session: Conservation Biology II

Abstract: Landscape design has been described as the third pillar of landscape ecology - after understanding pattern and process, we can design a landscape that meets conservation goals while working within the parameters set by the patterns and processes. The Playa Lakes Joint Venture is using landscape design to determine playa wetland conservation needs to meet continental waterfowl management goals established in the North American Waterfowl Management Plan (NAWMP). We worked with partners to hypothesize drivers most likely to influence the future landscape. We used GIS to project potential futures and impacts to wetlands. Then, using Human Dimensions research, we developed a comprehensive conservation plan that includes conservation opportunities and communications strategies for delivering conservation. We estimate that if the landscape were to remain the same as it is today, we are 50% towards our goal of supporting waterfowl management goals set forth in the NAWMP. However, we project that with current rates of wetland loss due to accumulated sediments and energy development, we will lose 20-30% of our ability to meet NAWMP goals, thus; our conservation plans need to include maintaining the current wetland landscape and gaining additional wetlands. Human dimensions research helps us direct conservation messages that will resonate with landowners and drive playa wetland conservation relative to competing economic demands. We will demonstrate how landscape-scale models and social science can be combined to create forward thinking landscape design plans.

Presenter: Bauder, Javan M

Title: Drawing lines in the landscape: Illustrating the challenges of assessing broad-scale habitat associations with radio telemetry data using a federally threatened snake species

Authors: Javan M Bauder (University of Massachusetts);David R Breininger (Kennedy Space Center);M Rebecca Bolt (Kennedy Space Center);Michael L Legare (Merritt Island National Wildlife Refuge);Christopher L Jenkins (The Orianne Society);Betsie B. Rothermel (Archbold Biological Station);Kevin McGarigal (University of Massachusetts);

Session: Wildlife I

Abstract: Radio telemetry data are often used to describe population-wide or region-wide patterns of habitat selection (i.e., Johnson's [1980] Level II) yet using such data for these purposes imposes several methodological challenges. These challenges may be exacerbated with data from rare or endangered species which are often obtained opportunistically in a clustered manner. We created a region-wide resource selection function (RSF) for the federally threatened Eastern Indigo Snake (Drymarchon couperi) in peninsular Florida and use this study to illustrate some of these challenges and to examine potential solutions. Specifically, we discuss how: 1) the scale at which habitat variables were measured and 2) local idiosyncrasies in the landscape affected our results and inferences. We used radio telemetry data from 80 snakes from four separate study sites and measured land cover densities at a range of spatial scales using a moving Gaussian kernel (standard deviations = 15–3,000 m). We defined habitat availability using a buffer around every telemetry point based on observed home range sizes. Habitat associations were strongly scale dependent and were strongest primarily at intermediate-to-large scales (e.g., SD = 300-2,500 m). Moreover, both the scale and the direction of selection varied among and within our study sites. Specifically, a subset of snakes found in urban landscapes unexpectedly showed strong positive selection for high urban densities while snakes from the less developed study areas typically showed selection for low urban densities. Our study highlights some of the concerns that must be addressed when using presence-only data to model habitat associations.

Presenter: Bauder, Javan M

Title: Multi-level, multi-scale habitat selection by the federally threatened Eastern Indigo Snake (Drymarchon couperi) in peninsular Florida

Authors: Javan M Bauder (University of Massachusetts);David R Breininger (Kennedy Space Center);M Rebecca Bolt (Kennedy Space Center);Michael L Legare (Merritt Island National

Wildlife Refuge);Christopher L Jenkins (The Orianne Society);Betsie B. Rothermel (Archbold Biological Station);Kevin McGarigal (University of Massachusetts);

Session: Wildlife I

Abstract: Anthropogenic landscape changes often have negative impacts on mobile, wide-ranging species. The Eastern Indigo Snake (Drymarchon couperi) has some of the largest home ranges reported among snakes. This species is federally threatened, primarily due to habitat loss and fragmentation, yet its habitat needs are poorly described. We examined multi-level, multi-scale habitat selection of Eastern Indigo Snakes in peninsular Florida using radio telemetry data collected from 80 individuals across four study sites. We measured land cover densities at a range of spatial scales using a moving Gaussian kernel across a range of kernel sizes (standard deviations = 15–3,000 m). We fit resource selection functions at the level of the study area across all individuals, and at the level of the home range and movement step separately by sex and season (breeding and non-breeding). Patterns of selection varied strongly across levels and spatial scales: selection was strongest at intermediate-to-broad scales at the study area level, and at the finest scales at the home range and movement step levels. Within our study areas, snakes selected increasing upland densities and intermediate wetland and wetland edge densities, yet showed neutral use of urban cover. At the home range and movement step levels, all groups selected intermediate densities of wetland edges, increasing upland densities, and decreasing urban densities. Responses to roads and urban edge varied across levels, sexes, and seasons. Our study suggests that large mosaics of natural habitats combined with low urban densities are important habitat requirements for Eastern Indigo Snakes in peninsular Florida.

Presenter: Baumes, Harry

Title: USDA and a sustainable bioeconomy

Authors: Harry Baumes (US Department of Energy);Todd Campbell* (US Department of Energy);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: This presentation will focus on USDA programs and policies that support the development of a sustainable bioeconomy – of which bioenergy is a key component. Agricultural and forestry resources are significant resources that will contribute to future economic growth in this country, yet at the same time there are many challenges and barriers to overcome to realize that potential. Sustainable biomass production varies across this country's unique spatial regions. Programs in place to support the bioeconomy include, for example, BCAP, BIP, CRP, and others. Specific examples of the barriers encountered – e.g.,

issues that limit adoption of practices designed to improve yields, nutrient management, and simultaneously produce biomass for potential use for bioenergy – will be discussed. Strategies to overcome the barriers and opportunities will also be discussed.

Presenter: Beck, Scott M

Title: The ecosystem service potential of urbanizing South Africa: An urban ecological approach

Authors: Scott M Beck (North Carolina State Unviersity);David N Bunn (University of the Witwatersrand);Mary L Cadenasso (University of California - Davis);Dan Childers (Arizona State University);Coleen Cluett (The Organization of Tropical Studies);Liesel Ebersohn (University of Pretoria);Ross K Meentemeyer (NCSU);Steward TA Pickett (Cary Institute for Ecosystem Studies);Rivers III (NCSU);Louis Swemmer (SANParks);Wayne Twine (University of the Witwatersrand);Melissa R McHale (NCSU);

Session: Poster

Abstract: Urbanization is arguably now the largest threat facing the Kruger National Park. Moreover, urbanization processes in neighboring local municipalities like Bushbuckridge (Mpumalanga Province), are the focus of increased debate about how to manage communal resources shared by people, wildlife, and the surrounding game reserves. In response to these and other pressures associated with global change, the Southern African Millennium Ecosystem Assessment has prioritized sustaining ecosystem services through more proactive conservation management practices. On the ground, these initiatives are most often operationalized using geospatial tools that map ecosystem service potential at regional to national scales for local planning decisions. This approach neglects developed areas and is problematic for several reasons. First, mapping is done at coarse spatial resolutions that cannot account for fine-scale urban heterogeneity. This means that the most tangible ecosystem services within the human matrix are overlooked. Additionally, ecosystem services are mapped according to bureaucratically defined land-uses that are not representative of ecosystem patterns, or community values. To address these contradictions and oversights, we present a more refined appraisal of ecosystem services in the Bushbuckridge Local Municipality. In this assessment, we leverage common urban ecological tools and methods like social walking-interviews, high-resolution remote sensing land-cover classifications, and spatial analytics to quantify community-scale ecosystem service potential in the region. We then provide direct comparisons to existing ecosystem service planning tools to demonstrate scale and methodological misalignments. Our results suggest that developed areas provide significant ecosystem services to communities and highlight the need for a paradigm shift in ecosystem service based conservation planning.

Presenter: Belote, R. Travis

Title: A national connected network of large protected areas: identification, challenges, and applications

Authors: Matthew S Dietz (The Wilderness Society);Brad H McRae (The Nature Conservancy);G Hugh Irwin (The Wilderness Society);Peter S McKinley (The Wilderness Society);Meredith McClure (Center for Large Landscape Conservation);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: A connected network of protected areas is needed to prevent ecosystems and populations from becoming isolated. Keeping protected areas connected in a network may be an especially important conservation priority in the era of rapid climate change. Models that identify structural linkages between core areas have increasingly been used to prioritize important corridors for maintaining functional connectivity. Here, we used a least-cost corridor modeling framework to identify the most “natural” corridors between large protected areas in the contiguous Unites States. We identified large protected areas primarily using the Protected Areas Database (PAD). We focused on modeling corridors between areas with the highest levels of protection (e.g., GAP 1 and 2 lands > 4047 ha and all wilderness areas regardless of size). The most natural corridors between protected areas were identified using resistance surfaces based on mapped indices of wildness and human modification. To determine corridors robust to model assumptions, we used four differently-scaled resistance surfaces in order to calculate a mean and variability among corridor values from each model output. We evaluated the connectivity priorities for lands within the PAD, but not included in our pool of core protected areas. Corridor values varied substantially across the US, with western states having more protected areas, higher degrees of naturalness, and lower cost corridor values. We identified unprotected lands important for maintaining a national network of large protected areas. We discuss our results in the context of future challenges associated with identifying and maintaining a large connected network of protected areas.

Presenter: Betts, Matthew G

Title: Pollinator recognition by a tropical plant facilitates long-distance gene transfer

Authors: Matthew G Betts (Oregon State University);

Session: The Landscape Ecology of Pollination Mutualisms

Abstract:

Presenter: Betts, Matthew G

Title: Pollination in a landscape context

Authors: Matthew G Betts (Oregon State University);Adam S Hadley (University of Toronto);

Session: The Landscape Ecology of Pollination Mutualisms

Abstract: Animal-mediated pollination is essential for both ecosystem services and conservation of global biodiversity, but a growing body of work reveals that it is negatively affected by anthropogenic disturbance. We provide a synthesis of the current landscape, behavioural, and pollination ecology literature in order to present preliminary multiple working hypotheses explaining how these two landscape processes might independently influence pollination dynamics. Landscape disturbance primarily influences three components of pollination interactions: pollinator density, movement, and plant demography. We argue that effects of habitat loss on each of these components are likely to differ substantially from the effects of fragmentation, which is likely to be more complex and may influence each pollination component in contrasting ways. The interdependency between plants and animals inherent to pollination systems also has the possibility to drive cumulative effects of fragmentation, initiating negative feedback loops between animals and the plants they pollinate. Alternatively, due to their asymmetrical structure, pollination networks may be relatively robust to fragmentation. Despite the potential importance of independent effects of habitat fragmentation, its effects on pollination remain largely untested. We postulate that variation across studies in the effects of 'fragmentation' owes much to artifacts of the sampling regimes adopted, particularly (1) not separating fragmentation from habitat loss, and (2) mismatches in spatial scale between landscapes studied and the ecological processes of interest. The field of landscape pollination ecology could be greatly advanced through the consideration and quantification of the matrix, landscape functional connectivity, and pollinator movement behavior in response to these elements. Studies that combine behavioral and landscape ecology are essential for gaining insight into landscape-mediated pollination declines, implementing effective conservation measures, and optimizing ecosystem services in complex landscapes.

Presenter: Bhotika, Smriti S

Title: Landscape simulation modeling of forest ecosystems: Effects of plot-level data representation on model performance

Authors: Smriti S Bhotika (USDA Forest Service);Christie M Stegall (USDA Forest Service);E Louise Loudermilk (USDA Forest Service);

Session: LANDIS Modeling

Abstract: Landscape simulation models are a valuable tool for projecting long-term impacts of disturbances, management, and climate on forest succession and ecosystem dynamics. The models process information from individual site measurements (i.e., plot level) to represent the conditions and processes in a larger area (e.g., forest level). This is typically achieved, in part, by assuming homogeneity at multiple organizational levels (e.g., sites, management units, disturbance areas) within the model. Sufficiently capturing the range of heterogeneity and disturbances across the region can be influenced by the sampling intensity and spatial distribution of plots. This study explores how plot-to-landscape level assumptions of data representation can affect model outputs. In this analysis, we implement the model Landscape Disturbance and Succession II (LANDIS-II). Our study area is the Joseph W. Jones Ecological Research Center at Ichauway, an 11,000 ha area of predominantly longleaf pine forests with some mixed pine and hardwood forests in southwest Georgia. We vary the number, distribution, and size of plot-level data inputs and evaluate if and how much it affects model outputs such as species dynamics and carbon flux. These results provide information about the model assumptions on representing plot-level data and how robust the model is to violations of these assumptions.

Presenter: Bisbing, Sarah M

Title: Microclimate drivers of decline and forest compositional shifts in yellow-cedar forests of southeast Alaska

Authors: Sarah M Bisbing (California Polytechnic State University);Brian J Buma (University of Alaska -Southeast);John P Krapek (University of Alaska -Fairbanks);

Session: Forests, Weather and Climate

Abstract: Climate-induced forest dieback has been documented as a recent widespread phenomenon, with mortality having profound impacts on ecosystem services and forest dynamics. In southeast Alaska, yellow-cedar (Calliptropsis nootkatensis) mortality has been

linked to a complex pathway of interactions related to climate change, and there is concern that predicted changes in climate will lead to loss of this endemic species. Understanding mechanisms of decline has been a research priority, but little is known about patterns of regeneration and survival. We installed permanent plots in an area of high mortality to track post-decline forest composition and structure. Our main objectives were to identify patterns of yellow cedar morality and regeneration as a function of the local environment and to examine changes in community composition. We observed higher levels of yellow cedar mortality on low productivity wetland sites than on higher productivity upland forests. Mortality on upland sites was constrained to mature trees but extended across all tree size classes on wetland sites. Across all sites, hemlock (Tsuga spp.) seedlings and saplings were more abundant than those of yellow cedar, with the significance of this effect magnified on high productivity sites, suggesting a type conversion to hemlock dominated forests. Yellow cedar mortality, crown retention, and snag class were spatially correlated, and local microsite, topographic position, and site productivity status were significant drivers of tree status. These results suggest that local site and landscape factors strongly influence the probability of decline and determine the long-term dynamics of these forests.

Presenter: Blaszczak, Joanna R

Title: Disentangling the landscape drivers behind urban stream degradation

Authors: Joanna R Blaszczak (Duke University);Joseph Delesantro (Duke University);Dean L Urban (Duke University);Emily S Bernhardt (Duke University);

Session: Urban III

Abstract: As low lying points in landscapes, streams are particularly hard hit by watershed urbanization due to well-documented increases in contaminant loading and heightened stormwater runoff that accompany impervious surface cover (ISC). While increases in the aggregate measure of percent watershed impervious surface cover are linked to stream degradation, there is considerable variability in both the spatial configuration of urban development and stream response at low development intensities. Common measures of urban connectivity and configuration are correlated with the amount of impervious surface cover making it difficult to discern what aspects of urbanization can explain the variability in stream response. In order to separate the effects of development intensity from pattern we selected 25 watersheds within a narrow range of development intensity (7-20% ISC) which also spanned the widest possible range in spatial configuration and connectivity metrics in the Piedmont Triangle, NC. We monitored the water level and chemistry at the pour point of the watersheds from October 2013-October 2015 and observed strong relationships between surface connectivity (road density) and hydrologic flashiness ($R2=0.66$, $p<0.05$). Chemical flashiness

(coefficient of variation of specific conductivity) was also strongly positively correlated with surface connectivity ($R2=0.48$, $p<0.05$), suggesting that contaminant loading increases with development connectivity to the stream. While the aggregation index (AI) of developed patches did not predict the stream response variables, increasing forest patch AI predicted lower hydrologic and chemical variability in streams ($R2=0.55$, $R2=0.42$, respectively). This analysis is an important step towards disentangling the multivariate and correlated drivers behind urban stream degradation.

Presenter: Bliss, Laura M

Title: Habitat availability assessment for the Gulf Coast kangaroo rat (Dipodomys compactus) in south-central Texas

Authors: Laura M Bliss (Texas State University);Joseph A Veech (Texas State University);

Session: Wildlife I

Abstract: As the human population increases worldwide, urbanization, habitat destruction, and habitat modification also increase. Recently the urbanization rate in central Texas has become one of the highest in the nation. The consequential loss of natural habitat could jeopardize native wildlife species that are already somewhat limited in their distribution. Based on specialized life-history traits that limit large-scale mobility, kangaroo rats (Dipodomys spp.) have been found to be especially sensitive to urbanization-induced habitat modification and fragmentation. Dipodomys compactus is one of five kangaroo rat species found in Texas, this species has narrow, specific habitat requirements. The objectives of this study were to: 1. Assess D. compactus suitable habitat availability and its spatial distribution. 2. Identify the areas that may be most appropriate to protect and manage. 3. Determine habitat patch quantity and connectivity necessary to support a viable population. 4. Evaluate impacts of human disturbance via spatially referenced traffic volume analysis. Using a geographic information system (GIS)-based habitat suitability model, I determined that due to isolation among suitable habitat patches, actual D. compactus range in south-central Texas is more fragmented than previously estimated. This assessment strategy can be broadly applied to other vulnerable species with similarly narrow habitat parameters in order to predict current and future management requirements.

Presenter: Boesing, Andrea L

Title: The role of matrix composition maintaining the taxonomic, functional, and phylogenetic diversity of birds in agricultural landscapes

Authors: Andrea L Boesing (University of São Paulo/University of Florida);Elizabeth Nichols (Swarthmore College);Jean P Metzger (University of São Paulo);

Session: Conservation Biology II

Abstract: Mounting evidence demonstrates that biodiversity declines non-linearly with reductions in native habitat cover. Threshold dynamics in diversity-habitat cover relationships are understood to be a function of landscape structure effects on landscape connectivity (ultimately determining species extinction rates). Matrix composition is expected to further influence these threshold dynamics, as it may strongly alter overall landscape connectivity. In addition, evidence suggests different measures of biological diversity may vary in their sensitivity to habitat loss. To test these related ideas, we evaluated how taxonomic (TD), functional (FD), and phylogenetic diversity (PD) of birds responds to native habitat loss along two forest-cover gradients (10-50%) located in distinct agricultural matrix contexts: low permeability (cattle pastures, n = 13) and higher permeability (coffee plantations, n = 10) in the Brazilian Atlantic Rainforest. We quantified avian biodiversity through point counts in four sites within each landscape, and explored the threshold dynamics of TD, FD, and PD for two forest-specialists and habitat-generalists. We quantified biodiversity metrics as a function of forest cover, matrix type, and their two-way interaction through GLMMs. For forest-specialists we found that TD was most strongly affected by native forest cover, while FD and PD were most strongly affected by the interaction between forest cover and matrix composition. For habitat-generalists, we found that the inclusion of either matrix composition or forest cover did not improve upon a null model for any measure of biodiversity. We discuss the implications of these results for our growing understanding of the drivers that structure and maintain biological communities in human-modified landscapes.

Presenter: Boisjolie, Brett A

Title: Policy Patterns in River Networks: Riparian Management in the Oregon Coast Range

Authors: Brett A Boisjolie (Oregon State University);Rebecca L Flitcroft (US Forest Service);Mary V Santelmann (Oregon State University);Sally L Duncan (Oregon State University);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: Environmental policies are ideas about natural systems projected onto a human defined landscape. A culmination of social, economic, and scientific factors, environmental policies result in baseline management requirements intended to affect ecological systems. In the case of riparian management policies in the Oregon coast range, requirements are based on human land uses (as mediated through site-specific environmental characteristics) rather than on ecologically defined criteria (such as the distribution patterns of specific species). This disconnect between human political structures and ecosystem-scale needs may result in gaps in the application of protective measures at broad spatial scales. For example, riparian buffers are intended to preserve cold water habitat for aquatic species, however, protections may not align with areas of concern. This is problematic in landscape-scale management of threatened anadromous fish species such as coho salmon (Oncorhynchus kisutch). The goal of this study is to explore the placement of riparian buffer policies with their intended goal of promoting cold water habitat for threatened coho salmon populations across the 84 HUC 10 watersheds the Oregon Coast Range. A geographic information system was created to map the spatial distribution of riparian management policies across river networks in the Oregon Coastal Coho Evolutionary Significant Unit (ESU) using the Oregon Department of Forestry stream layer. This stream layer provides the foundation for applied policy in the Oregon Coast Range, but was cobbled together from existing stream linework, resulting in varying stream densities across the region. A consistently derived stream layer (from NetMAP) was also attributed with riparian policies in order to evaluate the patterns of protection for coho salmon at a riverscape scale. Models of intrinsic potential for coho salmon habitat were used to identify river reaches with the capacity to support high quality habitat. Gaps in policy protection within stream reaches of high intrinsic potential were compared across the watershed and cataloging unit scales. Results indicate that gaps in riparian protection of high intrinsic potential are ubiquitous across watersheds in the Oregon Coast Range. Further, watersheds vary in the distribution of gaps in protective measures.

Presenter: Boucher, Adrienne F

Title: Effects of the urban heat island on Anurans in remnant and stormwater control ponds in the Charlotte metropolitan region

Authors: Adrienne F Boucher (University of North Carolina at Charlotte);Matthew D Eastin (University of North Carolina at Charlotte);Sara A Gagné (University of North Carolina at Charlotte);

Session: Amphibians in a changing landscape

Abstract: The urban heat island (UHI) has been documented to increase urban air temperatures compared to rural areas, but little is known about the effects of UHI-induced meteorology on

anuran breeding and diversity. Our research objective is to understand how the meteorology associated with a UHI affect the breeding activity and diversity of anurans. We selected 66 ponds in the Charlotte Metropolitan Region, in landscapes that varied in impervious surface cover, a correlate of air temperature, and precipitation amount. Twelve evening call surveys at each pond occurred between February-June 2014 and March-June 2015, assessing anuran breeding activity. We quantified meteorological conditions at ponds using data loggers at pond edges, recording air temperature and relative humidity for both breeding seasons and using monthly average rainfall for each landscape. Accounting for variation in local habitat quality and landscape composition, in 2014 and 2015 we measured pond descriptors and vegetation in and around each pond and measured the proportions of landscapes covered by forest, wetlands, agricultural, and impervious surfaces. Landscape variables were quantified for circular areas within 0.5-20 km of ponds. Occupancy analysis and generalized linear modeling will be used to assess the effects of meteorological variables on occupancy and detectability of individual anuran species and on anuran species richness. Preliminary results indicate that anuran species richness is negatively influenced by the minimum temperature range and positively influenced by relative humidity range at ponds. This outcome of this research will inform urban planning to promote the conservation of anuran species in an urban area.

Presenter: Brandes, Elke

Title: Subfield profitability analysis reveals an economic case to increase biodiversity

Authors: Elke Brandes (Iowa State University);Gabriel S McNunn (Iowa State University, AgSolver, Inc.);Lisa A Schulte (Iowa State University);Ian J Bonner (Monsanto);David J Muth (AgSolver, Inc.);Bruce A Babcock (Iowa State University);Bhavna Sharma (Iowa State University);Emily A Heaton (Iowa State University);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: Public and private entities increasingly desire to enhance biodiversity in agroecosystems, but are limited by perceived conflicts between economic and ecologic goals and a lack of tools enabling effective operational management. We use Iowa – an agriculturally homogeneous state representative of the Maize Belt – to demonstrate an economic rationale for cropland diversification with reconstructed prairie at the subfield scale. We used a novel computational framework that integrates disparate, publically available data to map ~3.3 million unique potential management polygons (9.3 Mha) and reveal subfield opportunities to increase overall field profitability. We analyzed subfield profitability for maize/soybean fields during 2010-2013 – four of the most profitable years in recent history – and projected results for 2015. While cropland operating at a loss of ≥ US$ 250 ha-1 was negligible between 2010 and 2013 (<2% of row-crop land), the extent of highly unprofitable land increased to 2.5 Mha (27%

of row-crop land) in 2015. Aggregation of these areas by township revealed 'hotspots' for potential management change in western, central, and northeast Iowa. In these regions, incorporating a low-cost and government supported conservation management such as prairie reconstruction into low-yielding portions of fields could increase overall cropland profitability, while providing habitat for pollinators and other species of varying vagility. We reveal best management practices of prairie integration for optimal economic and ecologic outcomes. This approach is applicable to the broader region and differs substantially from the status quo of 'top-down' land management for conservation by harnessing private interest to align profitability with the enhancement of biodiversity.

Presenter: Breckheimer, Ian K

Title: Climate drives fragmentation of montane meadow ecosystems via phenological mismatch

Authors: Ian K Breckheimer (Department of Biology, University of Washington);Elli J Theobald (Department of Biology, University of Washington);Anna K Wilson (Entomology Department, Cornell University);Janneke HilleRisLambers (Department of Biology, University of Washington);

Session: Landscape Dynamics II

Abstract: Landscape phenology, the spatial distribution of the timing of biological events like leafing and flowering, has strong influences on the demography and population structure of interacting organisms. This is especially true for non-mobile groups such as plants in environments where the cues that trigger phenological events vary across small spatial scales. In these systems, mismatches in phenology between adjacent patches of habitat driven by fine-grain environmental variation could potentially exacerbate the negative impacts of climate change on vulnerable populations by reducing effective population sizes. Here, we use high resolution (3m) estimates of snow duration and its strong relationship with plant phenology to examine how annual variation in climate drives changes in connectivity for animal-pollinated plant populations across a large network of alpine and subalpine meadows in Mt. Rainier National Park, Washington, USA. Our results indicate that in years with early snow melt, overall predicted pollen dispersal across the network of meadows decreased by 5-10%, driven by increasing heterogeneity in snow disappearance dates between nearby meadows. We also show that early snow melt's negative effects on connectivity are enhanced for species with short flowering periods, and in small meadows that are relatively poorly connected by dispersal. Our study is the first to demonstrate direct climatic effects on the connectivity of plant populations, but our results likely apply to many montane systems where climate change is driving upward movement of the rain/snow transition zone, generating increasing differences in snowpack and snow duration between the high-elevation and low-elevation boundaries of montane ecosystems.

Presenter: Briske, David D

Title: Resilience and resilience-based management derived from analysis of multiple long-term vegetation records in the western US

Authors: David D Briske (Texas A&M University);

Session: Climate change and landscape sustainability of global drylands

Abstract: Resilience is a widely accepted theory explaining landscape vegetation dynamics, but empirical evidence supporting its interpretation is limited. We located and analyzed long-term vegetation records from diverse ecosystems throughout the western U.S. to address this knowledge gap. Species composition of permanent plots was initially assigned to a specific community on the basis of species similarity and temporal transitions to other communities were analyzed with univariate and multivariate statistical procedures to document the magnitude, frequency and reversibility of community transitions through time. Vegetation trajectories conformed to resilience theory by displaying frequent community transitions of varying species dissimilarity that were both reversible and non-reversible over various time periods. Grassland records showed frequent community transitions characterized by large species dissimilarity, but only one non-reversible transition was identified as a potential ecological threshold. Grassland dynamics displayed both resilience in the form of frequent, but readily reversible community transitions among subordinate species, and resistance based on the persistence of a few dominant bunchgrass species. The single instance of a non-reversible community transition was associated with the drought induced mortality of a dominant bunchgrass in a desert grassland during the 1950's drought. Invasion of an exotic annual grass in sagebrush steppe was also associated with threshold conditions where cheatgrass (Bromus tectorum) had attained the highest density and greatest irreversible replacement of native species, including a decrease in sagebrush density. Empirical evidence derived from long-term vegetation records is of great value to the assessment of resilience theory and to development of resilience-based management procedures.

Presenter: Brooke, Michael

Title: Texas Disasters II: Utilizing NASA Earth observations to assist the Texas Forest Service in mapping and analyzing fuel loads and phenology in Texas grasslands

Authors: Michael Brooke (NASA DEVELOP National Program);Meredith N Williams (NASA DEVELOP National Program);Teresa E Fenn (NASA DEVELOP National Program);Joseph P Spruce (NASA DEVELOP National Program);Kenton Ross (NASA DEVELOP National Program);

Session: Landscape Dynamics II

Abstract: The risk of severe wildfires in Texas has been related to weather phenomena such as climate change and recent urban expansion into wild land areas. During recent years, Texas' wild land areas have experienced sequences of wet and dry years that have contributed to increased wildfire risk and frequency. To prevent and contain wildfires, the Texas Forest Service (TFS) is tasked with evaluating and reducing potential fire risk to better manage and distribute resources. This task is made more difficult due to the vast and varied landscape of Texas. The TFS assesses fire risk by understanding vegetative fuel types and fuel loads. To better assist the TFS, NASA Earth observations, including Landsat and Moderate Resolution Imaging Specrtoradiometer (MODIS) data, were analyzed to produce maps of vegetation type and specific vegetation phenology as it related to potential wildfire fuel loads. Fuel maps from 2010-2011 and 2014-2015 fire seasons, created by the Texas Disasters I project, were used and provided alternating, complementary map indicators of wildfire risk in Texas. The TFS will utilize the end products and capabilities to evaluate and better understand wildfire risk across Texas.

Presenter: Brooks, Bjorn-Gustaf J

Title: Phenological dynamics under global-change-type drought

Authors: Bjorn-Gustaf J Brooks (USDA Forest Service);Danny C Lee (USDA Forest Service);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Few factors more profoundly affect vegetation that the frequency, duration, and intensity of droughts. As global warming proceeds, changes in drought dynamics become more evident. Since the 1970s global aridity has increased considerably. Although dry spells lasting decades have occurred many times over the past millennium in North America, climate models project still further shifts toward drier conditions for many places over the 21st century. These droughts are typically triggered by natural, decadal scale cycles in sea surface temperature (such as La Niña), which themselves are susceptible to climate shifts. The stresses from climate extremes are readily apparent in forest and grassland vegetation, shaping the structure and composition of those ecosystems. Remote sensing offers an extensive view of changes in vegetation as revealed in changing phenological patterns. Differences in phenology are measurable at high precision through more than 140 million MODIS NDVI pixels across North

America, which we use to characterize vegetation change in response to both continental and local external drivers. Unraveling the importance of these different drivers from one place to another is challenging. Through a set of tools and measures developed from information theory we have examined the resultant patterns in present-day vegetation and investigated their relationship to historical droughts, as estimated from a data set of potential evapotranspiration covering more than a century. This presentation addresses what changes, if any, that climate extremes like drought have imposed on landscape phenological diversity. Further we address how frequency, duration and intensity may have contributed to observable vegetation phenology dynamics.

Presenter: Brown, Jesslyn F

Title: Exploring climate and phenology relationships in the western U.S.

Authors: Jesslyn F Brown (USGS);Lie Ji (Arctic Slope Regional Corp. InuTek);Alisa L Gallant (USGS);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Climate and weather influences the timing of spring phenology. The effect of temperature on initiating spring vegetation growth is well documented. Phenological models, such as the set of models called Spring Indices, estimate the start of spring using daily temperatures as a primary input. However, some studies have identified other climatic variables that influence spring phenological transitions, including preceding moisture in the form of either rain or snow. We explored additional drivers for spring phenology in the mountains of the western U.S. For example, in addition to late winter maximum temperature, snow moisture as measured by April 1 snow water equivalent (SWE), played a significant role in spring initiation. The strength of the snow influence varied geographically. Spring SWE was strongly correlated with spring in aspen woodlands across most of the Wasatch, Uinta, and Southern Rocky Mountains. Aspen spring phenology revealed a larger snow influence in areas adjacent to the arid Colorado Plateau and south of 40°N latitude. Further north in Wyoming, we found statistical evidence that drier and warmer late winter climate conditions advanced spring green-up, especially in the Greater Yellowstone and Southeastern Wyoming Ranges. The influence of spring moisture was especially important in higher elevation forests above 2100m. We did not find evidence that climate conditions influenced the speed of spring progression. The spatial variability in the relationship between winter moisture and spring green up shows that possible future winter droughts could shift the growing season in the forests of the Rocky Mountains earlier than temperature increases alone.

Presenter: Brubaker, Kristen M

Title: Using LiDAR to model vegetation structure and above-ground carbon storage in the critical zone

Authors: Kristen M Brubaker (Hobart and William Smith Colleges);Quincey Johnson (Hobart and William Smith Colleges);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: Understanding patterns of above-ground carbon storage across forest types is increasingly important as managers adapt to the threats of climate change. We compared the fine-scale above ground carbon storage in two watersheds; one watershed was underlain by sandstone bedrock and the other by shale. We sampled tree, shrub, and coarse woody debris across three topographic positions for both watersheds, and calculated the component of carbon stored in each. We then used leaf on and leaf off LiDAR to model carbon storage for each component across the watershed, using a combination of terrain and vegetation metrics from LiDAR. We found that there is an inverse relationship between tree carbon storage and shrub carbon storage across sites, and that LiDAR can be used to model these relationships across a broader, watershed scale. We also found differences in the tree carbon, shrub carbon, and CWD carbon ratios between bedrock types.

Presenter: Bukowski, Catherine J

Title: Human well-being, social cohesion and environmental benefits of community food forests in the U.S.

Authors: Catherine J Bukowski (Virginia Tech);John F Munsell (Virginia Tech);

Session: Urban I

Abstract: Community food forests (CFFs) are increasing in popularity across the United States. Food forests, also known as forest gardens, are edible perennial landscapes modeled after a young forest ecosystem. We define community food forests as forest gardens scaled to the community level, built with community input and generally open to the public for harvesting and recreation. Their use across landscapes in the US constitutes a new frontier where agriculture and forestry combine via the science and practice of agroforestry to produce food,

provide ecological services and contribute to community development. Projects typically start at the grassroots level and bring together a mix of stakeholders (community members, local government agencies, organizations and universities) to form partnerships, create a shared vision, acquire land, navigate policies, and establish the food forest. CFFs are participatory landscapes that engage citizens with their environment on multiple levels. Participating community members help shape their urban landscape, local food production, community interactions, environmental beenfits, healthy eating habits and urban agriculture and forestry policies. We are examining the social design and management processes of food forests in the United States to better understand the different forms of capital that support their establishment, maintenance and success. Project objectives are to provide one of the first generalizable studies of CFFs in the US and develop best practices at the outset of an emerging movement.

Presenter: Bulley, Henry N

Title: A landscape based assessment of the spatial relationship between land use change and water quality in the Catskill/Delaware watersheds

Authors: Henry N Bulley (BMCC, City University of New York);

Session: Watersheds and Hydrology

Abstract: Anthropogenic impacts on watershed ecosystems services, including water quality, is of primary concern especially in watersheds that serve major cities like New York City. This paper presents insights from a multi-scale assessments of landscape change in the Catskill/Delaware watersheds and their linkages with 3 ecosystem service (water quality) indicators, i.e. total nitrogen, total phosphorus, and suspended solids. The Catskill/Delaware watersheds constitute the larger of two water supply watersheds for New York City. The study was conducted in order to understand the implications of increased human activities, especially non-point agricultural and urban runoff, on the water ecosystem services derived from Catskill/Delaware watersheds. Landsat imagery were used to characterize land use and land cover in the watershed at 5 year intervals over a 15 year period from 1997. The outcome were then used to compute landscape metrics, that impact reservoir water quality, including proportion of land use, proportion of land use in riparian zones, proportion of land use near riparian zones, length of roads near streams, land use (mostly agriculture) on steep slopes, and percentage of open areas. These information were correlated to water quality parameters of total nitrogen, total phosphorus, and suspended solids. Preliminary results indicate gradual changes in the landscape metrics and this is reflected in the changes observed in the water quality. Understanding the relationship between the landscape change (spatial extent and

metrics) and trends in water is vital for effective watershed scale ecosystem approach to land use planning and water quality management in the Catskill/Delaware watersheds.

Presenter: Buma, Brian J

Title: How big is a complete (disturbance) landscape? The role of study extent on disturbance/area relationships across the North American continent

Authors: Brian J Buma (University of Alaska);Kurt Riitters (USFS);Jen Costanza (North Carolina State University);

Session: Landscape Dynamics I

Abstract: Scale is a fundamental aspect of ecological research, and picking the appropriate scale for analysis is critical. This can be difficult, especially for infrequent or spatially-extensive phenomena like forest disturbances, yet the scale of investigation plays a critical role in theoretical assumptions about stability, variance, and equilibrium. A fundamental understanding of disturbance processes in a given ecoregion is important for a variety of needs, such as conservation/reserve design or monitoring of shifts in disturbance frequency due to climate change; scales of investigation which minimize variance across the ecoregion are good candidates for monitoring of disturbance-sensitive ecosystem properties. In addition, determining scales which exhibit low variability in disturbance characteristics provides information necessary for assumptions regarding stability and/or variance for theory-based research. We present the results of a continent-wide, high resolution (30m) investigation into scale-disturbance relationships, stratified by WWF ecoregions. Specifically, we look at how changing the scale of investigation (from 0.01 to 180 km2) changes estimates of area disturbed and the shape of disturbances, as well as variance in those metrics. Results indicate that many ecoregions are not “stable” (in terms of percent disturbed or shape) even at broad investigation extents (180 km2), however a number are stable at small extents (<10 km2). Heavily managed ecoregions show a significant deviation from expected values, including reduced variance. The results, applicable to all areas in North America, give insight into the scale of disturbance as a function of investigation extent and provide important baseline information on how disturbances play out on the landscape.

Presenter: Butler, Patricia R

Title: Forest adaptation examples

Authors: Patricia R Butler (Michigan Technological University);Christopher Swanston (US Forest Service, Northern Research Station);Leslie Brandt (US Forest Service);Stephen Handler (US Forest Service, Northern Research Station);Maria Janowiak (US Forest Service, Northern Research Station);Danielle Shannon (Michigan Technological University);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: Land managers face the immense challenge of integrating the uncertainties of a changing climate into decisions that span large spatial and temporal scales. The Climate Change Response Framework is a collaborative, cross-boundary approach among scientists, managers, and landowners to incorporate climate change considerations into natural resource management across the Midwest and Northeast. The Framework delivers credible, relevant information to land managers and provides a process to apply that information at multiple scales through: (1) Partnerships that engage hundreds of land managers and scientists; (2) Vulnerability assessments for that synthesize projected changes in climate and impacts on forest ecosystems; (3) the Forest Adaptation Resources document which provides tools, including an adaptation workbook and menu of adaptation actions, to help integrate climate change information into planning and decisionmaking; and (4) Adaptation Demonstrations which provide real-world examples of how the resources described above have been used by land managers to integrate climate considerations into planning and activities. There are currently over 150 examples of forest adaptation across a variety of federal, state, tribal, and nongovernmental organizations each working toward unique goals and objectives. These examples provide tangible illustrations of adaptation, strengthen the community of practice, implement new ideas, and reinforce conceptual adaptation actions. This talk will highlight the main components of the Climate Change Response Framework, with a focus on adaptation demonstration projects.

Presenter: Buyantuev, Alexander B

Title: Satellite time-series analyses of dryland landscape change: A case of urbanizing Inner Mongolia in China

Authors: Alexander B Buyantuev (University at Albany, SUNY);Jianming Niu (Inner Mongolia University, Hohhot, China);Shiguo Jiang (University at Albany, SUNY);

Session: Climate change and landscape sustainability of global drylands

Abstract: From ecologic and sustainability perspectives quantification of land-cover changes and their ecological implications, especially those due to urbanization, is a fundamental challenge faced by ecologists engaged in understanding co-evolution of human societies and ecosystems. Our case study of three urbanizing landscapes in grasslands of Inner Mongolia used 20+-year time-series of Landsat imagery and employed the commonly used metric-based landscape pattern analysis applied to thematic maps (LULC classifications) and the trajectory-based analyses whereby annual images are evaluated to extract spectral trajectories of land surface. The second approach allows to capture short-duration events and smooth longer-term trends. This is important for drylands where highly variable land cover dynamics is driven by patterns of climate. It is therefore more suitable for tracking changes due to phenology or vegetation successions. Since the inception of economic reforms urban area here expanded by 20-30%, mostly at the expanse of villages, agriculture, wetlands, and grassland. These landscapes became more diverse and fragmented ecologically and more compact and simple geometrically. The results are generally in line with findings from other arid cities. The trajectory-based approach allowed us to map areas of change outside the immediate vicinity of cities. Those are mainly the result of deforestation/reforestation, coal mining, and transportation development. Of specific interest are soil erosion and dieback of planted trees. Our results can inform predictive models of land cover change, which is important since this inland region of China possess a great potential for growth, especially in connection to the 'Go West' policy initiated in the 1990s

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Presenter: Caldwell, Peter V

Title: Applications of the WaSSI ecosystem model for assessing global change impacts on water supply and carbon sequestration from the watershed to the continent

Authors: Peter V Caldwell (USDA Forest Service);Ge Sun (USDA Forest Service);Steve G McNulty (USDA Forest Service);

Session: Assessment II

Abstract: Forested watersheds provide many ecosystem services; principle among these are water supply and carbon sequestration. Water and carbon are inextricably linked, thus managing forests to benefit one ecosystem service will affect the other. Tools are needed at multiple scales that can evaluate the potential impact of climate and land use change on water resources and ecosystem productivity. The US Forest Service Southern Research Station has developed the Water Supply Stress Index (WaSSI) model that has the capacity to model seasonal dynamics of watershed hydrology and ecosystem carbon balances, and estimate water supply stress at a small watershed scale (12-digit Hydrologic Unit Code, HUC12) for the lower 48 states. The model was designed to capture the broad patterns of water yield and ecosystem

productivity at the regional to continental scale. In this paper, we will demonstrate the utility of the model in a few regional projects including the 'Forests to Faucets', 'Forest Future Projects', 'Wildland Fire and Water', and environmental flows.

Presenter: Cardille, Jeffrey A

Title: Planning for ecological connectivity in the Okanagan Valley, British Columbia

Authors: Jeffrey A Cardille (McGill University);Lael Parrott (The University of British Columbia);Catherine Kyle (The University of British Columbia);David Pelletier (McGill University);Valerie Hayot-Sasson (McGill University);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: In British Columbia's Okanagan Valley, conversion of natural habitats for human land use is a significant threat to its high biodiversity. At approximately 8000 km2, the Okanagan represents only 0.8% of British Columbia's land area, yet it contains over 30% of the red-listed species in the province and 46% of the blue-listed species. The Okanagan Valley is still mostly a naturally vegetated landscape, with over 50% of the area in patches of natural vegetation larger than 100 hectares. With high development pressure likely to continue into the foreseeable future, the regional questions center on deciding what to keep on the landscape to maintain ecological function and habitat connectivity as development occurs, while also restoring connectivity among fragments in developed areas. In this study we illustrate our contribution to practical planning in the Okanagan. We built on an existing regional biodiversity conservation strategy, which had assigned an estimated importance value for movement to each parcel. Using general criteria for movement of a generic species for demonstration, we estimated resistance values to movement, running Circuitscape and our omnidirectional connectivity approach to identify a potential movement surface across the study area. We then implemented our experimental "skeletonization" approach, which simplifies Circuitscape surfaces into a network of linear features using techniques borrowed from computer vision. The resulting connectivity web can be used—given the model's assumptions—for informing stakeholder discussions about what areas should be prioritized for maximizing the future connectivity of the rapidly growing Okanagan Valley.

Presenter: Carson, William O

Title: Acid deposition effects on yellow birch in the southern Appalachians

Authors: William O Carson (Equinox);

Session: Disturbance

Abstract: In the early 2000s, unusual numbers of dead trees of an unknown species were observed on Grandfather Mountain; ground surveying revealed large scale die-off of yellow birch (Betula alleghaniensis), a key component of high-elevation maple-beech-birch forests. A three-year study funded by the USFS Forest Health Monitoring Program (FHM) was initiated to determine the condition of yellow birch at high elevations within the Southern Appalachian Mountains. Over the course of four years, Equinox collected physical data at 48 plots in North Carolina and eastern Tennessee, including ecological health data, soils and duff samples, tree cores, and damage response. The resulting data showed that plots at the highest elevations received the highest concentrations of acid deposition, had the highest rate of mortality and lowest rates of regeneration, and increased decay to healing ratios.

Presenter: Cartwright, Jennifer M

Title: Islands of terrestrial biodiversity in a changing climate

Authors: Jennifer M Cartwright (U.S. Geological Survey);

Session: Biogeography

Abstract: Terrestrial insular ecosystems—such as rock outcrops, depression wetlands, high-elevation balds, flood-scoured riparian corridors, and insular prairies—occupy a small fraction of land area but constitute an important source of regional and global biodiversity, including concentrations of rare and endemic plant taxa. Maintenance of this biodiversity depends upon regimes of abiotic stress and disturbance, such as soil-surface temperature, extreme hydrologic conditions, fires, flood-scouring, and episodic droughts, all of which may be subject to alteration by climate change. Over several decades, numerous site-specific investigations have yielded important information on the floristics, physical environments, and ecological dynamics of these insular ecosystems, but this literature has generally remained fragmented. Regional and cross-system syntheses are needed to discern larger patterns in the drivers of plant biodiversity in these ecosystems, identify knowledge gaps, and lay the groundwork for climate-change vulnerability analysis. For eight categories of insular ecosystems of the southeastern United States, a synthetic literature review was completed to assess the state-of-the-science concerning (1) physical geography including geologic, topographic, edaphic, hydrologic, and geomorphic context; (2) ecological determinants of community structures including factors

regulating successional dynamics and spatial vegetation patterns; (3) contributions of the insular ecosystem to regional and global biodiversity; (4) historic and current anthropogenic threats as well as conservation approaches to mitigate these threats; and (5) key knowledge gaps relevant to conservation, particularly in terms of climate-change effects on biodiversity. From this synthesis, new conceptual models were developed to assess ecosystem-level exposure, sensitivity, and adaptive capacity to climate change and other anthropogenic influences.

Presenter: Castro-Prieto, Jessica H

Title: Declining population but increasing housing pressure surrounding natural protected areas in Puerto Rico

Authors: Jessica Castro-Prieto (Department of Environmental Sciences, University of Puerto Rico);Sebastian Martinuzzi (Department of Forest and Wildlife Ecology, University of Wisconsin);Maya Quiñones (Remote Sensing and GIS Laboratory, USDA Forest Service);Volker C Radeloff (Department of Forest and Wildlife Ecology, University of Wisconsin);William A Gould (International Institute of Tropical Forestry, USDA Forest Service);

Session: Urban III

Abstract: Urbanization, and denser human populations, in the vicinity of protected areas (PAs) is a major threat for PAs worldwide. Urbanization around PAs is of particular concern in tropical islands where urban impacts (e.g., habitat loss, invasive species) are likely elevated due to limited land area, steep environmental gradients, high biodiversity and endemism. However, while human populations are increasing on most tropical islands, then have declined in Puerto Rico over recent decades. Puerto Rico thus presents a unique natural experiment to assess the relationship between urbanization and human populations in lands adjacent to PAs. We calculated housing development and population change from 2000 to 2010 in Puerto Rico in order to better understand rates, patterns and drivers of urbanization around protected lands. We developed an scripts for allocating 2000 housing to 2010 blocks and adjust those blocks for the PA boundaries. We applied dissolved buffer zones at: .5-, 1-, 1.5- and 2-km outward PA boundaries, calculated the proportion of the population and housing within buffer zones, and summarized changes and densities within each buffer zone. We found that housing growth continued both island-wide and in the vicinity of PAs even though population decreased. A total of 63,889 new houses were constructed within 2-km from PA boundaries, but 44,460 fewer people lived there. Maximum rate of change occurred within 1-km (17%) for housing, and within .5-km (-6%) for population. Our study suggests that housing growth is an important threat to PAs in Puerto Rico, and potentially to PAs in other US islands.

Presenter: Cattau, Megan E

Title: Fire disturbance on the peat-swap landscape in Kalimantan, Indonesia: climate change, hydrological perturbation, and anthropogenic ignitions

Authors: Megan E Cattau (Columbia University);Mark E Harrison (University of Leicester);Maria Uriarte (Columbia University);Ruth S DeFries (Columbia University);

Session: Disturbance

Abstract: Fire disturbance in Southeast Asian tropical peat swamps has become more frequent and extensive in recent decades. These fires compromise a variety of ecosystem services, notably mitigating global climate change through carbon storage. We evaluate how human-driven and biophysical landscape changes affect fire disturbance in a peat-swamp landscape in Central Kalimantan, Indonesia. We use the MODIS Active Fire product from 2000-2010 with hierarchical Bayesian modeling to evaluate the relative contributions of climate, vegetation, hydrology, and human access to the probability of fire occurrence, and we use hierarchical clustering to evaluate the oft-asserted claim that oil palm concessions and smallholder farms near settlements are the primary ignition sources. We find that climate is the largest contributing factor to fire occurrence, followed by the density of canals and the amount of vegetation. The influence of variables related to human access on the landscape were negligible or insignificant. Furthermore, we find that most fires (68-71%) originate in non-forest, compared to oil palm concessions (17%-19%), and relatively few (6-9%) are within 5 km of settlements. Moreover, most fires started within oil palm concessions and close to settlements stay within those boundaries (90% and 88%, respectively). In conclusion, these results demonstrate that climate coupled with human alteration of hydrology and the biophysical response to that alteration are the largest contributors to fire probability in the peat-swamp landscape. Effective fire management in this area should therefore target non-forested, degraded areas where fire probability is high and ignitions are most likely to occur.

Presenter: Celik, Seval

Title: Impacts of saltwater intrusion on tidal freshwater forested wetlands in the Apalachicola Bay, Florida

Authors: Seval Celik (Auburn University);Christopher Anderson (Auburn University);Latif Kalin (Auburn University);

Session: Coastal and Marine

Abstract: Climate change is likely to alter precipitation patterns, temperatures, sea level, and the frequency of disturbance events, all of which could have strong impacts on a variety of ecosystems, especially in coastal areas. Coastal ecosystems, particularly tidal freshwater forested wetlands, provide diverse ecological and socioeconomic services. These wetlands are influenced by tides, however they remain primarily freshwater because of river flow. Change in the frequency of saltwater intrusion has been identified as a major factor that may impact tidal freshwater forested wetlands in the future. However, studies on how salinity affects tidal freshwater wetlands are limited. The purpose of this study is to describe the hydrology, salinity, and vegetation along a tidal gradient using the St. Marks River and East River (distributary rivers of the Apalachicola River in northwest Florida). Twenty-two forest plots were sampled (11 per river) to document changes in forest composition along a tidal gradient. Also, six monitoring stations were established along this reach to monitor tidal exchange and salinity along the rivers. Water data collection began in December 2014 and continued for one year. These data will be used with other ongoing, long-term monitoring of the river to develop data-driven models that predict the potential impacts of sea level rise and variations in freshwater input from the Apalachicola River and the potential response of different forest species to changing salinities.

Presenter: Chaudhary, Anand

Title: Cross-scale interaction effects of regional climate and local proportion of land cover in agriculture on avian persistence

Authors: Anand Chaudary (Baylor University);Joon J Song (Baylor University);Kevin J Gutzwiller (Baylor University);

Session: Avian I

Abstract: Cross-scale interaction effects involving major causes of biodiversity loss, such as climate and land use, have significant potential to impact native biota, yet such effects remain largely unexplored. Across four Bird Conservation Regions (BCRs) in the eastern United States, we assessed whether cross-scale interaction effects involving regional climate and the local proportion of land cover in agriculture influenced the persistence of three bird species of conservation concern: wood thrush (Hylocichla mustelina), prairie warbler (Setophaga discolor), and Kentucky warbler (Geothlypis formosa). The regional-scale variable (30-year mean daily temperature during the breeding season) was measured within BCRs, and the local-scale variable (proportion of land cover in agriculture) was measured for landscapes within the

species' mean natal dispersal distance (1.1 km) along North American Breeding Bird Survey routes (each 39.4 km long with 50 survey stops). We estimated a species' persistence for each route as the 3-year mean proportion of the 10-stop route segments at which a species was present. Linear mixed-effect models and spatial eigenvector analyses indicated a significant cross-scale interaction effect of climate and agriculture only on wood thrush persistence. Persistence of all three species declined with an increase in the local proportion of agriculture, but the negative influence of agriculture on wood thrush persistence was stronger with higher regional temperatures. Failure to consider cross-scale interaction effects in species distribution modeling may result in misleading interpretations about the influences of main effects. Assessment of cross-scale interaction effects is therefore essential for ensuring that landscape planning and management for species are conservation-effective.

Presenter: Chen, Liding

Title: The role of green landscape in thermo-environmental amelioration: A case study in Beijing

Authors: Liding Chen (State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Zhifeng Wu* (State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Ranhao Sun (State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);

Session: Urbanization and Landscape Change: Socioeconomic Drivers and Ecological Consequences

Abstract: Increasing population and rapid urbanization may lead to the loss of green spaces and ecosystem services at enhancing traffic congestion and urban heat island (UHI). UHI, as a consequence of urban expansion, may result in increased energy consumption, thermal comfort reduction and life quality decline. However, the demand on improving human living environment is still increased with the rise of global human population residing in the urban areas. To mitigate the urban heat island and improve urban thermal environment is becoming one of the urgent issues in the metropolitan areas. At present, to increase more green landscape becomes the focus and is believed to be a vital strategy in ameliorating urban thermal environment and meeting the human needs on ecosystem services. However, how much of the green landscape can contribute to the thermo-environmental amelioration is still in dispute. In this study, a residential quarter with high-rise building in Beijing was chosen to study the role of green landscape in thermo-environmental amelioration based on ENVI-met modeling. It was found that green landscape may contribute much to the thermal environmental amelioration in-situ and little effects on air temperature of the surrounding

areas. The findings in our study will offer information to evaluate the function of green landscape in mitigating urban heat island.

Presenter: Christie, William M

Title: Distinguishing ephemeral from seasonally-persistent forest disturbances using NDVI time series

Authors: William M Christie (US Forest Service, Southern Research Station);Steven P Norman (US Forest Service, Southern Research Station);William W Hargrove (US Forest Service, Southern Research Station);Joseph P Spruce (Self Represented);

Session: Poster

Abstract: Efforts to quantify the relative importance of forest disturbances using remote sensing have been limited by our ability to efficiently and accurately recognize the intensity and duration of impacts. To date, far more attention has been afforded to mapping the intensity of immediate effects than how disturbances persist within a growing season or across years. These two indicators of disturbance severity—intensity and duration—are not necessarily correlated, as many forest species rapidly resprout or re-leaf after intense spring or early summer insect defoliation or abiotic damage. That is, equally intense disturbance effects can be ephemeral or persistent. Meanwhile, the intensity of gradually unfolding disturbances that take several weeks or months to develop may not be captured by imagery from a single date, yet that is how disturbance intensity is generally mapped. Here, we quantify the persistence of growing season disturbances for the eastern US using an 8-day 240m resolution NDVI time series from the MODIS-based US Forest Service's ForWarn system. We show examples of ephemeral and persistent disturbances as quantified by the duration of 1-year NDVI anomalies at a 5% change threshold over six 8-day periods of summer for the period 2006-2015. This approach distinguishes disturbances that may have the greatest impact on annual productivity from those that are likely of relatively minor impact.

Presenter: Chung, Min Gon

Title: Telecoupled interactions among tourism, ecosystem services, and human well-being

Authors: Min Gon Chung (Center for System Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University);Tao Pan (Institute of Geographic Sciences and

Natural Resources Research, Chinese Academy of Sciences);Yingying Yao (College of Engineering, Peking University);Jianguo Liu (Center for System Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University);

Session: Landscape networks as telecoupled human and natural systems

Abstract: Tourism is a telecoupling process that provides physical and psychological benefits to human well-being across local to global levels. It has grown rapidly worldwide. For example, the contribution of tourism to the total GDP in Qinghai Province of China experienced a 4-fold increase between 1999 and 2014. However, it is not clear how increased tourism affects ecosystem services and local livelihood. The purpose of this research is to apply the integrated telecoupling framework to understand the complex interactions among tourism, ecosystem services, and human well-being in Qinghai Province. Our results indicate that the increased number of visitors boosts local income, accelerates the development of tourism infrastructure, and exacerbates natural habitats. More local people have participated in tourism industries to receive direct and indirect benefits: working in travel agencies, working temporarily on infrastructure construction, and selling local agricultural products to tourism industries. The interactions between tourism and local people may have a positive feedback, and therefore lead to increases in both agricultural products and tourism development. Also, tourist water consumption and carbon emissions affect people and the environment locally and globally. This research can provide guidelines for new payments for ecosystem services to sustain ecosystems and enhance livelihood simultaneously.

Presenter: Claggett, Peter R

Title: Can afforestation and forest conservation save the Chesapeake Bay?

Authors: Peter R Claggett (USGS);Sally W Claggett (USFS);Fred M Irani (USGS);Quentin Stubbs (USGS);Renee L Thompson (USGS);

Session: Planning

Abstract: Since 1950, the Chesapeake Bay watershed's human population has increased by over one million people every decade. State population projections indicate this trend is expected to continue through 2040. Population growth and accompanying urbanization will result in the conversion of forests and farms to developed land with increases in wastewater loads from sewer and septic systems. The Bay TMDL (Total Maximum Daily Load) requires significant reductions in pollutant loads from current levels and offsetting all future increases in loads. Afforestation associated with both farming and land development activities could potentially result in substantial reductions in pollutant loads, and forest conservation can serve to limit

development, avoiding offsets required to accommodate a growing population. We used a model that simulates land change to quantify changes in pollutant loads and reductions in offset requirements from a range of five afforestation scenarios coupled with protecting all large forest patches in areas most vulnerable to development. The five afforestation scenarios include no afforestation, afforest 5% and 10% of soils with marginal productivity, afforest lands adjacent to new development to the extent of 100% and 200% of the land area required to accommodate future development. The results will be used to inform discussions on whether to plan restoration actions based on current or future land use conditions.

Presenter: Clark, James S

Title: Forecasting the forest and the trees: consequences of drought in competitive forests

Authors: James S Clark (Duke University);Aaron A Berdannier (Duke University);Bijan B Seyednasrollah (Duke University);Bradley B Tomasek (Duke University);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: Models that translate individual tree responses to distribution and abundance of competing populations are needed to understand forest vulnerability to drought. Currently, biodiversity predictions rely on one scale or the other, but do not combine them. Synthesis is accomplished here by modeling data together, each with their respective scale-dependent connections to the scale needed for prediction—landscape to regional biodiversity. The approach we summarize integrates three scales, i) individual growth, reproduction, and survival, ii) size-species structure of stands, and iii) regional forest biomass. Data include 24,347 USDA Forest Inventory and Analysis (FIA) plots and 135 Long-term Forest Demography plots. Climate, soil moisture, and competitive interactions are predictors. We infer and predict the four-dimensional size/species/space/time (SSST) structure of forests, where all demographic rates respond to winter temperature, growing season length, moisture deficits, local moisture status, and competition. Responses to soil moisture are highly non-linear and not strongly related to responses to climatic moisture deficits over time. In the Southeast the species that are most sensitive to drought on dry sites are not the same as those that are most sensitive on moist sites. Those that respond most to spatial moisture gradients are not the same as those that respond most to regional moisture deficits. There is little evidence of simple tradeoffs in responses. Direct responses to climate constrain the ranges of few tree species, north or south; there is little evidence that range limits are defined by fecundity or survival responses to climate. By contrast, recruitment and the interactions between competition and drought that affect growth and survival are predicted to limit ranges of many species. Taken together, results suggest a rich interaction involving demographic responses at all size classes to neighbors, landscape variation in moisture, and regional climate change.

Presenter: Clark, John M

Title: An approach to monitoring cyanobacteria blooms at surface drinking water intakes using satellite imagery

Authors: John M Clark (US EPA);Blake A Schaeffer (US EPA);John A Darling (US EPA);Erin A Urquhart (US EPA);

Session: Watersheds and Hydrology

Abstract: Cyanobacterial blooms occur worldwide and are associated with the undesirable taste and odor of potable water, increased drinking water treatment costs, loss of revenue from recreational use, and human illness as a result of ingestion or skin exposure during recreational activities. Satellite remote sensing technology has the potential to inform and accelerate the engagement of communities and managers in the implementation of best management practices in response to blooms. In this study we explore the possibility of applying this technology to assess relative levels of exposure risk for spatially resolvable water bodies, particularly those utilized as surface drinking water sources. Cyanobacteria cell counts were derived using historical data from the Medium Resolution Imaging Spectrometer (MERIS) deployed on the European Space Agency's Envisat-1 satellite from 2009 to 2012. First, the frequency of usable satellite images was calculated to estimate the number of observations available throughout a calendar year. These observations were then used to estimate risk as the fraction of cyanobacteria cell count observations that exceeded the World Health Organization High threshold of 100,000 cells/mL. Geographic patterns of vulnerability to blooms were assessed in order to develop a broader understanding of risk at multiple spatial scales, and as a precursor to examining landscape influences on bloom occurrence. In addition, temporal analysis was performed to test the potential for future development of near-real time cyanobacteria bloom detection.

Presenter: Cocking, Dean

Title: Detecting patterns of distribution of low concentration airborne mercury deposition in the landscape of the Shenandoah Valley VA

Authors: Dean Cocking (James Madison University, Harrisonburg,VA);

Session: Urban I

Abstract: Thirty years ago there was little interest in trace mercury (Hg) presence as a background contaminant in terrestrial ecosystems. It was known that there were concentrations causing concern in the vicinity of point sources, such as cinnabar mines, but the focus of attention was on aquatic systems. Various terrestrial studies in the Shenandoah Valley by our laboratory have involved many students over the intervening period. They demonstrated widespread low level detectable presence of Hg associated in part with atmospheric deposition. This led to detailed examination of Hg within terrestrial ecosystem food webs. Meanwhile, atmospheric scientists elsewhere have created networks monitoring the atmosphere for Hg with the goal of precise quantification. An individual passive sampler can cost $250 per unit and active filtering samplers cost more. This is in addition to analysis costs. As part of our Shenandoah Valley projects, inexpensive passive air samplers (1-2 $ each) have been used at the landscape level to produce relative survey indices of Hg content associated with airborne deposition. The total Hg was measured with a Perkin Elmer Flow Injection (FIMS) atomic absorption analyzer. Our screening samplers are orders of magnitude less expensive and therefore allow the study of the landscape at a much finer scale. One of the studies involved 115 locations within the City of Waynesboro VA, and a different group of studies involved an even larger total of locations in Rockingham Co. VA. This paper will be an overview of our study of airborne Hg in relation to landscape ecology.

Presenter: Coffin, Alisa W

Title: Landscape considerations of perennial biofuel feedstock production in conservation buffers of the Georgia Coastal Plain, USA

Authors: Alisa W Coffin (USDA-ARS);Timothy Strickland (USDA-ARS);William Anderson (USDA-ARS);Marshall Lamb (USDA-ARS);Jason Schmidt (University of Georgia);Dawn Olson (USDA-ARS);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: With global increases in the production of cellulosic biomass for fuel, or “biofuel,” concerns over potential negative effects of using land for biofuel production have promoted attention to concepts of agricultural landscape design that sustainably balance tradeoffs between food, fuel, fiber, and conservation. The southeastern region of the USA has been identified as a contributor to meeting half of this goal. We used a GIS-based approach to estimate the production and N-removal potential of three perennial biofeedstocks planted as conservation buffers (field borders associated with riparian buffers, and grassed waterways) on

the Coastal Plain of Georgia, USA. Land cover, hydrology, elevation, and soils data were used to identify locations within agricultural landscapes that are most susceptible to runoff, erosion, and nutrient loss. We estimated potential annual biomass production from these areas to be: 2.5–3.5 Tg for giant miscanthus (Miscanthus × giganteus), 2–8.6 Tg for "Merkeron" napier grass (Pennisetum purpureum), and 1.9–7.5 Tg for "Alamo" switchgrass (Panicum virgatum). When production strategies were taken into consideration, we estimated total biomass yield of perennial grasses for the Georgia Coastal Plain at 2.2–9.4 Tg year−1. Using published rates of N removal and ethanol conversion, we calculated the amount of potential N removal by these systems as 8100–51,000 Mg year−1 and ethanol fuel production as 778–3296 Ml year−1 (206 to 871 million gal. US). Further ongoing work is examining, on the one hand, economic dimensions of lignocellulosic biofeedstocks, and, on the other hand, bio-contol services provided by perennial biofeedstocks.

Presenter: Coleman, Andre M

Title: Opportunities and barriers for waste resource utilization in bioenergy production

Authors: Andre M Coleman (Pacific Northwest National Laboratory);Mark S Wigmosta (Pacific Northwest National Laboratory);Timothy E Seiple (Pacific Northwest National Laboratory);Richard L Skaggs (Pacific Northwest National Laboratory);Ashok K Mishra (Clemson University);Rebecca Efroymson* (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Susan Schoenung (Oak Ridge National Laboratory);Matt Langholtz (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: Industrial and municipal waste streams have significant potential for use in synergistic bioenergy production, enabling waste remediation through greenhouse gas (GHG) utilization, nutrient and heat removal while minimizing life cycle impacts and often increasing cost-effective operations. Several bioenergy production pathways are in early commercial development and consequently, the availability and economics of required upstream resources remains a major challenge to sustainable and affordable commercial bioenergy production. There are numerous candidate waste streams to consider, but a key challenge to ensuring economic and environmental viability is to assess the spatial position, temporal variability, waste-stream characteristics, capture technology, and transport engineering, energetics and costs of the potential waste resources. With the United Nations sponsored 21st Conference of Parties (COP-21) and the United States Environmental Protection Agency's Clean Power Plan, there are specific motivations to reduce GHG emissions for which bioenergy feedstocks such as microalgae can directly utilize. In addition, opportunities exist to use industrial and municipal wastewater effluents for key nutrients and numerous industrial operations are able to supply

waste heat resources. Combining resource and techno-economic assessments reveals candidate locations and energy potentials where specific bioenergy feedstocks and pathways are sustainable with respect to economics, net energy ratio, and environmental objectives. Non-viable production scenarios are also revealed with specific barriers identified.

Presenter: Compton, Bradley W

Title: Landscape conservation design in the Northeastern U.S.

Authors: Bradley W Compton (University of Massachusetts);Kevin McGarigal (University of Massachusetts);Ethan Plunkett (University of Massachusetts);William V DeLuca (University of Massachusetts);Joanna Grand (University of Massachusetts);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: The Designing Sustainable Landscapes project for the North Atlantic Landscape Conservation Cooperative (DSL-NALCC) incorporates a multifaceted landscape change, assessment, and design model for 13 states in the north Atlantic region. This model assesses coarse-filter ecological integrity as well as habitat and climate suitability for a number of representative wildlife species. We used results from this assessment to build a Landscape Conservation Design (LCD) framework with the goal of providing a common blueprint for land protection and other conservation action. Our LCD approach was piloted in the Connecticut River watershed in collaboration with a number of stakeholders from state and federal agencies and NGOs. We used a two-phase approach based on resistant kernels to build conservation cores that included high-integrity examples of ecological systems and mapped rare communities in a spatially coherent manner. We then added high-quality habitat for representative species to the core network until species targets were met. Cores were built in multiple nested tiers representing different targeted percentages of the landscape. This approach represents a balance among competing goals of quality, efficiency, distribution, and core size and contiguity. Cores were connected via multiple context-sensitive paths for ecosystems represented in each core, taking into account both abiotic and anthropogenic elements of intervening land. The final results provide a “big picture” roadmap to conservation design, while intermediate results and a number of ancillary tools allow conservation organizations to use our model results to inform their individual goals.

Presenter: Conatser, Jess M

Title: Forest cover loss and anthropogenic modification in Virunga National Park

Authors: Jess M Conatser (Marshall University);Anne Axel (Marshall University);

Session: Poster

Abstract: Established in 1925, Virunga National Park has existed as a home for tropical biological diversity and ecosystem services. The Virunga landscape has undergone significant modification and change since its establishment. Specifically, political unrest, oil concessions, and ecological disturbances have contributed to forest loss and a degree of biological impact within the area since the mid 1980s. The effect of habitat fragmentation, poaching, and human-transmitted disease have reduced the quality of gorilla populations within the park (Plumptre & Williamson, 2012). The history of these sources of impact have been well documented—through the use of Geographic Information Systems and related programs, this project aims to quantify and present the landscape changes that have occurred since the 1980s. Major sources of forest loss in this study are predicted to be a product of industrial logging, war-related resource consumption, and mining practices. Landsat images of partial park area will be downloaded in ten-year intervals beginning in 1985 and continuing to present day. For every image downloaded, a classification of land cover type and accuracy assessment will be conducted with ERDAS Imagine software. The results of this assessment will help guide education and conservation efforts in the area, as well as providing an up to date record of land cover change within the park.

Presenter: Cook, Gericke L

Title: Anthropogenic mechanisms of spread for an invasive species varies across space in national risk models

Authors: Gericke L Cook (USDA APHIS PPQ CPHST);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: The spread of invasive species across a landscape may be facilitated by patterns of human activity, which adds complexity to the development of national risk models. In the case of gypsy moth (Lymantria dispar dispar), we found distinct shifts in predictor importance across geographic space when developing species distribution models for this forest pest. In particular, the identification and development of origin-destination datasets showed the greatest interpretability of gypsy moth introduction potential, compared to proxies of human activity such as population density. This presentation will discuss how methods for species distribution

models may be adapted to vary across space, and applied in survey designs that target rare introduction events for invasive species.

Presenter: Cooper, Caren B

Title: Citizen Science: Managing residential landscapes based on scientific discoveries that build social capital

Authors: Caren B Cooper (NC Museum of Natural Sciences);

Session: Modeling with Stakeholders

Abstract: There are two interlocking keys needed to solve so-called 'wicked' problems: (i) reliable knowledge of what can be done and (ii) social capital to make it happen. (The social networks, cohesion, and individual investment in community that makes democracy work better are social capital). The scientific enterprise can't efficiently do its part in solving problems while located apart from society. The remedy is to relocate science from its isolation and foster its growth in the mainstream of society as an ongoing collaboration between the public and professionals. How can we do this? Citizen Science has already begun to do it, every day, and we need to expand the process. Citizen science presents an opportunity to develop systems of engagement and participation aimed at collective problem-solving, planning, and landscape management. In the context of the emerging disciple of citizen science, Dr. Cooper will discuss public stewardship of natural resources.

Presenter: Cosofret, Cosmin V

Title: Forest vegetation disturbances and landscape changes in complex forest ownership areas on LANDSAT Images: a case study in the northern Romanian Carpathians

Authors: Cosmin V Cosofret (Stefan cel Mare University, Forestry Faculty);Ionut Barnoaiea (Stefan cel Mare University, Forestry Faculty);Liviu Nichiforel (Stefan cel Mare University, Forestry Faculty);Ovidiu Iacobescu (Stefan cel Mare University, Forestry Faculty);

Session: Assessment I

Abstract: Forest disturbances are a resultant of a complex of factors, both natural and human. The most frequent cases of disturbance in the study area are related to windthrown, insect

attacks and illegal logging. The disturbance drivers mentioned have mutual interactions and tend to enhance their total influence on the forest ecosystems and also to reshape the landscape on large scale creating landscape patterns. Analysis of satellite images over time serves as a powerful tool to track changes in forest cover, which short-term fieldwork cannot observe. The archive of LANDSAT images is practically the only accessible source of spatial information on forest cover around 1990, since no higher spatial resolution data (aerial images) were taken in the period 1978-2004. The forest disturbance maps represent a basis for further investigations related to the forest vegetation successions in the areas that were affected by forest vegetation loss in an effort to delineate the owners' approach to the continuous management of these areas and landscape change maps also represent a first step in future forest landscape managements.

Presenter: Costanza, Jennifer K

Title: Toward a general measure of landscape connectivity for climate change

Authors: Jennifer K Costanza (NC State University);Curtis Belyea (NC State University);James I Watling (John Carroll University);Ron Sutherland (Wildlands Network);Nick M Haddad (NC State University);

Session: Monitoring and assessment of landscape change

Abstract: A general method for assessing changes in wildlife habitat connectivity over time is necessary for determining conservation priorities that will be relevant for a variety of species and across jurisdictional boundaries. However, maps of connectivity can vary with the input data, connectivity model framework, and by species, so generalizing among connectivity maps that use a variety of approaches is challenging. We sought to synthesize 21 maps of habitat connections in the southeastern US to assess the level of exposure of current habitat connections to future landscape and climate change. These maps were created for the contemporary landscape using a variety of resistance surfaces and connectivity algorithms for three wildlife species. To develop a general comparison and assessment of change for the 21 maps, we converted all to a common format: tables of nodes and edges. We then calculated a set of simple indices based on the amount of climate and land use change expected in each node and edge. Our results show that across the 21 maps, connections are likely to experience greater future exposure to changes in climate than to urbanization. Generalization of future changes is easier among alternative connectivity maps for the same species than for different species. These results identify priority regions for conservation in the Southeast, and begin to bridge the gaps among methods for mapping and assessing change in habitat connectivity.

Presenter: Cowie, Annette L

Title: How emission accounting and reporting influence perceptions of bioenergy

Authors: Annette L Cowie (NSW Department of Primary Industries);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: Bioenergy is commonly considered to be “carbon neutral” because the carbon that is released during combustion has previously been sequestered from the atmosphere and will be sequestered again as the plants regrow. Under the Kyoto Protocol bioenergy is counted as carbon neutral in the energy sector because carbon stock changes due to harvest of biomass for energy are counted in the land use sector. However, incomplete coverage means that some emissions from bioenergy are overlooked. Also, asynchrony between emissions and regrowth has led to concerns that bioenergy does not deliver climate benefits in the required time frame. Thus doubts about the climate benefits of bioenergy, and current accounting approaches, have grown. These assessments generally derive from a narrow perspective, focussed on a single forest stand, a short time frame, and a simplistic forestry model. Instead, quantifications of climate change impacts of forest bioenergy systems should consider the entire forest landscape and the specific conditions within which the forest bioenergy system operates, long term as well as short term effects and climate policy objectives, interactions between the energy sector and forest industry facilitated by markets and policy instruments, and how forest ecosystems are shaped by biophysical factors such as changing climatic conditions, human actions, and natural disturbances.

Presenter: Coyle, Theraesa A

Title: Shoreline verification for marine oil spill preparedness

Authors: Theraesa A Coyle (Fisheries and Oceans Canada);Steve MacDonald (Fisheries and Oceans Canada);Herb Herunter (Fisheries and Oceans Canada);

Session: Coastal and Marine

Abstract: Unconsolidated segments of shoreline, including sand, pebble and boulder beaches, increase marine biodiversity by providing habitat variation in intertidal and subtidal environments. Small pocket beaches are of particular ecological importance, especially in bedrock-dominated fjord environments, as they provide hydrodynamic refuge and high quality feeding grounds for juvenile fish. These areas, however, are particularly sensitive to marine oil

spills, as the interstitial spaces between the sediment particles can trap oils and allow for resuspension on subsequent tides. Unconsolidated beaches also cause complications for marine response teams, as the sediments must often be completely removed if contaminated. Accurate knowledge of the location of sensitive beach habitats is therefore critical, particularly in areas of heavy tanker traffic. We collected ground-truth GPS points at all segments of unconsolidated shoreline for six islands in the Douglas Channel, British Columbia, to quantify the accuracy of available shoreline databases. We found that, due to their very coarse spatial resolution, existing data sets greatly overestimate the total amount of unconsolidated beach on these islands, while still failing to identify important pocket beaches. We explored other possible methods to develop accurate physical shoreline data for the British Columbia coastline, including use of 3D laser scanned data and remotely sensed satellite and aerial imagery. Our results highlight the need for improved methods of physical shoreline classification, as well as the importance of accuracy assessments of publicly available large data sets.

Presenter: Craig, Kevin

Title: Linking watershed processes to coastal fisheries: effects of nutrient enrichment and hypoxia on the Gulf of Mexico fishery ecosystem

Authors: Kevin Craig (NOAA Southeast Fisheries Science Center);Kevin M Purcell (NOAA Southeast Fisheries Science Center);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: The northwestern Gulf of Mexico drains the largest watershed in the continental United States via the Mississippi-Atchafalaya river system. Three-fold increases in nutrient loads to the shelf since the 1950s now result in one of the largest seasonal hypoxic (dissolved oxygen ≤ 2 mg l-1) zones in the northern hemisphere. Hypoxia is most severe during the summer (Jul-Aug) when major fisheries in the region are at their peak, yet the consequences of nutrient pollution for harvested ecosystems are largely unknown. We conducted retrospective analyses of long-term survey data, as well as process-oriented field studies to investigate the effects of hypoxia on the upper trophic level fish community in the northwestern Gulf. Shrimp and a number of demersal fishes have similar hypoxia avoidance thresholds and aggregate at high density in nearby oxygenated habitats, suggesting the potential for a number of indirect and sublethal effects. Shrimpers also target these edge habitats suggesting hypoxia enhances catch rates of both target (shrimp) and nontarget (juvenile fishes) species. Multiple ecosystem level indicators show changes in biomass, biodiversity, and pelagic:demersal ratios on the northwestern Gulf shelf over the last 25 years. However, these indicators appear more strongly related to decadal scale changes in shrimping effort than to hypoxia. Our results indicate that understanding spatially-mediated responses to hypoxia within the context of other ecosystem

stressors is critical to understanding how watershed processes influence downstream coastal fish communities and fisheries.

Presenter: Cunningham, Caitlin L

Title: The honey bee (Apis mellifera) colony carrying capacity of Nova Scotia, Canada

Authors: Caitlin L Cunningham (School for Resource and Environmental Studies, Dalhousie University);Peter H Tyedmers (School for Resource and Environmental Studies, Dalhousie University);

Session: Conservation Biology II

Abstract: Managed western honey bee (Apis mellifera) colonies play an integral role in Nova Scotia's agroecosystems as pollinators of lowbush blueberry (Vaccinium angustifolium) crops. Currently, the ~20 000 colonies in the province cannot adequately provide pollination services to the crop, so colonies are temporarily brought in for the blueberry bloom season from Quebec and Ontario. This has put pressure on the local beekeeping industry to expand to meet the pollination demand. An increase in colonies can be supported while the blueberries are in bloom, however it is uncertain if the province has sufficient floral resources, in terms of density, quality and seasonal diversity, to support such an increase over the rest of the year without having to rely on food supplementation to artificially support colonies. When developing a growth strategy for the industry, it is imperative to understand the potential number of colonies the province can support under current landscape characteristics. Predicated on the assumption that beekeepers place their colonies in locations that will yield productive colonies, this research seeks linkages between the vegetation surrounding apiaries and honey production. Within a one kilometer radius surrounding apiaries, vegetation was evaluated at multiple points over the growing season in terms of the quantity and quality of honey bee forage. The vegetation characteristics were then related to colony productivity of the site. Spatial modelling techniques are being used to determine the number of honey bee colonies the province can support and identify regions of the province that are currently underutilized by beekeepers.

Presenter: Cushman, Samuel A

Title: Calculating the configurational entropy of a landscape mosaic

Authors: Samuel A Cushman (U.S. Forest Service);

Session: Implications and applications of thermodynamics in landscape ecology

Abstract: Applications of entropy and the second law of thermodynamics in landscape ecology are rare and poorly developed. This is a fundamental limitation given the centrally important role the second law plays in all physical and biological processes. A critical first step to exploring the utility of thermodynamics in landscape ecology is to define the configurational entropy of a landscape mosaic. In this talk I present how the configurational entropy of a landscape mosaic may be calculated. I begin by drawing parallels between the configuration of a categorical landscape mosaic and the mixing of ideal gases. I propose that the idea of the thermodynamic microstate can be expressed as unique configurations of a landscape mosaic, and posit that the landscape metric Total Edge length is an effective measure of configuration for purposes of calculating configurational entropy. I propose that the entropy of a given landscape configuration can be calculated using the Boltzmann equation. Specifically, the configurational entropy can be defined as the logarithm of the number of ways a landscape of a given dimensionality, number of classes and proportionality can be arranged (microstates) that produce the observed amount of total edge (macrostate).

Presenter: Cushman, Samuel A

Title: Thermodynamics in landscape ecology: An introduction and overview

Authors: Samuel A Cushman (U.S. Forest Service);

Session: Implications and applications of thermodynamics in landscape ecology

Abstract: Entropy and the second law of thermodynamics are the central organizing principles of nature. Yet strangely, the ideas and implications of the second law are poorly developed the landscape ecology literature. This is particularly strange given the focus of landscape ecology on understanding pattern process relationships across scale and through time. Every interaction between entities leads to irreversible change which increases the entropy and decreases the free energy of the closed system in which they reside. This is the essence of the entropy principle. Descriptions of landscape patterns, processes of landscape change, propagation of pattern-process relationships across scale and through time are all governed, constrained, and in large part directed by thermodynamics. In this presentation I provide a brief review of thermodynamic concepts of relevance to landscape ecology and discuss examples of literature addressing them, and close with a prospectus for future research to strengthen application of thermodynamic ideas and methods in landscape ecology.

Presenter: Cushman, Samuel A

Title: Using random forest machine learning to improve prediction of temperature across topographically complex landscapes

Authors: Samuel A Cushman (US Forest Service);Andrew J Shirk (University of Washington);Zack H Holden (US Forest Service);Gretchin E Moisen (US Forest Service);

Session: Machine Learning and Data Mining Applications in Land- and Seascape Ecology: What it is, Why it matters, and Where the Progress Still Sits

Abstract: Microclimatic variability in mountainous landscapes has large and important effects on ecological processes ranging from disturbance regimes, adaptive evolution, community structuring, and population dynamics. Yet gridded climate models have variable ability to reflect fine scale climatic differences in landscapes with complex topography. We combined a vast collection of microclimatic measurements from a network of over 900 temperature loggers distributed across the United States Rocky Mountains with Random Forest machine learning to predict fine scale topographically mediated patterns of temperature. We found that Random Forest machine learning modeling was able to predict departures from gridded temperature products with very high success and identified areas, such as deeply dissected topopgraphy, where these departures were of a magnitude to be ecologically highly relevant.

Presenter: Dale, Virginia H

Title: Opportunities and constraints for progress toward sustainable bioenergy in forests of the southeastern United States

Authors: Virginia H Dale (Oak Ridge National Laboratory);Keith L Kline (Oak Ridge National Laboratory);Esther S Parish (Oak Ridge National Laboratory);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: Landscape design refers to a spatially explicit, collaborative plan for management of landscapes and supply chains that can be applied to production of wood-based bioenergy in the southeastern United States (SE US). Several European nations are purchasing wood pellets from the SE US to use as a substitute for non-renewable coal at large electric power plants in an

effort to meet 2020 European Union climate and renewable energy targets. Although wood pellets are a small part of the total US wood export (~2%), the volume of SE US wood pellet exports to Europe has grown rapidly since 2007. The wood pellets are largely a byproduct of the timber harvested for lumber. In addition to developing the ability to provide energy, it is important to identify ways to do so in a manner that addresses several dimension of sustainability. Growth of the pellet industry in the SE US would provide jobs in rural areas where unemployment is high. However there are concerns that the growing pellet industry might impact carbon emissions, ecosystem services, and biodiversity (particularly in hardwood wetland forests). Application of best management practices can be used to avert anticipated problems. Identifying the locations, feedstocks, production pathways, management practices, and technologies that support progress toward sustainable bioenergy must be specific to particular contexts. Bioenergy is not a "one-size-fits-all-situations" solution for addressing energy needs; rather it is a renewable energy source that could be designed for specific landscapes to meet society's needs while protecting or conserving ecosystem services in some locations.

Presenter: Dannenberg, Matthew P

Title: Environmental stresses recorded in tree rings: Development and evaluation of a continental-scale index of environmental limitations to plant growth

Authors: Matthew P Dannenberg (University of North Carolina at Chapel Hill);Conghe Song (University of North Carolina at Chapel Hill);Erika K Wise (University of North Carolina at Chapel Hill);

Session: Landscape Dynamics II

Abstract: Terrestrial primary production is the entry point of energy and carbon into ecosystems and the fundamental source of food and fiber for land-dwelling organisms. Productivity of vegetation can be limited by multiple environmental factors, including non-optimal temperatures and water deficits, with strong spatial and temporal variability in the dominant environmental stressors. The complexity of environmental stresses to plant growth, as well as stressor interactions and varying importance over different spatial and temporal scales, adds considerable uncertainty to models that attempt to monitor primary production based on satellite data. Here, we develop a data-driven approach for estimation of environmental stress effects on plant growth based on a large network of tree-ring widths. We define "environmental stress" as the proportion of the theoretical optimal basal growth that is realized in a given year, as measured from tree-ring widths. This ratio of actual to optimal growth integrates the multiple sources of environmental stress experienced by each tree into a single index. We test and evaluate the index at six ponderosa pine tree-ring sites in the Pacific

Northwest, USA and then apply the index to a network of tree-ring widths in the conterminous United States. Our environmental stress index is robust to uncertainties in tree-ring based estimates of stem diameter and captures a significant amount of variance in primary production at a continental scale. This environmental stress index will be useful both for delineating spatiotemporal patterns of environmental stressors in different regions and for assimilation into remotely-sensed primary production models.

Presenter: Davis, Amy J

Title: Effect of multi-temporal forest cover change trajectories on forest plant diversity

Authors: Amy J Davis (US EPA);Jean-Claude Thill (UNC Charlotte Dept. of Geography & Earth Sciences);Ross K Meentemeyer (NCSU Center for Geospatial Analytics);

Session: Landscape Dynamics II

Abstract: One of the principal tenets of landscape ecology is that forest loss and fragmentation negatively affects biodiversity. However, historical fluctuations in forest cover resulting from repeated cycles of deforestation and reforestation are likely important in influencing patterns of native plant diversity, but are overlooked when forest cover change is assessed using a single time interval. We asked if forest cover change trajectories, assessed over multiple time intervals explains patterns of native plant diversity better than a simple measure of overall forest change. We collected data on plant species richness and abundance at 177 field plots located in forests throughout the Charlotte, NC region in the U.S. Using a longitudinal forest cover dataset spanning 1938-2009, we derived multi-temporal forest cover change trajectories using k-means clustering for nested spatial extents ranging from 100 to 1000 m in diameter surrounding each plot. While accounting for landscape and environmental covariates, we used linear mixed modeling to assess the effects of forest cover change trajectories classes or overall forest cover change measured from 1938 to 2009. Forest cover change trajectory types derived at the 100 m and 200 m spatial extents significantly improved model fit as indicated by likelihood ratio tests, whereas overall forest cover change at any spatial extent had little effect. We conclude that the effects of forest cover change on biodiversity should be assessed over multiple temporal intervals instead of relying on a single interval, especially in areas that are known to have experienced repeated cycles of deforestation and reforestation

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Presenter: de Beurs, Kirsten M

Title: Using multiple remote sensing perspectives to identify and attribute land surface dynamics in the changing grasslands of the Western Hemisphere

Authors: Kirsten M de Beurs (University of Oklahoma);Braden C Owsley (University of Oklahoma);Geoffrey M Henebry (South Dakota State University);

Session: Mapping spatiotemporal pattern and process: re-imagining arid grassland mapping from local to global scales

Abstract: Large portions of the Western Hemisphere are classified as arid lands, which are regions where the mean annual precipitation is less than half the mean annual potential evapotranspiration. To understand the land surface changes that these arid lands experienced between 2001 and 2014, we investigate trends in time series of MODIS Nadir BRDF-adjusted reflectance (NBAR) data at 8-day and 500m resolution between 2001 and 2014. We investigate conventional vegetation indices such as NDVI and EVI, but also extend the analysis to MODIS Tasseled Cap Brightness, Greenness, and Wetness. In addition, we investigate changes in day and night time surface temperatures from the MODIS Land Surface Temperature (MOD11) product and Evapotranspiration (MOD16) data. We combine the trend results from these multiple datastreams within the interpretative context of surface dynamics to form a more complete picture of the changing landscape. Besides investigating monotonic trends, we also investigate observed changes in land surface phenology. In this talk we will first provide an overview of the entire Western Hemisphere and then highlight changes in the Brazilian Cerrado.

Presenter: de Beurs, Kirsten M

Title: Urban land surface phenology: An evaluation of Oklahoma City using the Oklahoma Mesonet and optical and thermal Landsat data

Authors: Kirsten M de Beurs (Geography and Environmental Sustainability, University of Oklahoma);Emily Windahl (Geography and Environmental Sustainability, University of Oklahoma);Braden C Owsley (Geography and Environmental Sustainability, University of Oklahoma);Pradeep Adhikari (Geography and Environmental Sustainability, University of Oklahoma);Geoffrey M Henebry (GSCE – Geospatial Sciences Center of Excellence, South Dakota State University);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: The U.S. Census Bureau estimated that the Oklahoma City metropolitan area population grew from just over 1 million in 2000 to 1.3 million people by 2013, which places the region in the top 10 fastest growing metropolitan areas in the country. In 2013, Oklahoma City was the largest city in land area, occupying more than 600 square miles. The extensive sprawl of the area combined with its lack of topographic features or adjacent large water bodies makes it an ideal place to study the effect of urban areas on land surface phenology. In this study we investigate all available Landsat images over Oklahoma City with less than 30% clouds between 1999 and 2015. We first use these images to form three year epochs (1999-2001, 2002-2004, 2005-2007, 2008-2010, 2011-2013, 2014-2015) and calculate the start and end of the growing season. We have validated a variety of methods to evaluate which method works best to identify land surface temperatures and we have validated this work against observations from the Oklahoma Mesonet. Here we use the best method to calculate the Land Surface Temperature based on the thermal data. We subsequently link the land surface temperature with the land surface phenology observations to identify the effect of the urban heat island on the observed phenology at 30m/120m spatial resolution. We evaluate the results against both land cover and percent impervious surface data from the NLCD database as well as phenology camera data over a small forest in the south of the study area.

Presenter: De Jager, Nathan R

Title: Simulating ungulate herbivory across forest landscapes: A browse disturbance extension for LANDIS-II

Authors: Nathan R De Jager (USGS);Patrick J Drohan (Penn State University);Brian R Sturtevant (USFS);Brian R Miranda (USFS);Susan L Stout (USFS);

Session: LANDIS Modeling

Abstract: Browsing ungulates alter forest productivity and succession, which may further interact with natural and anthropogenic disturbance regimes (e.g. harvesting, fire, and insects). We developed a Browse Disturbance Extension that simulates the effects of browsing ungulates on the growth and survival of plant species cohorts within the LANDIS-II spatially dynamic landscape simulation model framework. We demonstrate the capabilities of the new extension and illustrate consistencies with published effects of browsing using two case studies. The first case study examined long-term effects of persistently high white-tailed deer browsing rates in the Alleghney National Forest, USA. The second case study examined interactions between a moose population and the boreal forest landscape at Isle Royale National Park, USA. In both case studies, browsing caused a reduction in aboveground live biomass and shifts in species composition. Patterns of forest succession in simulations that included effects of browsing were more similar to those reported in the literature, than for simulations that did not include effects

of browsing. Both model applications suggest that not including effects of browsing in ecosystems known to be influenced by ungulates may result in over-predicting aboveground biomass, annual net primary productivity, and the abundance of highly preferred plant species. The browse disturbance extension allows researchers and managers to explore alternative scenarios of disturbance, climate change, and forest and population management on large-scale and long-term dynamics of forest succession.

Presenter: DeLuca, Bill V

Title: Wildlife landscape capability models assess vulnerability to climate change and inform landscape conservation design

Authors: Bill V DeLuca (University of Massachusetts);Kevin McGarigal (University of Massachusetts);Bradley Compton (University of Massachusetts);Joanna Grand (University of Massachusetts);Ethan Plunkett (University of Massachusetts);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: The primary goals of conservation are to protect, manage and restore habitat, minimize the forces of habitat degradation, and design landscapes to ensure habitat connectivity and persistence within the limits imposed by the socio-economic realities of human population growth. To achieve these objectives we developed a landscape change, assessment and design model for the North Atlantic Landscape Conservation Cooperative that predicts changes to species' distributions under a variety of alternative future climate change and urban growth scenarios. We downscaled general circulation models to predict changes in climate and constructed a regional urban growth model. We then developed habitat capability models and climate suitability models for a suite of representative wildlife species to assess the effects of predicted landscape and climate change scenarios. We assessed the nature and magnitude of potential habitat gains and losses due to projected changes in climate and urban growth by identifying areas on the landscape where species' distributions are most likely to persist, contract, or expand. We describe the implications for strategic habitat conservation planning given uncertainty in future climate and landscape conditions and develop tools to inform landscape design that effectively combines approaches that simultaneously address habitat loss and potential shifts in species' climate niches.

Presenter: Dickson, Brett G

Title: Bureau of Land Management lands as opportunities to connect and protect the last vast places in the western U.S.

Authors: Brett G Dickson (Conservation Science Partners);Christine Albano (Conservation Science Partners);Brad McRae (The Nature Conservancy);David Theobald (Conservation Science Partners);Jesse Anderson (Conservation Science Partners);Luke Zachmann (Conservation Science Partners);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: Scientists often lack the tools or opportunity to affect management or policy actions. Yet the need for successful communication of science to prompt conservation action is urgent. In order to maintain biodiversity and promote ecological process, such as connectivity, at least one fourth, and up to three-fourths, of a typical region must be managed with conservation of nature as a primary objective. Today, only 20 percent of the total acreage of the 11 western contiguous US is protected, tens of millions of acres shy of a scientifically defensible 25 percent minimum conservation target. In this context, the U.S. Bureau of Land Management (BLM) governs more land than any other federal agency, and those lands are being developed more rapidly than any other federal jurisdiction. We used new approaches to estimate and map ecological flow across BLM land and other jurisdictions in the western US. Among all principal federal jurisdictions, BLM lands exhibited the greatest importance in maintaining ecological connectivity. Patterns of ecological flow were most apparent between existing protected areas in the central portion of the western US. Current flow centrality was greatest in those areas that spanned the border between southeastern Oregon and southwestern Idaho, as well as central Nevada, northern Arizona and central Utah. These lands help form the 'connective tissue' among multiple protected areas and jurisdictions. Measures of potential connectivity can inform proactive strategies that serve as a principal basis for land allocation decisions on BLM and other public lands.

Presenter: Dilkina, Bistra N

Title: Shifting habitats in response to changing climate in the Southeastern U.S.

Authors: Bistra N Dilkina (Georgia Institute of Technology);Jenny L McGuire (Georgia Institute of Technology);Renee Bach (Georgia Institute of Technology);

Session: Conservation Biology II

Abstract: The southeast United States is a critical place to study the effects of climate change on biodiversity because it contains the highest richness of plants and amphibians in the contiguous U.S. and has high levels of habitat fragmentation, limiting the abilities of these diverse fauna to track their habitats. We characterize the species distributions and species richness across the regions in current conditions and in the future under different climate scenarios. Our study examines ~300 vertebrate species that live in the southeastern U.S. including birds with limited dispersal abilities, mammals, reptiles, and amphibians. We limit the species examined to those species with sufficient observational data to represent the range of environments in which they live. We identify the biodiversity hotspots today and in the future, investigate the current and future representation of species in protected areas in the Southeast, and identify potential areas of high conservation priority with respect to future range shifts due to climate change. We develop a methodological framework that starts with raw occurrence data from GBIF, uses careful subsampling approaches, Maxent distribution modeling based on climate covariates, and combines this with several ensembles of climate projections from the present to 2080. Within this framework, we extrapolate a consensus model given the suite of projected distributions. We identify which species will be most at risk of extinction, which will require movement connectivity to track their niches, and which will interact with urbanized areas.

Presenter: Dillon, Whalen W

Title: Influence of climate variability on pathogen spillover in a multi-host forest disease

Authors: Whalen W Dillon (North Carolina State University);Ross K Meentemeyer (North Carolina State University);

Session: Forest Pests

Abstract: Variation in disease transmission is caused by heterogeneity of individuals, species, and landscapes across space and time. Some disease systems are characterized by pathogen spillover, where an alternate amplifying host drives disease transmission. Spillover is frequently associated with multi-host disease systems where a single species is substantially more competent in terms of pathogen transmission. When these hosts aggregate under environmental conditions favorable to the pathogen disease transmission may be amplified. We investigated how interannual variability of weather in space and time influences pathogen spillover in the multi-host forest disease sudden oak death. This disease kills tanoak and some oak species in coastal forests of California and Oregon, but an alternate amplification host, California bay laurel, drives disease transmission. We applied path analysis to examine the direct and indirect influences of the precipitation, local microclimate temperature, and host density on pathogen spillover and oak infection. Using 10 years of data from 200 ecological

monitoring plots located across a 275-km2 study area, we modeled the direct and indirect effects of the landscape, precipitation, temperature, and plant community on spillover from bay laurel leading to infection of oak species. With this approach we confirmed that weather conditions directly affect spillover and infection of oak species, and that the plant community mediates the potential for spillover. These results also confirm that co-occurrence of oak hosts with California bay laurel is not sufficient for disease transmission, but that transmission simultaneously depends on favorable environmental conditions for the pathogen.

Presenter: Donovan, Kaley J

Title: Songbird conservation on the landscape scale in southeast Ohio's public forestland using habitat suitability index models

Authors: Kaley J Donovan (The Ohio State University);Bryce T Adams (The Ohio State University);Stephen N Matthews (The Ohio State University);

Session: Avian II

Abstract: Sound conservation planning is essential for the maintenance of biodiversity and ecosystem function. We aim to identify landscape-scale management recommendations to maintain avian diversity in the Appalachian Foothills Region of Southeast Ohio. Several focal species representative of different stages of forest succession include birds of conservation concern: Cerulean Warbler (Setophaga cerulean), Prairie Warbler (Setophaga discolor), Eastern Towhee (Pipilo erythrophthalmus), Wood Thrush (Hylocichla mustelina), and Kentucky Warbler (Geothlypis formosa). We will use established Habitat Suitability Index Models (HSI) and validate those models with data from our field study. We will then develop and integrate statistical models into established HSIs to create more robust region-specific habitat models. These will be based on presence/absence data as well as detailed vegetation data collected from May to June at 308 point count stations in four state forests in Southeast Ohio. For the Kentucky Warbler, low elevation sites with dense understory woody vegetation in moist contiguous forest predict high habitat suitability in established HSIs. In our study, we did detect a strong positive association of Kentucky Warblers to woody stem density ($p = 0.049$). Contrary to expectations, neither elevation nor distance to streams had a significant relationship with this species. These results, although preliminary, demonstrate a framework by which we can evaluate and improve variable selection in our region-specific HSIs. This, along with validation of model prediction ability and comparisons across species, will provide the needed data to help inform forest management planning decisions.

Presenter: Dorning, Monica A

Title: Influence of oil and gas development on big game hunting success in Wyoming, USA

Authors: Monica A Dorning (USGS);Steven L Garman (USGS);Jay E Diffendorfer (USGS);Darius J Semmens (USGS);Todd J Hawbaker (USGS);Kenneth J Bagstad (USGS);

Session: Ecosystem Services I

Abstract: Development from extracting oil and gas resources can have unintended impacts on multiple ecosystem functions, with cascading effects on wildlife, ecosystem services, and local economies. Big game hunting opportunities may be closely tied to these effects, but empirical analyses of the impacts of oil and gas development on hunting are scarce. We examined the influence of oil and gas development density on hunting success within all hunt areas in Wyoming from 2008 to 2014 for three big game species: Cervus canadensis (elk), Odocoileus hemionus (mule deer), and Antilocapra americana (pronghorn). Using 'harvest per hunter day' as a response, we compared linear mixed-effects models for each species that included either total well density (all wells constructed up to the year of record) or active well density (only those wells currently producing oil/gas in that year) as the key predictor variable. Models also accounted for the fixed-effects of road density, hunter density, proportion of the area that is public land unrestricted to hunters, proportion of the area that is forested, and year of observation, as well as random variation among hunt areas nested within associated game herd units. Presence of oil and gas wells had a positive influence on hunting success for elk and mule deer, with no overall influence on pronghorn, though effects varied depending on the animal's life-stage and sex. Changes in hunting success as a result of oil and gas development could have subsequent impacts on hunter satisfaction and game populations, issues relevant to both hunters and wildlife managers.

Presenter: Dowdell, Jennifer A

Title: Ecological planning in parks and open space along the Gulf Coast

Authors: Jennifer A Dowdell (Biohabitats Inc.);

Session: Planning

Abstract: While green infrastructure is most frequently associated with stormwater management in the field of environmental consulting, there is a growing acknowledgment of the importance of systems-thinking in long-term planning. Public open spaces like parks, trails, and greenways, are key elements in the broader application of ecological principles associated

with corridors, connectivity and ecosystem services. In the southeastern US, there is the added complexity of climate change considerations including sea level rise, large storms, impacts of urbanization on water quality, and the particular sensitivity of the Gulf ecosystems to development pressures. Dunes and bayous are two specific systems that are experiencing increased pressure as recreation, tourism and economic drivers stay at the forefront of design and planning. Landscape architects are working with planners, ecologists and academics in an iterative process that invigorates the design process and inserts ecological function as a key driver for revitalization with restoration. A series of case studies delves into an interdisciplinary design and planning approach that applies ecological principles at the site and watershed scale with a focus on Louisiana and Alabama.

Presenter: Drake, Joseph C

Title: Impacts of temporary and permanent isolated water resources in the Sonoran Desert on connectivity, isolation, and wildlife management strategies: An example of transient connectivity

Authors: Nancy E McIntyre (Texas Tech University);Joseph C Drake (Texas Tech University);Kerry L Griffis-Kyle (Texas Tech University);

Session: Connectivity

Abstract: Desert waters are rare resources that act as literal oases to support a number of endemic, rare, or sensitive species, so water supplementation is a commonly used wildlife-management tool in arid and semi-arid regions. However, such supplementation may also have unintended negative consequences. A network of 82 natural waters (67 charcos, 15 natural tinajas) on the U.S. Air Force's Barry M. Goldwater Range East (BMGR-E) and Bureau of Land Management (BLM) lands in the Sonoran Desert of Arizona has been supplemented with 35 anthropogenic waters (13 modified tinajas and 22 artificial catchments, i.e. "guzzlers") to support wildlife with various water-use strategies and dispersal capabilities. We used graph theory and circuit theory to explore the influence of highly ephemeral (but abundant) charcos and artificially permanent guzzlers on structural and functional connectivity in the BMGR-E/BLM lands. Guzzlers are important wildlife management tools and appear to play an outsized role in countering the natural isolation of Sonoran Desert waters. However, this reduction in isolation could harbor unintended consequences by providing low-suitability habitat for native amphibians and by facilitating the spread of invasive species and zoonotic diseases. Circuit theory simulations helped illustrate landscape influence on animal movements between waterbodies. Simulated removal of waters allowed us to generate a prioritized list of waters found to be consistently important for connectivity conservation for wildlife (large and small) on BMGR-E and adjacent BLM lands. Such an approach could be adopted in situations where

quantitative assessments of connectivity among habitat patches and management options are needed.

Presenter: Duveneck, Matthew J

Title: Tradeoffs between increased gross photosynthesis and increased respiration demand under climate change: Seasonal and spatial variability in New England

Authors: Matthew J Duveneck (Harvard Forest, Harvard University);Jonathan Thompson (Harvard Forest, Harvard University);

Session: LANDIS Modeling

Abstract: New England includes diverse forest types that vary spatially based on climate, topographic position, and forest recovery dynamics stemming from colonial land use. The net effect of anticipated increases in temperature on forest productivity in this region will depend on trade-offs between two counteracting processes, the strength of whose effects also vary spatially based on the same factors. First, productivity may increase due to longer growing seasons; and, second, productivity may decrease due to greater respiration and evaporative demands. In effect, increased growth in the shoulder seasons (spring and fall) may be offset by declines in growth during the peak growing season. How the seasonal and spatial variability of growth and respiration will affect future forests remains uncertain. For example, conifer forests may respond more favorably to climate change due to evergreen foliage responding immediately to warmer spring temperatures compared to deciduous forests. We used LANDIS-II/PnET-Succession to simulate monthly forest growth in New England under a high emissions climate scenario (RCP 8.5) under four separate downscaled Global Circulation Models from 2010 to 2110. Preliminary results suggest that within most New England forests productivity enhancements due to longer growing seasons compensated and outweighed increased respiration and evaporative demand. However, large spatial variability existed in the seasonal tradeoffs associated with net growth.

Presenter: Dyer, James M

Title: Incorporating interactive climatic influences on tree growth rates in the mid-Atlantic U.S.

Authors: James M Dyer (Ohio University);Elizabeth R Matthews (NPS Inventory and Monitoring, National Capital Region Network);John P Schmit (NPS Inventory and Monitoring, National

Capital Region Network);Aaron S Weed (NPS Inventory and Monitoring, Mid-Atlantic Network);James A Comiskey (NPS Inventory and Monitoring, Mid-Atlantic Network);Norman A Bourg (Conservation Ecology Center, Smithsonian Conservation Biology Institute);William J McShea (Conservation Ecology Center, Smithsonian Conservation Biology Institute);JP Campbell (NPS Inventory and Monitoring, National Capital Region Network);

Session: Landscape Dynamics I

Abstract: Successional patterns in eastern U.S. forests are influenced by historic land use patterns, herbivory pressures, disturbance, specific site conditions, and climate change – both historic and ongoing. In an effort to quantify the effects of climate on rates of tree growth, data on >28,000 trees from permanent plots across ~20 study sites in the Mid-Atlantic region (National Park Service Inventory and Monitoring Networks and a Smithsonian field station) have been linked with PRISM climatic variables. This presentation focuses on the development of interactive climatic variables for the analysis. An ArcGIS Water Balance tool is presented, that computes a monthly water balance for each study site using readily-available data layers; water balances are computed for each pixel within 10-meter digital elevation models for the years 2007-2013. Moisture availability is a function of precipitation and soil available water capacity, whereas moisture demand (potential evapotranspiration) is determined by temperature and topographically-controlled radiation load, incorporating interactive effects between temperature and radiation throughout the day. Compared to stand-alone climatic variables, or standard proxy variables such as slope and aspect, an integrative water balance approach enables a biologically-meaningful assessment of vegetation-site relationships. Micro-climatic relationships vary by species, and may also vary within an individual species across size classes. Results demonstrate the utility of adopting a fine-scale approach to examining species response to climate, both past and future.

Presenter: Edwards, Thomas C

Title: Selecting optimal watersheds for restoration efforts in the Colorado Plateau of western North America given economies of energy development

Authors: Thomas C Edwards (USGS / Utah State);Jacob R Gibson (Utah State University);

Session: Planning

Abstract: The Colorado Plateau of western North America contains large energy reserves currently under development or proposed for development. The Plateau is also home to considerable biodiversity. In addition, the ecological integrity of many areas in the Plateau have been degraded due to suppression of natural disturbance factors like fire, or the influx of

invasive species. Many of these areas are amenable to management manipulations for restoration purposes. Using a MARXAN framework, we ran 5 different scenarios of restoration potential vs. energy development and rank-ordered the locations of potential restoration from highest to lowest. Restoration potential was based on ability to manipulate current habitat within watersheds given sets of biodiversity. Energy development was considered at two levels: current, in-place infrastructure (eg well-heads) not amenable to change, and potential energy development defined as future risk. Results indicate that upwards of 80% of the higher energy potentials could be realized while affording restoration opportunities to 80% of the watersheds. Variable land tenure complicates the findings given a mixture of private and state lands co-mingled with Federal lands, each of which has different required legal responses under ESA listing.

Presenter: Efroymson, Rebecca A

Title: Investigating sustainability issues in bioenergy resource assessments: The example of the US 2016 Billion-Ton Report

Authors: Rebecca A Efroymson (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Matthew H Langholtz (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Kristen Johnson (US Department of Energy, Bioenergy Technologies Office);Bryce J Stokes (Allegheny Science & Technology);Zhangcai Qin (Argonne National Laboratory);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: Global, national, state, and regional resource analyses have been conducted to estimate the potential biomass that can be generated on a land area under specific biophysical or price assumptions. Because bioenergy is renewable, there is an interest in quantifying the sustainability of projected biomass with respect to environmental categories of sustainability. These categories include soil quality, air quality, water quality and quantity, greenhouse gas emissions, and biodiversity. We provide information on how sustainability requirements that may affect biomass resource potential estimates can be implemented in models, i.e., by 1) restricting areas on which bioenergy crops may be grown or residues may be collected, 2) restricting crop choices in particular locations to those that meet sustainability objectives, 3) implementing management practices that maintain or enhance sustainability, 4) implementing targets for sustainability, or 5) altering farmer or forester choices. Alternatively, the environmental effects of biomass potential across maps can be assessed, compared to baselines or business-as-usual scenarios. Analyses for the US Billion Ton report are incorporating a few of these strategies in sustainability evaluations performed by DOE national laboratories and the USDA Forest Service. We will discuss scenarios and approaches for environmental sustainability analyses in the US Billion Ton report.

Presenter: Eichler Inwood, Sarah E

Title: Cover crops reduce agricultural nutrient export in a simplified model of land use change in the Upper Beaver Creek Catchment, Ohio

Authors: Sarah E Eichler Inwood (University of Tennessee);Virginia H Dale (Oak Ridge National Laboratory);

Session: Poster

Abstract: The detrimental effects of excess nutrients to receiving waters are well documented. Ohio's Nutrient Reduction Strategy guidelines list a goal of cover crop (CC) implementation on 50% of all farms in "highly targeted" watersheds (OH EPA 2013). Data are lacking on the impact CC may provide to phosphorus and nitrogen water quality goals. The Upper Beaver Creek catchment ("UBCc": HUC12 041000090505 Ohio) is a useful pilot case study for modeling the potential impact of CC in an impaired, predominately agricultural (>90%) subwatershed of the Lake Erie basin. Using geographic information system (GIS) and statistical meta-analysis, we determined (1) CC may reduce annual N export by two-thirds and P export (based on preliminary meta-analysis) by one-fourth, and 61% of agricultural land in the UBCc is suitable for CC within a corn or soybean rotation; (2) a non-random static model of CC implementation results in over 90% of suitable area having CC after 10 years of outreach involving 20% 'new CC land owners' each year applying CC to 10% of acreage; (3) CC could thus reduce N by ~60% and P by ~50% of UBCc annual export compared to SPARROW load predictions after 10 yrs of CC outreach; and (4) simplified economic estimates include small yield boosts and reduced fertilizer needs that offset seed costs and result in additional gain (~$86/ha) to farmers implementing CC in the UBC catchment. Future research would assess the impact of CC on soil carbon storage and expand the model to examine the potential usefulness of CC across the Lake Erie basin.

Presenter: Endries, Mark J

Title: Using Maxent and Geographic Information Systems to assist with aquatic and terrestrial conservation efforts in the Southeast United States

Authors: Mark J Endries (US Fish and Wildlife Service);

Session: Conservation Biology II

Abstract: To better understand the spatial distribution of fish, wildlife, and natural habitats in North Carolina and the greater Southeast United States, the U.S. Fish and Wildlife Service's Asheville Field Office incorporates the tools of geographic information systems and maximum entropy modeling to create predictive habitat maps for a wide range of terrestrial and aquatic species. Predictive habitat maps for 289 different freshwater aquatic species were created and summarized into a statewide prioritization of all streams in North Carolina in order to gain a better understanding of freshwater aquatic species in the state. The maps were derived by comparing species occurrence information with a suite of stream- and landcover-derived environmental variables. The maps identify the predicted probability of suitable habitat conditions, by species, for each stream segment in North Carolina. To create a statewide prioritization of all streams in North Carolina, 257 species maps were summarized using a weighted NatureServe global rank scheme. Predictive distribution maps covering a large portion of the Southeast have also been created for two species of bats—the Indiana bat and the northern long-eared bat. These maps were created using a combination of landscape-landcover- and climate-derived variables. The maps add additional information on the potential locations of these secretive species. The maps and data associated with the work facilitates the communication of this information with partners to assist with conservation planning efforts throughout the state and Southeast. How the work is being integrated with current conservation efforts will be discussed.

Presenter: Evans, Samuel G

Title: The role of economics in understanding biodiversity in bioenergy landscapes

Authors: Samuel G Evans (University of California, Berkeley);Matthew Potts (University of California, Berkeley);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: Biofuel production is shaping large-scale transformations in land use, both in the United States and globally, that will have important consequences for biodiversity and species conservation. Results from two regional case studies are presented to illustrate the importance of factoring economic behavior and decision-making into biodiversity assessments of biofuel production. The first explores the impact of the 2006-2012 surge in corn ethanol demand on grassland bird species in the Midwest. The second provides an ex ante analysis of the potential impact of dedicated energy crop production on species of conservation concern in the US. Results from both examples suggest that the spatial distribution of biofuel feedstock production, and associated impacts on biodiversity, is primarily driven by landowner responses

to agricultural commodity markets and land values. Understanding the role of economic behavior in shaping bioenergy landscapes is therefore critical in helping to proactively mitigate any negative consequences on biodiversity and other environmental indicators.

Presenter: Farina, Almo D

Title: The Ecoacoustic Event Identification (EEI): A new tool to explore soundscapes

Authors: Almo D Farina (Urbino University);Paolo Salutari (Int. Institute of Ecoacoustics);Enrico Tognari (Int. Institute of Ecoacoustics);Alex Lombardi (Int. Institute of Ecoacoustics);

Session: Assessment III

Abstract: We define ecoacoustic events as inclusive portions of soundscape, at which we recognize distinct roles and/or meanings. Theecoacoustic events may be represented by geophonic, biophonic,and technophonic sounds (e.g., thunder, ice melting, eruptions,currents, different typologies of wind and rain, morning and duskchoruses, alarm calls, human voices, blasts, horns, bells, androad and airplane traffic) and their combinations. Their identification results in great assistance to better interpret soundscape composition and dynamics.We propose an ecoacoustic event identification (EEI) model articulated in the following three successive steps:1) Processing acoustics files by adopting the acoustic complexity index (ACIf and ACIt) methodology.2) Combining ACIf with its temporal evenness (ACIfe) in an Euclidean space, which we call ecoacoustics event space (EES),after the assumption that the value of ACIf found in a temporal interval (e.g., one minute) may have a different temporal distribution inside the sampled time. For instance, heavy rainsare characterized by high values of ACIf and ACIfe, while background isolated calls of a bird are characterized by low values of ACIf and ACIfe. The application of empirical thresholdsto both the metrics can restrict the identification process to events of interest.3) Searching for significant correlations between the selected events and a library of classified acoustic signatures (ACIt) to complete the identification process. Due to the capacity to classify a large amount of acoustic data in a short time, EEI results in a powerful tool for analysis of large data sets from long-term monitoring programs of soundscape surveys.

Presenter: Fasona, Michelle I

Title: Landscape occurrence and diversity of large mammals in Omo-Shasha-Oluwa Forest Reserves, southwest, Nigeria

Authors: Michelle I Fasona (University of Lagos);Queen O Omoregie (University of Lagos);Rosemary I Egonmwan (University of Lagos);

Session: Conservation Biology II

Abstract: The occurrence and diversity of large mammals study was done in the Omo-shasha-Oluwa forest reserves. The study area was stratified into four habitat type (Natural forest, Gmelina plantation, Teak plantation and Agricultural lands) based on the land-use of the study area. Transects were used to identify large mammals in each habitat type in the study area. A total of nine large mammal species were recorded during the study included; Red-capped Mangabey (Cercocebus torquatus), African Civet (Civettictis civetta), Bush Buck (Tragelaphus sylvaticus), Forest Buffalo (Syncerus caffer nanus), Forest elephant (Loxodonta africana cyclotis), Red River Hog (Potamochoerus porcus), Mona Monkey (Cercopithecus mona), Maxwell's duiker (Cephalophus maxwelli) and Black duiker (Cephalophus niger), Variation in species diversity was evaluated using diversity indices. The Maxwell's duiker had the highest relative abundance (45.6 %). It was observed that species were more abundant (Mean= 9 ± 3.009, S.D= 9.027) in natural forest compared to Gmelina plantation (3.777 ± 2.259, S.D= 6.778), Teak plantation (1.55556 ± 1.068, S.D= 3.205) and Agricultural lands (0.777 ± 0.323, S.D= 0.971. Species diversity in natural forest was higher (H'= 1.798) when compared to Agricultural lands (H'= 1.475), Gmelina plantation (H'= 1.136) and Teak plantation (H'= 0.994). Urgent conservation measures and appropriate management plans are needed to conserve the wildlife diversity across the Omo-Shasha-Oluwa forest landscape.

Presenter: Fei, Songlin S

Title: Biotic resistance of invasive species

Authors: Songlin S Fei (Purdue University);Basil Iannone (Purdue University);Qinfeng Guo (USDA Forest Service);Christopher Oswalt (USDA Forest Service);Kevin Potter (North Carolina State University);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: Biotic resistance, the ability of a community to suppress the establishment of exotic species, is a key concept in invasion ecology and management. While theory, experiments, and meta-analyses have suggested that diverse communities are less invasible than species-poor communities, other studies have suggested the opposite, especially at large spatial scales. We use an observational dataset with more than 44,000 forested plots across the eastern United States to rigorously test diversity-invasibility relationships. Plot-level invasive plant cover and

richness have hump-shaped associations with native plant biomass and richness, relationships not detected by previous, data-limited studies. Invasive cover and richness peak at intermediate levels of native biomass and richness, then decrease above these thresholds. Our results suggest that biotic resistance commonly occurs, but only above certain thresholds of native biomass and richness. Our analysis reveals how the observed invasion paradox can emerge from comparing studies using different sample sizes or sampling at varying spatial scales.

Presenter: Filotas, Elise

Title: Ecological resilience of fragmented forests: linking functional response diversity with landscape connectivity

Authors: Elise Filotas (Centre for Forest Research, TELUQ, Université du Québec);Dylan Craven (German Centre for Integrative Biodiversity Research);Virginie A Angers (Centre for Forest Research, Université du Québec à Montreal);Christian Messier (Centre for Forest Research, Université du Québec à Montreal);

Session: Assessment I

Abstract: Management plans for forest landscapes often ignore how local disturbances and habitat fragmentation jointly operate on ecological resilience at different scales. Functional response diversity (FD) has been proposed as a proxy for quantifying ecological resilience, given its ability to capture the variation in community-level responses to a range of disturbances. In this study, we evaluate the extent to which functional connectivity of fragmented forests, a landscape-level property, can buffer the impacts of anthropogenic disturbances on FD at local scales.We inventoried patches of private forests in an agricultural landscape in Centre-du-Québec, Canada, and calculated FD and community-weighted means to quantify the effects of forest-use intensity on ecological resilience. Subsequently, we constructed a regional map of FD, from which a spatial network was extracted. To assess potential impacts of fragmentation on FD at the landscape scale, we examined how the functional connectivity of the landscape, measured by the probability of connectivity (PC), varied across a range of maximum seed dispersal distances. Lastly, we evaluated the importance of individual forest fragments in maintaining landscape FD by measuring the connectivity fractions of PC. Across tree communities, ecological resilience was low as FD increased sharply with species diversity. FD was maintained across the landscape by forest fragments acting as intermediate stepping stones in the transfer of seeds. This study provides a novel application of spatial networks in fragmented forests that illustrates the need for management plans to simultaneously consider the effects of anthropogenic disturbances on both local and landscape scales.

Presenter: Fitzgerald, Maegan A

Title: Functional heterogeneity of Pan troglodytes in montane rainforests

Authors: Maegan A Fitzgerald (Texas A&M University);Robert N Coulson (Texas A&M University);

Session: Poster

Abstract: Tropical forests and the biodiversity within them are rapidly declining in the face of an increasing human population. Resource management and conservation of endangered species requires an understanding of functional landscape heterogeneity and species distribution modeling (SDM) is suitable for this purpose. In this study, maximum entropy SDM was used to identify areas of suitable chimpanzee (Pan troglodytes) habitat based on the location of nests and other environmental variables. The model was run at two different scales, 1 km and 30 m spatial resolutions. The models accuracy was higher at 30 m (AUC = 0.818) than it was at 1 km (AUC = 0.444; less than a random expectation, which is AUC = 0.5). Additionally, at 30 meters, the variables most influencing habitat suitability are elevation (23.2% permutation importance) and precipitation (17% permutation importance for precipitation of the coldest quarter; 10% permutation importance for precipitation of the wettest month). The results highlight the importance in considering spatial scale when addressing the effect of functional landscape heterogeneity on species distribution.

Presenter: Flake, Samuel W

Title: Scale-dependent tree mortality in semiarid woodlands: Incorporating fine-scale stand structure improves predictions of mortality and canopy dieback

Authors: Samuel W Flake (University of Nevada, Reno);Peter J Weisberg (University of Nevada, Reno);

Session: Forests, Weather and Climate

Abstract: Severe drought has caused extensive mortality and canopy decline of trees in semiarid regions, and droughts are predicted to become more severe and frequent under future climate scenarios, potentially causing dramatic landscape change. Understanding the drivers of tree mortality at different scales is critical to predicting resilience to future droughts.

Topography and climate are primary influences over coarser scales but competition and microsite variability exert strong proximate influence on finer-scale patterns of tree mortality. To understand the importance of fine-scale stand structure on canopy die-back and stem mortality, we resampled a network of permanent plots in central Nevada pinyon-juniper woodlands and calculated distance and size asymmetry between neighbors, as well as tree density at varying spatial scales. At a coarser scale, we compared changes in Landsat NDVI from 2005 to 2015 to field-measured tree canopy mortality from the same time period. Having a close neighbor increases canopy mortality, but the effect depends on tree species and site-level water deficit. Nearest-neighbor distance has an opposite effect as plot-level stand density on tree mortality (trees in dense stands have lower canopy mortality), indicating that competition as a fine-scale process may be more important than density at a stand scale. Plant-plant interactions are an important driver of tree mortality, but their context- and scale-dependent nature creates difficulties for predicting future changes in woodlands. We present a model of tree mortality using Landsat data, and discuss the relative importance of fine-scale processes in scaling up field data to a regional model of tree mortality.

Presenter: Florence, Kuukyi S

Title: The prevalence of insects that visit cashew (Anacardium occidentale L) plant during the flowering and fruiting seasons in northern Ghana

Authors: Kuukyi S Florence (Ga South Municipal Assembly);Edward D Wiafe (Presbyterian University College-Ghana);

Session: Ecosystem Services II

Abstract: Information of insect complex associated with crops is necessary for early pest managing strategies for the crops. Field survey was conducted from December 2014 to April 2015, to collect and identify insects on cashew during flowering and the fruiting seasons. The survey was conducted in Ghana on ten farms. Five farms closer and five farms away from a forest reserve, each farm with four plots of area measuring 20m x 25m were established. Insects found on cashew plant during flowering and fruiting seasons were identified and counted. Insects enumerated in the farms closer to the forest reserve during the flowering season was 6161 with a mean of 1232.2 (SD=250.7, N=20) insects per plot. The density was 6161 insects per ha in the farms. Diversity of insects was 3.34. Insects enumerated in the remaining five farms away from the forest was 4665 with a mean of 933 (SD=143.5, N=20) species per plot. Density was 4665 insects per ha. with a diversity of 3.13. Total number of insects enumerated in farms closer to the forest during the fruiting season was 2745 with a mean of 549 (SD=103.2, N=10) insects per plot. Density of insects per hector was 2745 and diversity was 3.56. Insects enumerated in the remaining farms away from the forest was 2056

with a mean of 411.2 (SD=52.1, N=10) species per plot. Density of insects per hector was 2056 and diversity was 3.14. This indicates that, there were difference among insects that associate with cashew plant during flowering and fruiting seasons.

Presenter: Forester, Brenna R

Title: Landscape genomics as a tool for conservation planning: The case of an endemic, montane salamander threatened by climate change

Authors: Brenna R Forester (Duke University - University Program in Ecology);Dean L Urban (Duke University - Nicholas School of the Environment);Thomas F Schultz (Duke University - Division of Marine Science and Conservation);Jennifer J Wernegreen (Duke University - Center for Genomic and Computational Biology);Rob R Dunn (North Carolina State University - Department of Biological Sciences);

Session: Genetics

Abstract: Faced with climate change, organisms either adapt in place or move—or they go extinct. Relative to dispersal, adaptive responses remain poorly understood. Fortunately, the recent development of techniques for detecting adaptation in wild populations has improved our ability to evaluate this response. We are using reduced representation, next-generation sequencing in combination with multivariate statistical methods to identify and understand spatial patterns and environmental drivers of local adaptation and gene flow in an endemic salamander. Plethodon welleri is a fully terrestrial salamander (lacking lungs and breathing through its skin) and is a species of conservation concern across its small range in the Southern Appalachian Mountains. Our analysis of neutral single nucleotide polymorphism (SNP) markers indicates significant differentiation in P. welleri populations both across mountain peaks and within elevation gradients indicating restricted gene flow. Additionally, these populations show a signal of local adaptation at SNP markers potentially under selection based on temperature and relative humidity. These analyses are helping us better understand the capacity of species to adapt to changing conditions and what actions will be most effective to conserve salamander biodiversity under global change. Additionally, our approach is applicable across taxa and montane systems, where the distribution of species on mountain peaks provides a naturally replicated environmental gradient for distinguishing local adaptation.

Presenter: Frans, Veronica F

Title: A whale of a tale: using local knowledge to predict baleen whale distribution around the Falkland Islands

Authors: Veronica F Frans (South Atlantic Environmental Research Institute, Stanley, Falkland Islands);Amélie A Augé (South Atlantic Environmental Research Institute, Stanley, Falkland Islands);Jan O Engler (Zoological Researchmuseum Alexander Koenig, Bonn, Germany);Hendrik Edelhoff (Dept. of Wildlife Sciences,Georg-August-University Göttingen, Göttingen, Germany);

Session: Coastal and Marine

Abstract: The whaling era of the 19th and 20th centuries had depleted whale populations worldwide, with the Falkland Islands as no exception. Local anecdotes indicate that whales were not seen in the Falklands' inshore waters for decades. Yet, over the past 20 years, there has been an increase in whale sightings, indicating a possible population recovery in the area. However, there is no consolidated knowledge on their historical or contemporary distribution or numbers to support this claim. With possible oil and gas exploitation in the near future, it is vital to map key habitats for whales in order to mitigate the risks to this potentially recovering population. Here, we present how all existing capture, opportunistic, and survey records were collected to generate a catalog of empirical data on baleen whale numbers and sighting locations around the Falkland Islands. As few post-whaling records exist, this dataset was further supplemented with anecdotal occurrence information obtained from interviewing local residents. Historical and contemporary whale sighting "hotspots" were identified for both the empirical and anecdotal datasets. A species distribution model was then used to predict baleen whale distribution based on available environmental variables for the Falklands' inshore and offshore waters. Predictions generated from the anecdotal dataset were compared with the empirical dataset predictions to see if anecdotal data could indeed be used as a supplement in seascape modeling when presence records are lacking. The outcomes of this work will provide valuable baseline information on baleen whale distribution for future cetacean management and monitoring efforts.

Presenter: Fraser, Jacob S

Title: Modeling responses of Eastern U.S. forests to climate change using a forest ecosystem model

Authors: Jacob S Fraser (University of Missouri);William D Dijak (U.S. Forest Service Northern Research Station);Brice B Hanberry (University of Missouri);Frank R Thompson III (U.S. Forest Service Northern Research Station);Hong S He (University of Missouri);

Session: Biogeography

Abstract: Responses of forests to climate change involve complex interactions among vegetation, soil, and climate in forest ecosystems, which presents unique challenges in modeling. We used a new forest ecosystem model (LINKAGES 3.0) to project the growth of forests across the eastern United States under five General Circulation Models (GCMs) and two Representative Concentration Pathways (RCPs). The mean maximum temperature is projected to increase in all five GCMs across the entire Eastern U.S. while precipitation changes vary among the five GCMs. We parameterized the model at the ecological subsection scale using over 46,000 forest inventory plots from the US Forest Service Forest Inventory and Analysis (FIA) and soil data from the USDA Soil Survey Geographic Database (SSURGO) and simulated forest growth at a daily time-step for 200 years under the 10 climate scenarios. Two of the GCMs under both RCPs showed significant decreases of total forest biomass within the Eastern Broadleaf Forest, Laurentian Mixed Forest, and the Coastal Plain Mixed Forest. All five GCMs showed a general increase in total forest biomass in the New England and Central Appalachian forest regions.

Presenter: Frazier, Amy E

Title: Patch-based vs. gradient paradigms: Bridging the gaps to measure local forest fragmentation dynamics

Authors: Amy E Frazier (Oklahoma State University);

Session: Fragmentation

Abstract: Fragmentation is an ongoing threat in forest communities, particularly in the eastern U.S. where the prevailing pattern of dispersed, low intensity development penetrates intact forest, increasing the amount of wildland urban interface (WUI). Remote sensing-derived land cover maps are frequently used to study forest fragmentation, but pixel-based classifications are inconsistent with ecological theory as they ignore the gradient nature of the environment. This study seeks to bridge the gaps between patch-based and gradient paradigms by using traditional patch-based tools (i.e., spatial pattern metrics) in conjunction with gradient land cover surfaces of tree canopy cover (TCC) and impervious surface area (ISA) to investigate development as a proximate driver of forest fragmentation at the local, pixel scale. The study area comprises the Piedmont ecoregion in the eastern U.S., which is experiencing extensive forest fragmentation. Gradient land cover surfaces are discretized into multiple maps through a threshold approach and subjected to spatial pattern analysis. The multiple metric values for each landscape are graphed as scalograms and fit with curves to determine the rate of change of fragmentation across forest density. These graphs are compared to similar plots of ISA metrics to determine the relationship between the two. Results show that gradient surfaces

analyzed in this manner can provide more information regarding the dynamics and causes of forest fragmentation than traditional single-value metrics. Further, results indicate that low density urban development (< 10%) is found mainly in conjunction with dominant forest densities (60-90%), thus providing evidence of WUI dynamics in the region.

Presenter: Fricker, Geoffrey A

Title: Predicting spatial patterns of guild diversity from LiDAR forest structure and topography in a tropical forest

Authors: Geoffrey A Fricker (University of California, Los Angeles);Jeffrey A Wolf (Columbia);Thomas W Gillespie (University of California, Los Angeles);Stephan S Schnitzer (Marquette University);Liza S Comita (Yale School of Forestry);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: Vertical forest structure and ground topography provide indirect information about light and water availability in tropical forests. Because plant growth forms differ in key resource acquisition traits, we hypothesized that remotely acquired data quantifying forest structure and topography could be used to predict patterns of guild level diversity and density. We also investigated whether patterns of diversity within guilds coincided with community-level patterns of diversity or whether there is evidence for alternative responses to resource gradients at the guild level. We found plant growth forms respond differently to light and water resource gradients. When considering all plant species, species richness and stem density are uncorrelated (r2 = 0.01, r2=0.02) with water availability. When considering individual plant guilds, the density and richness of species of shrubs and small understory trees were positively associated (r2 = 0.06, r2 = 0.44) with higher water availability while mid-story and tall canopy tree species were negatively associated (r2 = 0.37, r2 = 0.39) with water availability indicating a partitioning of water resources by plant species of different guilds. Liana species richness and density was highly correlated (r2 = 0.45, r2 = 0.47) with high light availability, but was not strongly associated with any topographic environment. This research takes a novel approach to analyzing plant species richness and density at the guild level. The results indicate that plant guilds respond differently to resource gradients and that remote sensing has the ability to detect fine scale environmental gradients which can predict plant richness across the landscape.

Presenter: Fu, Jing

Title: Applying spatial resilience concept to landscape pattern analysis of mega city: A case study on city of Shanghai

Authors: Jing Fu (Shanghai Normal University);Jun Gao (Shanghai Normal University);

Session: Poster

Abstract: As we knew from the “World Urbanization Prospects The 2014 Revision”, Shanghai has ranked the third mega city on the world, more than 230 million people lives in this developing city. While the pollution, such as air pollution has become a worse pressure on the environment. The most important event during December 2013 has shown the smog was a severe air pollution episode that affected East China, including all of the municipalities of Shanghai. Spatial resilience is a new concept that can connect researches with landscape and social-ecological system (SES). This concept may be a suitable method to analysis the relationship between ecosystem and social system. In this study, we apply the concept of spatial resilience to the assessment and management of the mega city. We consider five criteria as indexes, which including: landscape pattern, vegetation cover (NDVI), urban heat island (UHI), population attribution and GDP. All of these data can be visualized by geographic information system (GIS) to thematic map. We use Moran's I to intergrade and calculate these criteria, the result was divided into five classes, show the important of resilient zones. The thematic maps can be used as reference for government.

Presenter: Fu, Xiao

Title: Vegetation dynamics and landscape change factors in a large coal power complex

Authors: Xiao Fu (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Mingfang Tang (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);

Session: Poster

Abstract: We monitored the vegetation dynamics and landscape change in a large coal power and mine complex and investigated the factors influencing these dynamics. The findings improve the understanding of the impact of climate change and human activities on vulnerable ecosystems. We used normalized difference vegetation index (NDVI) images derived from a 16-day maximum-value composite of Moderate Resolution Imaging Spectroradiometer (MODIS) data, and employed the greenness rate of change and coefficient of variation as indicators of the vegetation dynamics in Xilinhot, Inner Mongolia, from 2001 to 2013. We investigated the

driving factors of vegetation dynamics and landscape change in different locations based on correlation and stepwise regression analyses. The results show that the vegetation dynamics of the study area have improved over the past 13 years. The vegetation dynamics were highly correlated with the average relative humidity of the current month. That is, the vegetation dynamics in the study area were mainly influenced by meteorological factors. Some regions suffered from vegetation degradation, accounting for 15.27% of the total area. The NDVI values of regions displaying vegetation degradation were jointly influenced by meteorological and human factors. The degree of vegetation degradation was negatively correlated with the population engaged in secondary industry. This indicates that industrial and mining development was the primary cause of vegetation degradation. However, the development of animal husbandry (characterized by the number of livestock on hand at the end of the year) had no significant influence on the vegetation dynamics.

Presenter: Fuentes, Rodrigo E

Title: Assessing the effects of landscape change on the provision of water supply and quality through spatially explicit modeling

Authors: Rodrigo E Fuentes (Universidad de Concepción);Cristian M Echeverría (Universidad de Concepción);Andrés A Esparza (Universidad de Concepción);

Session: Poster

Abstract: The south-central Chile is characterized by exhibiting substantial changes as a result of human-induced processes. These changes have led to the homogenization of the landscape, either by the conversion of native forests to forest plantation of exotic species or to agricultural land. This landscape change may lead to a risk in the provision of ecosystem services for human well-being given by a loss of forest biodiversity. This work analyzed through the use of satellite images and a spatially explicit hydrological model the relationship between land use change and changes in the provision of ecosystem services such as water regulation. Water quantity and quality were measured in 40 watersheds in terms of annual flow (m3/s) and total phosphorus and nitrogen in rivers (mg/L) respectively. Our results showed a positive relationship between the degree of conversion of native forest to other land uses and a more irregular stream flow regimes and an increase of up to 25 times of the load of pollutants (mg/L). We expect that this study provides information about the effect of landscape change on the provision of water ecosystem services which can be crucial to support decision-making in conservation and watershed planning.

Presenter: Fullem, Abby K

Title: Climate, terrain and vegetation influence on wildfire skips

Authors: Abby K Fullem (Haverford College);Ganapathy Narayanaraj (Swarthmore College);

Session: Poster

Abstract: Burned areas have been relatively well studied in many geographic regions. However, the relationship of fire skips, unburned locations, to environmental variables is largely unknown to date. Therefore, we sought to examine the fire skips in relation to climate, terrain and vegetation factors. We analyzed six fires within the eastern Cascades mountain range of Washington State. Fire skip locations (cases) value generated from unburned areas and random control locations were generated and assembled from multiple federal agency data and Monitoring Trends in Burn Severity data. Both the case and control locations were intersected with the geo-processed explanatory climate, terrain and vegetation data and attribute values were extracted. We used a case-control logistic regression model for the probability of a fire skip taking place as a linear function of explanatory environmental variables. The statistical significance of the coefficients showed spatial associations between fire skips and climate, terrain and vegetation variables. We found that fire skip locations were concentrated in areas with lower temperature, lower elevation, cove areas and low vegetation cover. When wildfire moves across the landscape a heterogeneous mosaic pattern of burned, partially burned, and unburned patches emerges within the fire perimeter. Identifying potential fire skips may help land managers to identify localized species' habitat for conservation and to more effectively restore landscapes to enhance fire suppression tactics.

Presenter: Gagné, Sara A

Title: The effects of road and landscape characteristics on the likelihood of a Barred Owl (Strix varia)-vehicle collision

Authors: Sara A Gagné (University of North Carolina at Charlotte);Jennifer L Bates (University of North Carolina at Charlotte);Richard O Bierregaard (University of North Carolina at Charlotte);

Session: Wildlife II

Abstract: Collision with vehicles is a major if not the dominant source of mortality for owls. Despite this, there has been no study to date on Barred Owl-vehicle collisions, a species that breeds in densely-populated suburban neighborhoods with high road density. We capitalized on the availability of a large dataset of the locations of Barred Owls hit by vehicles and brought

to a rehabilitation center in Charlotte, North Carolina, USA to investigate the factors underlying collision incidence. Using autologistic regressions and multi-model inference, we found that the explanatory variables with the largest effects on the likelihood of a Barred Owl-vehicle collision were speed limit, road width, and habitat suitability within 825 m of roads, in that order. Speed limit and habitat suitability had positive effects whereas road width had a negative effect. Our results are in agreement with existing studies of birds that have investigated the relative effects of road features and landscape structure in demonstrating the greater importance of the former. Future research should include systematic Barred Owl roadkill surveys that account for sampling biases in order to determine the importance of roads as a source of mortality for the species and to gain a better understanding of the effects of roadway design on the incidence of Barred Owl-vehicle collisions.

Presenter: Galford, Gillian L

Title: Smallholder African land-cover and land-use change: Detection, constraints and impacts

Authors: Gillian L Galford (University of Vermont);Hope Michelson (University of Illinois, Urbana-Champaign);Greg Fiske (Woods Hole Research Center);

Session: Mapping spatiotemporal pattern and process: re-imagining arid grassland mapping from local to global scales

Abstract: Detecting change in land-use and land-cover is a challenge in dryland ecosystems, particularly in sub-Saharan Africa were remote sensing archives are sparse, cloud-cover is an issue and spectral as well as phenological distinctions between classes are fuzzy. Methods for classification in dryland ecosystems with relatively large parcel sizes, such as in the Brazilian Cerrado, have made much progress lately but extremely heterogeneous landscapes with very small-scale mixed fields, grasslands and dry forests remain difficult to distinguish classes. In Malawi, 80% of the population are small-holder farmers with average land holdings of 0.5-1.0 ha that creates a sufficiently complex landscape. Here, we address land-cover and land-use changes and their underlying drivers and constraints including inter- and intra-annual variations in precipitation, environmental variables such as soils, aspect, biomass, and socioeconomic characteristics including access to markets, metrics of health and extent of education. In particular, we focus on the socioeconomic and environmental constraints to crop health under a massive government intervention program from 2005-present with comparison to pre-subsidy trends. We present new methods for remote sensing analysis and classification utilizing the Google Earth Engine API. These land-cover and land-use change products are fused with socioeconomic data from multi-year household surveys. We find significant changes in land cover, food production and health outcomes, both positive and negative, and analyze these changes in the context of underlying socioeconomic and environmental constraints.

Presenter: Gaydos, Devon A

Title: Resilience of the diversity-disease risk hypothesis following wildfire disturbance

Authors: Devon A Gaydos (North Carolina State University);Ross K Meentemeyer (North Carolina State University);Krishna Pacifici (North Carolina State University);

Session: Forest Pests

Abstract: The potential for biodiversity to mitigate risk of infectious diseases in ecological communities – known as the diversity-disease risk hypothesis – is fundamental to understanding links between landscape change and environmental health. Under different contexts, ecological theory suggests that high biodiversity can either dilute or amplify disease risk, but empirical evidence to date has only considered static temporal relationships. Little is known regarding the resilience of biodiversity effects through time, particularly when complicated by other natural disturbances. Using Phytophthora ramorum, the causal agent of sudden oak death, as a case study, we investigate how this relationship responds to the restructuring of biodiversity following wildfire. A previous study of the P. ramorum pathosystem found evidence for a dilution effect in Big Sur, California, a region prone to disturbances. Following this study, two wildfires burned nearly half of our disease monitoring plots, creating a natural biodiversity manipulation experiment. Using 5 years of data spanning pre- and post-fire forest conditions, we examine this relationship using three hierarchical models of varying complexity: (1) a binomial generalized linear model (GLM) (2) a zero-inflated binomial GLM and (3) a zero-inflated binomial generalized linear mixed model (GLMM) with a spatial random effect. Our results indicate that the dilution effect was retained in both burned and unburned plots, suggesting that biodiversity effects are resilient to wildfire disturbances. These results provide valuable insights on how disease and disturbance interact to affect landscape health, an ever more pressing need as natural disturbance regimes continue to be altered by anthropogenic change.

Presenter: Gibson, Dainee M

Title: Scenario planning for land use change in the rapidly urbanizing southeast US: Conservation goals and tradeoffs

Authors: Dainee M Gibson (Furman University);John Quinn (Furman University);

Session: Urbanization and Landscape Change: Socioeconomic Drivers and Ecological Consequences

Abstract: Complexities in rates and patterns of change necessitate scenario planning to improve research, planning, and practice. The southeastern United States is undergoing rapid change due to change driven by urbanization. After summarizing local and regional data and collaborating with local stakeholders, we used InVEST software from the Natural Capital Project to develop and test nine stakeholder-defined scenarios for future land use development in Greenville Co., SC. These scenarios prioritize agriculture retention, native habitat conservation, and water quality improvement in a rapidly urbanizing landscape. In this project, we focused on assessing the opportunities and tradeoffs for local wildlife conservation, carbon sequestration, and stormwater controls within each of the future land cover scenarios in Greenville Co., SC. We found that there are distinct tradeoffs between the alternative futures. For example, only the two forest restoration scenarios and the food production scenario increase carbon sequestration values. Furthermore, modeling the impact of these alternative futures on three different species types produced conflicting results. Each species benefited from different types of alternative futures, demonstrating the need for clear conservation goals. Additionally, results indicate how lands currently used for recreation could complement other goals for the landscape. These data are valuable for landscape planning and conservation practice because they illustrate the importance of exploring tradeoffs between alternative futures across multiple systems and scales.

Presenter: Gill, Nathan S

Title: The Africanized honeybee in a telecoupling framework: a comparison between species distribution models for southern Utah and southern California

Authors: Nathan S Gill (Clark University);Florencia Sangermano (Clark University);

Session: Poster

Abstract: In an increasingly telecoupled world, the spread of invasive species has been both a product of and an influence on trade and trade regulation, in some cases creating large, unintentional economic and environmental costs. The Africanized honeybee (AHB) is an example of one such invasive species which spread from a laboratory in South America and is now well established among commercial honeybee colonies which are regularly transported and used for pollination services across the United States. The AHB poses a threat to the United States' agricultural industry because of potential decline in pollination services. Previous research has confirmed that the AHB may still expand its range farther north and that suitable

environmental factors for AHB distribution vary between broad regions of the country (southeast and southwest). This study examines similarities and differences in AHB distribution and the relative importance of environmental factors between two regions within the southwestern United States: southern Utah and southern California. The Maximum Entropy (MaxEnt) modeling approach was used to create two species distribution models of the AHB, one based in Utah, the other in southern California. In each model, variable importance was measured through percent contribution and permutation importance. Model performance was assessed through the area under the receiver operating characteristic curve (AUC). Models estimated AHB presence with high accuracy (AUC > .5) in original environments, but were less accurate (AUC < .8) in novel environments, suggesting that AHB in these regions may not have realized their potential geographic range.

Presenter: Giri, Chandra P

Title: Is the geographic range of mangrove forests in the conterminous United States really expanding?

Authors: Chandra P Giri (USGS);

Session: Coastal and Marine

Abstract: Changes in the distribution and abundance of mangrove species within and outside of their historic geographic range can have profound consequences in the provision of ecosystem goods and services they provide. Mangroves in the conterminous United States (CONUS) are believed to be expanding poleward (north) due to decreases in the frequency and severity of extreme cold events, while sea level rise is a factor often implicated in the landward expansion of mangroves locally. We used ~35 y of satellite imagery and in situ observations for CONUS and report that (i) poleward expansion of mangrove forest is inconclusive, and may have stalled for now, and (ii) landward expansion is actively occurring within the historical northernmost limit. We revealed that the northernmost latitudinal limit of mangrove forests in the east coast of Florida, west coast of Florida, Louisiana, and Texas has not systematically expanded toward the pole. Mangrove area, however, expanded by 4.3% from 1980 to 2015 within the historic northernmost boundary, with the highest percentage of change in Texas and southern Florida. Several confounding factors such as sea level rise, absence or presence of sub-freezing temperatures, land use change, impoundment/dredging, changing hydrology, fire, storm, sedimentation and erosion, and mangrove planting are responsible for the change. For instance, sea level rise is attributed to landward expansion, while relatively milder winters and the absence of sub-freezing temperatures in recent decades may be enabling the expansion locally. The results highlight the complex set of forcings acting on the northerly extent of mangroves and emphasize the need for long-term monitoring as this system increases in

importance as a means to adapt to rising oceans and mitigate the effects of increased atmospheric CO2.

Presenter: Glenn, Nancy F

Title: Deriving ground-based and airborne LiDAR metrics for habitat restoration on the Lower Colorado River

Authors: Lucas P Spaete (Boise State University);Bob Unnasch (Sound Science LLC);Sonja Kokos (US Bureau of Reclamation);Nancy F Glenn (Boise State University);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: Ground based and airborne lidar provide the vertical and horizontal structural data to assess components of habitat suitability for successful vegetation restoration. In this study we used a combination of terrestrial laser scanning (TLS) and airborne laser scanning (ALS) data to compare habitat based on vegetation structural heterogeneity for the endangered Southwestern Willow Flycatcher. This species once thrived in the riparian forests along the Lower Colorado River (LCR). As part of a 40 year program, the Bureau of Reclamation is creating and managing cottonwood-willow forests along the LCR to create suitable habitat for this species. We compared successful nesting and feeding areas within restoration areas along the Salt River in Arizona, with a variety of created forest plots along the LCR. The aim was to identify the structural heterogeneity of the successful habitat areas such that the heterogeneity could be replicated in the created LCR forests. Thus, the overall objective of the study is to identify quantitative measures of structural heterogeneity with TLS and ALS such that land management can use these targeted measures in their restoration and stewardship planning. We used the TLS data as baseline information to capture the 3-dimensional complexity and to corroborate the ALS metrics. We then developed a number of vertical and horizontal metrics from the ALS for the two study sites and demonstrate the differences in heterogeneity between the sites. While habitat suitability is more complex than the vertical structural heterogeneity, the data are a key resource in assessing suitable habitat.

Presenter: Gonzalez-Roglich, Mariano

Title: Pan-tropical deforestation trends from 2001-2013: Bigger chunks or smaller nibbles?

Authors: Kemen Austin (Nicholas School of Environment, Duke University);Mariano González-Roglich (Nicholas School of Environment, Duke University);Danica Schaffer-Smith (Nicholas School of Environment, Duke University);Amanda M. Schwantes (Nicholas School of Environment, Duke University);Jennifer J. Swenson (Nicholas School of Environment, Duke University);

Session: Landscape Dynamics II

Abstract: Tropical forests are critical for the functioning of the Earth as we know it. They annually capture and store more atmospheric carbon than any other terrestrial ecosystem, and provide habitat for a vast proportion of global biodiversity. Numerous human communities also inhabit tropical forests and rely on forest resources for their livelihoods. Rates of forest fragmentation and loss are accelerating at unprecedented rates and are now tracked through global products. However we lack understanding of the process and patterns of tropical deforestation. In this study, we used the most recent 30-m resolution global assessment of forest cover and deforestation to characterize trends in deforestation patch size across the tropics, by sub-region and by income group. Over the 13 year period, the overall rate of deforestation increased across the globe. Over this period the proportion of small clearings decreased and the proportion of larger cleared patches increased; indicating an increasing dominance of larger-scale industrialized drivers of deforestation. Upper middle income and South American countries were the only income group and region to experience slowing forest loss over time and a reduction in mean clearing patch size. We found that the unusual behavior of these two groups was driven by a single country, Brazil. Our results improve understanding of deforestation trends over time and space in the pan tropics and provide insight on the drivers of forest loss in different regions and economic contexts. This information can be used to inform forest conservation policies more broadly.

Presenter: Gorelick, David E

Title: Spatial optimization of bioenergy feedstock introductions in the Arkansas White-Red River Basin: Trade-offs between nutrient loadings and agricultural economic benefits

Authors: David E Gorelick (UNC Chapel Hill);Henriette I Jager (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);

Session: Poster

Abstract: The uncertainty of future energy security for the United States means new domestic, renewable energy resources must be considered. Second-generation (cellulosic) ethanol from feedstocks such as switchgrass, poplar, and sorghum will be crucial in helping the U.S. meet

legislative mandates for 2015 and beyond. However, conversion of cropland could adversely affect water quality and profit margins. To assess the impact of conversion, we conducted a multi-objective spatial optimization of bioenergy feedstock introductions to the Arkansas White-Red River Basin (AWR). To avoid computationally intensive optimization with the Soil and Water Assessment Tool (SWAT) model, we used first-order derivatives between simulated baseline and projected landscapes. Projected land use changes were consistent with the Billion Ton Update to estimate changes in water quality. Nitrate, total phosphorus, and sediment loadings were minimized while basin-wide economic benefits due to conversion were maximized within the optimization framework, subject to geographic constraints. Results highlighted trade-offs between economic benefit and water quality objectives. Pareto-optimal frontiers suggest a small decrease in economic benefits can produce a large relative improvement in water quality. Increased converted cropland area is correlated with greater economic benefit, though decreased converted area does not directly correlate to decreased nutrient loadings. Solutions with similar objective results had different spatial patterns; hypothetically, objective targets or governmental mandates could be reached in many ways. Our solutions can be confirmed in the future by SWAT modeling of our optimized landscapes.

Presenter: Goslee, Sarah C

Title: Shifting patterns of agricultural diversity

Authors: Sarah C Goslee (USDA-ARS);

Session: Ecosystem Services II

Abstract: Although monocultural cropping systems can provide the greatest yield efficiency in the short term, more diverse agricultural landscapes may contribute multiple ecosystem benefits. The USDA's Cropland Data Layer provides a yearly map of the agricultural lands of the continental United States broken down by crop type. Random Forest models related both individual crop distributions and local measures of agricultural landscape diversity and structure to climate. The climatic variables chosen determine temperature and water availability, and thus are important for plant species distributions. The models explained 89% of the variability in area planted to corn, 83% of the area planted to perennial grassland (hay and pasture), and 82% of the variability in local crop diversity. Models were used to make predictions on variables from climate change scenarios, and these predictions were merged with land use maps to characterize future agricultural potentials. Current centers of agricultural landscape diversity and productivity are determined by climate, but soil quality contributes to agricultural productivity, and infrastructure is required to translate production into food. Over time, optimal climatic areas will shift away from current agricultural centers into regions with less

favorable soils and less well-developed infrastructure. Characterizing these shifts in advance will enable us to adapt to changing climatic conditions, rather than to continually react.

Presenter: Gottdenker, Nicole L

Title: Heterogeneities in vector and host composition in fragmented forest landscapes: Relationships to Chagas disease and cutaneous leishmaniasis transmission in Panama

Authors: Nicole L Gottdenker (University of Georgia);Jose E Calzada (Instituto Conmemorativo Gorgas de Estudios de la Salud);Luis F Chaves (Nagasaki University);Azael Saldaña (Instituto Conmemorativo Gorgas de Estudios de la Salud);

Session: Landscape Change and Infectious Disease Ecology: Applications to Public Health

Abstract: Deforestation and forest fragmentation are associated with emergence of vector-borne zoonotic diseases. Understanding ecological, spatial, and seasonal heterogeneity in vector-borne zoonotic disease transmission in anthropogenic landscapes is important for prediction and prevention of zoonotic disease transmission between animal reservoirs, vectors, and humans. The objective of this study is to evaluate how forest fragmentation and deforestation influence differences in vector and host abundance and species composition in relation to infection with the Chagas disease agent Trypanosoma cruzi, which is transmitted by triatomine insect vectors. Chagas disease is an important cause of heart disease in Latin America, with over 8 million estimated human infections worldwide. In fragmented forests and peridomiciliary areas in rural Panama, we collected triatomine vectors in palm trees, trapped mammal hosts, and tested vectors and hosts for T. cruzi in fragmented forests and peridomestic sites over a period of two years across wet and dry seasons. Vector abundance markedly increased in peridomestic habitats, and vector infection prevalence with T. cruzi was relatively high in both fragmented forest and peridomestic sites. Although synanthropic mammals were relatively common in all sites, there was heterogeneity in reservoir host composition and relative abundance that was related to available resources within each site and season. Analyzing relationships between vector and host relative abundance and T. cruzi infection, and the variation in resource availability within habitat patches is important to predicting vector infection dynamics and evaluating human disease risk in relation to increased frequency and intensity of ENSO events in the context of climate change.

Presenter: Gracio de Barros, Ana M

Title: Wildfire in the Pacific Northwest under climate change

Authors: Ana M Barros (Oregon State University);Alan Ager (US Forest Service);Michelle Day (Oregon State University);Haiganoush Preisler (US Forest Service);John Abatzoglou (University of Idaho);

Session: Wildland Fire I

Abstract: In this work we quantified the change in future area burned and fire severity under climate change scenarios on a 1.2 million ha fire prone landscape in central Oregon, US. The study area contained extensive private and public lands including the Deschutes National Forest. Future climate was modeled considering four alternative global circulation models (GCMs) – the CanESM2, CSIRO-Mk-3-6-0, HadGem2-ES and MIROC5, and two representative concentration pathways (4.5 and 8.5). We used the agent-based Envision model to simulate forest vegetation succession, forest management and wildfire on a yearly time step. Wildfire was simulated with the minimum travel time algorithm and a spatiotemporal ignition model that predicted ignition location and density based on energy release component (ERC) streams derived from the downscaling of meteorological variables forecasted with the four alternative GCM's. Forest management was simulated according to the current management targets and prescriptions in the national forest. Our results highlighted expected changes in overall burned area and fire severity and its variability according to different GCM models and the potential for forest management to curb the expected effects of climate change.

Presenter: Graves, Rose A

Title: Landscape dynamics of floral resources: Implications for cultural ecosystem service supply in the Southern Appalachians

Authors: Rose A Graves (University of Wisconsin-Madison);Scott M Pearson (Mars Hill University);Monica G Turner (University of Wisconsin-Madison);

Session: Poster

Abstract: Cultural ecosystem services (non-material benefits to people from nature) contribute substantially to nature-based economies but are seldom quantified biophysically. Cultural ecosystem services often depend strongly on biodiversity yet are largely absent from biodiversity-ecosystem service studies. Incomplete knowledge of links between landscape heterogeneity, biodiversity, and potential ecosystem service supply can lead to unintended shifts in cultural ecosystem services. We modeled the landscape dynamics of wildflower blooms in the Southern Appalachians and asked: (1) What factors influence the distribution of floral

resources across the landscape? (2) How do patterns of biodiversity-based cultural ecosystem service supply change within the spring to late-summer seasons? (3) How does accessibility of floral resources shift from early spring through summer? Data were collected at over 60 sites across a rural-to-urban gradient, and potential wildflower viewing opportunity was mapped. Floral resources were strongly affected by topoedaphic and climate gradients, but their relative importance varied with time period (early spring, late spring, and summer). Flower species richness was negatively related to surrounding building density, but flower abundance was unaffected by building density. Hotspots of floral resources often were not spatially concordant and their locations shifted from early spring to late summer, which changed the proportion of floral resource hotspots accessible to the public. Maintaining a mixture of natural, semi-natural, and agricultural cover types may sustain a high diversity of floral resources and provide increased opportunities to view wildflowers.

Presenter: Gray, Josh M

Title: A kalman filter approach to multitemporal, multisensor image fusion

Authors: Josh M Gray (Boston University);Mark A Friedl (Boston University);Eli K Melaas (Boston University);Damien Sulla-Menashe (Boston University);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: The availability of images from Earth observing satellites continues to grow as new sensors become operational, and existing archives are expanded and made more accessible. Meanwhile, advances in computation have made it feasible to process these large image datasets. However, while it is often desirable to estimate some quantity or characteristic (e.g. land cover, phenology, or leaf area index) across the entire landscape, image records are typically incomplete in space and/or time, and comprised of images from diverse sensors. For example, cloud cover may partially or entirely obstruct the landscape, and some locations have many archived images from a variety of sensors while others may have only a few images from a smaller set of sensors. Most existing multisensor fusion and image interpolation approaches are designed for specific applications and/or sensor combinations. Thus, there is a need for a more general and flexible approach capable of yielding optimal estimates of landscape states/variables with heterogeneous image records. Here we argue that Kalman Filtering is such an approach, and demonstrate its use through a number of experiments designed to monitor land surface phenology at Landsat resolution. We demonstrate time series smoothing and gap-filling for the single-state, single-sensor case using all available Landsat data across several diverse sites, multisensor, multiple state fusion with Landsat and Sentinel data, and fusion across multiple spatial resolutions with Landsat, Sentinel, and MODIS. We conclude by

discussing some outstanding challenges related to process and error model specification, along with potential solutions.

Presenter: Greenberg, Cathryn H

Title: Natural disturbances shaping the structure and composition of southeastern forests

Authors: Cathryn H Greenberg (USDA Forest Service, Southern Research Station);Beverly S Collins (Western Carolina University);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: Wind, fire, ice, drought, insect pests, oak decline, floods, and landslides are recurring or episodic natural disturbances that can kill or damage trees, at scales ranging from scattered- to small or large groups of trees, across small to large areas. The spatial extent, frequencies, and severities differ among and within these natural disturbance types. Natural disturbances create mosaics and gradients of structural conditions and canopy openness within stands, over the landscape, and across forest types and ecoregions within the southeastern US. Historically as today, natural and human-caused disturbances created diverse habitats that helped to promote diverse plant and animal communities at the landscape level. Here we provide an overview of these major disturbance types, the range of variation in frequency, scale, and how they shape the structure and composition of forests.

Presenter: Grider, John F

Title: Determining the distribution of declining bats in north Georgia

Authors: John F Grider (Warnell School of Forestry and Natural Resources, University of Georgia);Steven B Castleberry (Warnell School of Forestry and Natural Resources, University of Georgia);Jeffrey Hepinstall-Cymerman (Warnell School of Forestry and Natural Resources, University of Georgia);

Session: Poster

Abstract: Since 2006, White Nose Syndrome has killed an estimated 5.5 million cave dwelling bats in the eastern United States and Canada leading to several species becoming a

management priority. Developing conservation strategies for these species in Georgia is difficult due to limited knowledge regarding their distribution and habitat associations. Further complicating the issue is that these bats have distinctly different habitat needs in summer and winter. Our study examines the summer ecology of cave roosting bats during a time when individuals are not in caves, but instead forming maturity colonies and foraging in forested areas. Our objective is to determine the summer distribution and habitat use of declining cave-dwelling bat species so that land use decisions, such as highway development, can be made that minimize impacts to bats in the region. To do this we sampled at 44 sites on public lands in north Georgia for two nights using mist-netting and acoustic detection to determine species presence. Only eight threatened or endangered individuals were captured, all of which were Northern long-eared bats (Myotis septentrionalis). Using data from our first field season, we developed preliminary logistic regression models for bat occurrence in response to land cover, aspect, elevation, and landscape dynamics at two spatial scales. Additional field seasons are planned for 2016-2017 and will increase the data available to build and refine spatially explicit habitat models for bats in northern Georgia.

Presenter: Grisnik, Matt S

Title: Frogs found, an analysis of landscape change in locations of species rediscovery

Authors: Matt S Grisnik (Marshall University);Anne Axel (Marshall University);

Session: Poster

Abstract: Anuran populations as a whole are currently in decline, largely driven by anthropogenically-induced changes. However many species are being ‘rediscovered’ in their type localities after years of being listed as extinct or presumed extinct. It is mostly unknown as to why these species are reappearing, some are being found 60 years or more after their last sighting (Biton et al 2013). Some of the reappearances can be attributed to ineffective survey methods, surveys that fail to detect species that are actually present, or changing environmental conditions, like habitat restoration (Rodrigues Da Silva 2010). The purpose of this study is to identify landscape changes over time in the areas where species of anurans were lost, and then reappeared. This will be assessed using a species distribution model type approach, with the goal of finding patterns that can be applied to future conservation planning. This will be done through the use of satellite imagery both before and after ‘rediscovery’ of each of the target species. At each site, land use changes will be identified as they pertain to each species as well as the closest distance to any anthropogenically induced habitat change. This will help account for changes in ease of the accessibility to the site, which would indicate the ‘rediscovery’ was an artifact of biased sampling. The results from this study will help to guide conservation planning in the future for these, and other similar species.

Presenter: Gu, Lianhong

Title: The legacy effects of drought on ecosystem phenology

Authors: Lianhong Gu (Oak Ridge National Laboratory);Stephen G Pallardy (University of Missouri);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Although drought events have limited duration, their impact on ecosystem structure and functioning can persist long after the events have gong. Due to a lack of long-term observations, it is not clear at present how ecosystem phenology is affected by the legacy of drought. The unique datasets obtained at the Missouri Ozark AmeriFlux (MOFLUX) site offer an opportunity to address this question. Since the establishment of the MOFLUX site in 2004, a wide range of precipitation regimes from abundant rain to extreme drought occurred at the MOFLUX site, resulting in large inter-annual fluctuations in plant water stress levels. In particular, several drought events with varying drought intensity occurred during the study period. The 2012 drought was the strongest category D4 (Exceptional Drought), according to the US Drought Monitor Classification Scheme and offered a contrast to earlier, less severe droughts. In this presentation, we will use a suite of indices to characterize how MOFLUX forest functional phenology is affected by droughts with different severities. These indices include spring photosynthesis development velocity, fall photosynthesis recession velocity, growing season initiation day, growing season termination day, center day of the growing season, length of the growing season, effective length of the growing season, effective daily maximum canopy photosynthetic rate, and seasonal carbon dioxide assimilation potential index. We will show that legacy effects on these indices can still be detected years after a drought.

Presenter: Guan, Kaiyu

Title: Hydroclimatic and biological controls on the photosynthesis seasonality of tropical evergreen forests

Authors: Kaiyu Guan (University of Illinois at Urbana Champaign);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: The response of tropical forests to droughts is highly uncertain1. During the dry season, canopy photosynthesis of some tropical forests can decline, whereas in others it can be maintained at the same or a higher level than during the wet season2. However, it remains uncertain to what extent water availability is responsible for productivity declines of tropical forests during the dry season2, 3. Here we use global satellite observations of two independent measures of vegetation photosynthetic properties (enhanced vegetation index from 2002 to 2012 and solar-induced chlorophyll fluorescence from 2007 to 2012) to investigate links between hydroclimate and tropical forest productivity. We find that above an annual rainfall threshold of approximately 2,000 mm yr−1, the evergreen state is sustained during the dry season in tropical rainforests worldwide, whereas below that threshold, this is not the case. Through a water-budget analysis of precipitation, potential evapotranspiration and satellite measurements of water storage change, we demonstrate that this threshold determines whether the supply of seasonally redistributed subsurface water storage from the wet season can satisfy plant water demands in the subsequent dry season. We conclude that water availability exerts a first-order control on vegetation seasonality in tropical forests globally. Our framework can also help identify where tropical forests may be vulnerable or resilient to future hydroclimatic changes.

Presenter: Guo, Qinfeng

Title: Abundance structure across invasive species' ranges: From center to margin

Authors: Qinfeng Guo (USDA FS);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: The species boundaries and patterns of abundance and population dynamics across species range continue to draw increasing attention because of their importance for current emerging issues such as biotic invasions and epidemic diseases associated with global change. Some recent studies question the existence or generality of "abundance-center". While comprehensive surveys of individuals and populations across the entire species ranges are clearly needed, several related issues need further clarification and discussion. Some of the uncertainties, we believe, may also be due to lack of clear definition of "abundance center" or is simply a proximity issue between model and reality and between sampling intensity and scale. This study will examine population and abundance structures across species' ranges using invasive species as examples.

Presenter: Gustafson, Eric J

Title: Using first principles to increase the robustness of forest landscape models for projecting climate change impacts

Authors: Eric J Gustafson (USDA Forest Service, Northern Research Station);Brian R Miranda (USDA Forest Service, Northern Research Station);Arjan MG De Bruijn (Purdue University);Brian R Sturtevant (USDA Forest Service, Northern Research Station);

Session: LANDIS Modeling

Abstract: Climate change is expected to affect temperature, precipitation and cloudiness throughout much of the world. Forest managers use forest landscape models (FLMs) to project the interaction of management strategies and climate futures, but many FLMs simulate growth using mean climate variables and cannot account for weather extremes that can have a profound impact on landscape ecological dynamics. PnET-Succession is a mechanistic succession extension to the LANDIS-II FLM that uses first principles to simulate tree cohort growth as a competition for light and water for photosynthesis with a monthly time step. We used PnET-Succession to experimentally study the interacting effects of temperature, precipitation, cloudiness, soil texture, and rising CO2 concentration on tree species growth and competition at the site scale and conducted a landscape experiment to explore the interactions between climate change and disturbance on forest landscape dynamics in northern Wisconsin (USA). A real weather stream was modified according to the climate treatments, thus incorporating weather extremes. Our results generally show increased productivity with increasing temperature and precipitation, but show that each species responds uniquely according to its life history and physiological traits. Cloudiness and soil texture have lesser effects, but for some species these effects may significantly influence competitiveness. Our study illustrates how including mechanistic first principles of growth, competition and disturbance can increase confidence in projected outcomes under the novel conditions of the future. Such a modeling approach can also simulate management options to generate robust predictions of the effectiveness of achieving management goals under specific climate futures.

Presenter: Guy, Rachel K

Title: Seascape changes due to sea level rise may affect salt marsh dependent fisheries

Authors: Rachel K Guy (University of Georgia);Nathan P Nibbelink (University of Georgia);

Session: Coastal and Marine

Abstract: Models predict sea level rise will reduce and fragment salt marsh over the next century on the Georgia (USA) coast. Studies have demonstrated that marsh habitat is critical for juvenile fishes and crustaceans, though broad scale quantitative models of these relationships are lacking. Knowing these relationships at a landscape level is paramount to forecasting the long-term stability of an ecosystem challenged by sea level rise. Using fisheries-independent field data we sought to quantify juvenile fish and crustacean habitat sensitivity to changes in salt marsh structure at a broad scale. We developed models using multi-scale landscape variables derived from the 2007 National Wetlands Inventory. Model results indicate a positive relationship between species richness and proportion marsh cover. Individual species models (e.g. white shrimp, Litopeneaus setiferus) also reveal a positive relationship with percent cover of regularly flooded salt marsh, implying the likelihood of habitat decline with sea level rise. Collectively, results indicate that seascape changes due to sea level rise may have consequences for nekton diversity, abundance of recreationally and commercially important species, and thus may challenge the sustainability of salt marsh dependent fisheries.

Presenter: Haase, Catherine G

Title: Quantifying landscape complementation and implications to habitat selection of a cold intolerant mammal

Authors: Catherine G Haase (University of Florida);Robert J Fletcher, Jr. (University of Florida);Daniel H Slone (US Geological Survey, Wetland and Aquatic Research Center);James P Reid (US Geological Survey, Wetlands and Aquatic Research Center);Susan Butler (US Geological Survey, Wetland and Aquatic Research Center);

Session: Wildlife II

Abstract: Many species rely on multiple resources that do not co-occur within a single habitat type, but instead many, spatially-separate habitat types. Landscape complementation occurs when one habitat type is within close proximity of another non-substitutable habitat type, allowing the exploitation of both resources with minimal travel effort. Considering the connectance and the spatial relationship (i.e., distance) between habitats can be critical when assessing questions regarding animal processes, such as habitat selection. Here we quantify landscape complementation using a bipartite network framework, which describes two distinct sets of nodes (habitat patches) connected by links, and include these metrics in assessing habitat selection of the Florida manatee (Trichechus manatus latirostris). Florida manatees are cold intolerant, herbivorous marine mammals that feed on offshore seagrass beds and travel to

inland thermal refugia when water temperatures reach <20°C. We hypothesized that the connectance and distance between thermal and forage resources dictate selection of forage patches, with shorter distances and more connected patches resulting in higher selection during colder periods (≤20°C). We used a conditional logistic model to relate covariates to the probability of selection of the link between habitats as it allowed for patch-level and link-level covariates. Our results support our predictions, with effective distance between forage and thermal sites, seagrass area, and water temperature influencing probability of selection during cold periods. More specifically, the spatial relationship between habitats is as important as patch-level covariates, indicating that the inclusion of landscape complementation into conservation measures is imperative, particularly in the face of landscape change.

Presenter: Hadley, Adam S

Title: Pollinator location data can predict landscape resistance to movement

Authors: Adam S Hadley (University of Toronto/Oregon State University);Matthew G Betts (Oregon State University);

Session: The Landscape Ecology of Pollination Mutualisms

Abstract: Measuring functional connectivity is critical to predicting key ecological processes such as dispersal and range shifting in heterogeneous landscapes, yet remains one of the central challenges of landscape ecology. Little consensus exists for how functional connectivity should be quantified and existing techniques typically rely on expert opinion, scarce experimental movement data, or infer connectivity from genetic data. Here we show that relatively easy to obtain animal location data can be used to generate realistic models predicting the functional connectivity of landscapes. For a generalist pollinator species, the green hermit hummingbird (Phaethornis guy), we used radio-telemetry location data combined with environmental variables to create a presence-only species distribution model of habitat suitability. We used the simple inverse of this suitability model to create a cost surface representing resistance to movement. We then tested the effectiveness of this resistance surface at predicting actual pollinator movements by generating least cost paths and comparing these to movement paths from experimental translocations. We found that predicted least cost paths closely matched actual routes chosen by birds in this independent dataset. Movement paths of hummingbirds were substantially less costly than straight-line routes and did not differ from predicted least cost paths in length. We show that some of the pervasive complications in resistance modeling can be avoided by using common animal location data and straightforward modeling techniques to provide quantitative estimates of how environmental parameters affect pollinator movement.

Presenter: Haines, Anna L

Title: Simulating residential development policies to measure forest fragmentation

Authors: Dan L McFarlane (University of Wisconsin - Stevens Point);

Session: Dynamics in landscapes dominated by family forests

Abstract: Forest fragmentation in Northern Wisconsin is increasing due to parcelization and subsequent development of the existing landscape. Parcelization and fragmentation of forestland impacts a forest's economic value and its ecological quality. Planners and resource managers have long sought to better control land development via the regulatory framework. In this study, we will simulate residential development in a set of northern Wisconsin municipalities. We will match municipalities that are similar in typology and landscape characteristics, but differ in land use policies. A forest fragmentation model will be applied to the modified landcover data to quantify the status of possible forest fragmentation at full build-out. This will allow us to simulate the resulting forested landscape over time.

Presenter: Hakkenberg, Christopher R

Title: Evaluating forest structure and foliar reflectance for modeling forest community properties in the NC Piedmont

Authors: Christopher R Hakkenberg (UNC Chapel Hill);

Session: Poster

Abstract: Concerns over global environmental change and biodiversity loss have driven increased efforts to model the wall-to-wall spatial distribution of forest communities, as well as emergent properties of those communities like species diversity. In this study, I employ airborne remote sensing from Goddard's LiDAR, Hyperspectral & Thermal Imager (G-LiHT) coupled with spatially-nested field plots in Duke Forest to assess a series of predictive spatial models of forest community continua and vascular plant species diversity. Results confirm that forest structure, foliar reflectance, and site-level heterogeneity are each a robust, if incomplete, predictor of forest composition and diversity, though the magnitude and directionality of these relationships depend heavily on site environmental correlates, as well as spatial (and taxonomic) resolution. Beyond practical application in forest monitoring and community

distribution models, results are of theoretical significance in improving our understanding of the role of spatial scale in characterizing forest diversity and compositional turnover across environmental gradients.

Presenter: Hall, Sonia A

Title: Meeting managers where they are at—Lessons learned engaging users of connectivity products in Washington State

Authors: Sonia A Hall (SAH Ecologia LLC);Meade Krosby (University of Washington);Brad H McRae (The Nature Conservancy);D John Pierce (Washington Department of Fish and Wildlife);Leslie A Robb (Independent Researcher);Michael A Schroeder (Washington Department of Fish and Wildlife);Peter Singleton (Pacific Northwest Research Station, US Forest Service);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: The Wildlife Habitat Connectivity Working Group (WHCWG) is an open partnership among biologists, researchers, and conservation practitioners that takes a science-based, collaborative approach to identify opportunities and priorities to conserve and restore habitat connectivity in Washington State. Given this goal and group composition, engaging with users is both built in and essential. The Group engaged—and continues to engage—with users of the different connectivity products in various ways, including incorporating their priorities in the selection of focal species, developing a landscape integrity approach, providing interpretation and discussing the implications of results for conservation efforts, actively collaborating on specific uses and applications, developing guidance tools to help users apply the products, and share them within their organizations. Challenges we have faced in helping managers embrace and use connectivity assessment products include how to communicate the methodology and biological interpretation of parameters, the biological and conservation implications of the products, incorporating climate change concerns, and potential users' willingness to "own" the products if they were not involved in the development process. We argue that successful applications of the WHCWG's products depended on (a) the continual engagement of users from the beginning of the process, (b) synthesizing results into simple, easy-to-explain maps linked to the underlying wealth of data products, (c) investing in interpretation of products, (d) making all products freely available online, and (e) working with users on additional analytical, interpretation or synthesis products tailored to their needs. We discuss how these challenges and lessons learned carry forth to permeability-based products.

Presenter: Hansen, Jason K

Title: Exploring integrated landscapes for Bioenergy Feedstock Pro

Authors: Jason K Hansen (Idaho National Laboratory);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: Sustainability is paramount when designing a feedstock supply system. Feedstock supply systems supporting the use of agricultural residues for energy are subject to limitations and risks in feedstock availability when analyzed in terms of soil health, environmental impacts, uncertain growing conditions, and producer economics. Today strategies to identify biomass resources such as corn stover rely on coarse data and large scale assumptions that have limited applicability with respect to understanding of the landscape's potential for sustainable land use. Better understanding requires strategies to properly characterize and drive land-use that optimizes land use decisions. Using subfield analytics, this presentation presents research that develops the capability to shed light on how integrating energy crops into the landscape improves producer economics while at the same time making more biomass available while increasing farm profitability. Moreover, integrated landscapes improve soil and water quality. In previous work at the Idaho National Laboratory researchers explored how high fidelity data and subfield decisions can significantly impact the sustainability of residue collection and how agronomic practices including adoption of energy crops can impact site sustainability. The present research expands on these precision conservation techniques to identify areas within fields where energy crops may be more competitive than row crops. This work fundamentally changes the objective of landscape integration to land use efficiency and practicality. In a county level case study we show that up to 85% of corn producing fields have at least some acerage operating at a financial loss. By targeting marginal areas for conversion biomass availability increases and makes flexible the harvest window. This results in better soil health, water quality, and ecosystem services.

Presenter: Hargrove, William W

Title: Temporal analysis of phenology to objectively determine normal seasonality of vegetation across the United States

Authors: William W Hargrove (USDA Forest Service);Danny C Lee (USDA Forest Service);Steven P Norman (USDA Forest Service);Forrest M Hoffman (Oak Ridge National Lab);Jitendra Z Kumar (Oak Ridge National Lab);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: We have used temporal phenological clustering within each spatial phenoregion to statistically determine seasons and seasonal transitions nationally. The number of different seasons can be pre-defined by selecting the number of clusters. Clustering can occur separately within each single phenoregion, resulting in a "local" seasonal "definition," or clustering can occur across all phenoregions, using a more "global" definition of seasons. Once seasons are quantitatively defined, national maps can be drawn showing the nature of dominant vegetation seasonality. Polar analysis of the annual distribution of NDVI allows for temporally seamless determination of vegetation seasonality. Circular statistics can be used to calculate the mean vector of the annual NDVI distribution. The magnitude of this mean NDVI vector describes how far "off-center" the center of mass of the NDVI distribution is, and characterizes the deciduous seasonality of the mixture of vegetation within each MODIS cell. The angle of the mean NDVI vector indicates the Day-of-Year of the center of mass of the NDVI distribution (regardless of its form), and the anti-vector of mean vector NDVI divides the annual cycle into a beginning and ending at the antipode of greenness center-of-mass, creating a unique, vegetationally defined "year" in every MODIS cell.

Presenter: Harmon, Brendan A

Title: Tangible Landscape for ecologists

Authors: Brendan A Harmon (Center for Geospatial Analytics);Anna Petrasova (Center for Geospatial Analytics);Vaclav Petras (Center for Geospatial Analytics);Helena Mitasova (Center for Geospatial Analytics);Ross K Meentemeyer (Center for Geospatial Analytics);

Session: Poster

Abstract: Landscape ecologists use computational modeling and simulation to analyze complex interactions between landscape patterns and processes and predict how these processes will unfold in time and space. Visualizing and interacting with digital data and models, however, can be unintuitive, requiring extensive training and highly abstract thinking. We have developed a tangible user interface for 3D sketching called Tangible Landscape that physically manifests digital data so that landscape ecologists and architects can naturally interact with models and simulations. Conceptually Tangible Landscape couples a physical model of a landscape with a digital model of the landscape in a geographic information system through a continuous cycle of 3D scanning, geospatial computation, and projection in near real-time. With this novel technology landscape ecologists and architects can intuitively interact with processes like water flow, erosion, solar radiation, flooding, fire spread, disease spread, and urban growth and

experimentally test interventions. In this poster session we will host a live, hands-on demonstration of Tangible Landscape. We will demonstrate two applications of Tangible Landscape – watershed restoration and urban growth planning. In the watershed restoration demonstration conference attendees will intuitively interact with water and sediment flow simulations by sculpting a physical terrain model. In the urban growth planning demonstration they will intuitively explore land change scenarios using the FUTure Urban-Regional Environment Simulation (FUTURES) – a land change model for predicting patterns of urban growth – coupled with Tangible Landscape.

Presenter: Harrison, Tina

Title: The landscape ecology of rare bee species

Authors: Tina Harrison (Graduate Program in Ecology & Evolution, Rutgers University);Rosy Tucker (Undergraduate Program in Ecology, Evolution and Natural Resources, Rutgers University);Rachael Winfree (Department of Ecology, Evolution, & Natural Resources, Rutgers University);

Session: The Landscape Ecology of Pollination Mutualisms

Abstract: Pollinator biodiversity plays critical roles in the functioning of pollination mutualisms. Therefore, a great challenge in studying the landscape ecology of pollination mutualisms is to understand how pollinator biodiversity is affected by land use change. Although rare species contribute a great proportion of biodiversity, little research has focused on the responses of rare pollinators to land use change, in part because correctly identifying species as rare requires a thoroughly inventoried regional fauna. We defined rare bees as those occurring in fewer than 5 sites in a large dataset of over 50,000 specimens of nearly 400 native bee species collected throughout New Jersey over the past 40 years. We first ask, how is the occurrence of rare bees related to different land cover types? We then explore how disproportionate sampling of different land cover types may affect both our definition of rare bees and our perception of their habitat associations. For example, many studies use equalized sampling effort across habitat types, which may cause rare species associated with uncommon land-cover types to be overrepresented in the data, and therefore incorrectly listed as common species. Finally, we test the sensitivity of our analysis to defining land cover at two spatial scales. Although rare bees are a large and divergent group of species, their aggregate response to land use is both conveniently measurable and informative. In particular, loss of rare species from anthropogenic land use types would suggest a biotic homogenization process that threatens regional pollinator biodiversity and future resiliency of pollination mutualism.

Presenter: Hazler, Kirsten R

Title: The Virginia Development Vulnerability Model: Exploring the driving forces of development

Authors: Kirsten R Hazler (Virginia Natural Heritage Program);Tracy Tien (University of Richmond);Roy Gilb (Virginia Natural Heritage Program);

Session: Planning

Abstract: Virginia ConservationVision is a suite of valuation models and associated maps representing a diverse array of conservation priorities. These models are intended to guide strategic conservation decisions that can help maintain and improve green infrastructure across the state. The Virginia Development Vulnerability Model quantifies the predicted relative risk of conversion from “natural”, rural, or other open space lands to urbanized or other built-up land uses. The model attempts to predict the spatial pattern of future growth from past patterns of growth, and relies on landcover classifications and estimates of impervious cover at multiple time periods. The relative probability of development can be modeled as a function of multiple predictor variables representing various driving forces of development. Our analysis, currently in progress, considers a number of predictor variables, including travel time to development “attractors” such as metropolitan areas or water frontage, access to important features such as sewer lines, components of development cost (e.g., slope steepness), value of public amenities (e.g., school district quality), cost of living (e.g., property tax rates), and conservation status (if applicable, legal protection as well as management intent). Once complete, the vulnerability model can be used in conjunction with other data to help prioritize lands for immediate protection. The model can also serve as an input for simulating future land cover change and its consequences under different planning scenarios.

Presenter: He, Hong S

Title: A framework of coupling forest ecosystem and landscape model to predict aboveground and belowground forest carbon dynamics

Authors: Hong S He (University of Missouri);Chao Huang (Institute of Applied Ecology, Chinese Academy of Sciences);Yu Liang (Institute of Applied Ecology, Chinese Academy of Sciences);Todd J Hawbaker (U.S. Geological Survey, Geosciences and Environmental Change Science Center);Peng Gong (Center for Earth System Science, Tsinghua University);Zhiliang Zhu (U.S. Geological Survey, Reston, VA);

Session: Landscape Dynamics II

Abstract: Forest carbon dynamics are affected by site-scale processes (e.g., tree establishment, growth, and mortality) and landscape-scale processes (e.g., seed dispersal, disturbance, and management). Forest landscape models (FLMs) are designed to simulate these multi-scale processes and are increasingly used to study regional carbon dynamics. Most FLMs, however, do not include biogeochemical cycling (BGC), which is often simulated by ecosystem process models. A few FLMs coupled BGC with FLM at pixel level. Such coupled models have advantages over either a FLM or BGC model alone, such that changes of soil carbon dynamics are a function of aboveground forest dynamics and the spatial effects of disturbance and management (e.g., harvest). However, these models are often overwhelmed by high computational load because of simulating BGC at each cell. Moreover, it is difficult to parameterize and validate such models because BGC variables often exist at a watershed (not at the cell) level. Thus, this study describes a new framework that couples a FLM with a BGC at a variable ecological hierarchy (e.g., land type unit to ecoregion). We show that the new framework is capable to (1) predict aboveground and belowground carbon dynamics at landscape scales; (2) include succession, fire, harvest and fire-harvest interaction, and (3) quantify the effects of fire and harvest on forest carbon dynamics in a very large boreal forest landscape.

Presenter: He, Chunyang

Title: How many people in global drylands will be water-stressed under climate change and urbanization

Authors: Chunyang He (Beijing Normal University,China);Zhifeng Liu (Beijing Normal University, China);

Session: Climate change and landscape sustainability of global drylands

Abstract: Drylands are areas characterized by lack of water, in which the ratio of mean annual precipitation to mean annual potential evapotranspiration is less than 0.65. Global drylands cover 41.3% of the ice-free land area of the earth and are home to more than 38% of the global population. While global dryland regions are already unsustainable due to their low precipitation, high climatic variability, and infertile soils, they are faced with increasing challenges of fast urbanization. Our objective was to clarify the water-stressed people global drylands under climate change and urbanization. We firstly examined the water-stressed people in global drylands from 1990 to 2010 using the water stress index. Then we assessed the water-stressed people in global drylands from 2010 to 2050 based on the scenario data of climate change and urbanization. We found that the heavily water stressed population in global drylands increased by 41.13% (from 1.21 billion in 1990 to 1.70 billion in 2010), while the

heavily water stressed urban population increased by 49.37% (from 0.64 billion to 0.95 billion). With the joint effects of urbanization and climate change, the heavily water stressed population in global drylands would increase from 1.70 billion in 2010 to 1.69 ~ 2.00 billion in 2050 , while the heavily water-stressed urban population would increase from 0.95 billion to 1.30 ~ 1.46 billion. So we suggest that effective measures need to be implemented to facilitate the sustainable development of the global drylands.

Presenter: Heintzman, Lucas J

Title: Patterns of surface water dynamics in salt playas of Texas over a 27-year span

Authors: Lucas J Heintzman (Department of Biological Sciences, Texas Tech University);Scott M Starr (Department of Biological Sciences, Texas Tech University);Caroline L Claassen (Department of Mathematics & Statistics, Texas Tech University);Lucia S Barbato (Department of Geosciences, Texas Tech University);Kevin R Mulligan (Department of Geosciences, Texas Tech University);Nancy E McIntyre (Texas Tech University);

Session: Poster

Abstract: We examined seasonal and interannual surface-water dynamics over the past 27 years in the 39 salt playas (salinas) occurring within a ~149,810 km2 portion of Texas. These groundwater- and precipitation-fed wetlands are regionally unique habitats with high salt concentrations and halophytic biota that may be vulnerable to changes from groundwater extraction for agriculture. We examined Landsat imagery from four satellite scenes to detect water within the 39 salina basins over seven dates (comparing summer and winter, representing periods of high and low groundwater demand, respectively) from 1986-2013, comprising all of the cloud-free data available simultaneously for all four scenes. During this span for our study area, the saturated thickness of the underlying Ogallala Aquifer decreased by ~0.19%, and the amounts of total and irrigated cropland increased in area. There was individual variation in surface water area per salina, with two salina basins never holding water at all during the duration of the study. Most salinas went dry at least once (although not simultaneously or in the same region), slightly more frequently during the summer than in winter. Our results suggest that these wetlands are being impacted by human changes to the landscape. Human activities are diminishing groundwater inputs to these wetlands, effectively creating novel wetlands that are now primarily or only supplied by precipitation and no longer by groundwater, thereby potentially altering water chemistry and biota. These novel wetlands no longer have the same hydrological or ecological dynamics and may exacerbate vulnerability to projected climate change.

Presenter: Henareh Khalyani, Azad

Title: Temporal stability in spatial suitability: Examining the assumptions of empirically fitted spatially explicit models of LULC change

Authors: Azad Henareh Khalyani (Colorado State University);William A Gould (International Institute of Tropical Forestry);Jaime A Collazo (North Carolina State University);Michael J Falkowski (Colorado State University);

Session: Assessment III

Abstract: The validity of projected changes from Land Use and Land Cover (LULC) models depend on data requirements and model assumptions. The temporal instability in the spatial suitability for LULC classes is usually disregarded when examining the stationarity assumptions of the empirically fitted spatially explicit models (EFSEMs) of LULC change. We examined the assumptions in Puerto Rico in three time intervals using the land cover maps of four dates: 1951, 1977, 1991, and 2000. The stationarity test showed that the land cover change rates were not stationary in the island from 1951 to 2000. We evaluated the association of urbanization and reforestation with the spatial predictor variables in the three time intervals to evaluate the assumption of stability in spatial suitability. The associations of spatial variables with the probabilities of reforestation and urbanization were changed between the three time intervals. We modeled four sets of future land use maps every year assuming stationary matrices of transition probabilities starting from each of the land cover maps and ending in 2050. The simulated maps at each year showed differences in landscape heterogeneity because of the different spatial suitability models obtained from each of the land cover maps. This study highlights the distinction between the stationarity in the class area change rates and the spatial suitability. We recommend evaluating the base LULC maps and the available predictor variables for the temporal stability in spatial suitability in addition to the temporal stationarity in transition probabilities before using the EFSEMs of LULC change.

Presenter: Henebry, Geoffrey M

Title: Land surface phenologies in Central Asian mountain pastures: modeling challenges and opportunities

Authors: Geoffrey M Henebry (South Dakota State University);Cole P Krehbiel (South Dakota State University);Kamilya Kelgenbaeva (South Dakota State University);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: To explore the vulnerability of high-elevation communities in Kyrgyzstan and Uzbekistan to changing climatic, sociodemographic, and socioeconomic conditions, we are assembling diverse remote sensing datasets to characterize the condition of pastures near villages at high elevation (>2000 masl) and in remote pastures at higher elevations. We are exploring how climatic changes that drive changes in pasture condition can be addressed through remote sensing of land surface seasonality (snow cover metrics) and land surface phenology (vegetation indices) and careful analysis of precipitation station data complemented by remote sensing of precipitation and soil moisture. Here we describe the particular technical challenges of modeling land surface phenology in mountainous environments and the mismatches between the pixel scale understanding of pasture condition and pastoralists' use of the landscape.

Presenter: Herold, Nathaniel D

Title: Coastal change analysis: Past, present, and future

Authors: Nathaniel D Herold (NOAA Office for Coastal Management);John McCombs (TBG at NOAA's Office for Coastal Management);

Session: Coastal and Marine

Abstract: Understanding current conditions and how the land has changed through the years is essential to improving our understanding of the impact of past management practices, and effectively responding to environmental and human induced changes now and in the future. NOAA's Coastal Change Analysis Program (C-CAP) produces nationally standardized land cover and change information for the coastal areas of the U.S. These products inventory coastal intertidal areas, wetlands, and adjacent uplands and are produced at both the 30 meter and high spatial resolution level. This presentation will provide an overview of changes seen in the contiguous U.S. from 1996 to 2011, describe NOAA's contribution to the National Land Cover Database (NLCD), provide example high resolution products and applications of the data (including impacts of climate and Sea Level Rise), highligh C-CAP availability via NOAA's Digital Coast, and discuss details concerning our upcoming 2016 update cycle.

Presenter: Herzberger, Anna J

Title: Telecoupled food trade drives farmer risk perception

Authors: Anna J Herzberger (Michigan State University);Jing Sun (Michigan State University);Yuxin Tong (Heilongjiang Academy of Agriculture Sciences);Jack (Jianguo Liu);

Session: Landscape networks as telecoupled human and natural systems

Abstract: In the past several decades, international trade has increased rapidly, connecting producers and consumers and environments across the globe. For example, there are increasing amounts of soybeans being exported from Brazil and the United States to meet rising demands in China. As soybean imports in China continue to increase, remote sensing research and Chinese national statistics have revealed that China's traditional primary soybean producing region, Heilongjiang Province, is decreasing in soybean area planted. Using the telecoupling framework as a guide and data from household surveys conducted in the region, our findings suggest that international soybean imports influence risk perceptions of farmers in Heilongjiang. Less affluent farmers perceived imports as more of a threat to their market crop prices, as they were more financially vulnerable (i.e. subject to more risk). Farmers use their risk perceptions to inform future cultivation decisions, which in turn affect cultivation patterns across landscapes. The telecoupling framework provides a systematic way of analyzing how risk perceptions are driven by international soybean imports and how that perception influences cultivation decisions.

Presenter: Hessburg, Paul F

Title: Early successional conditions in the eastern Washington Cascade Mountains: Contrasting the premanagement and modern-eras

Authors: Paul F Hessburg (USDA-FS, PNWRS);Nicholas A Povak (USDA-FS, PNWRS);R Brion Salter (USDA-FS, PNWRS);

Session: Wildland Fire I

Abstract: In forest ecosystems, early-successional habitats result from severe disturbances. Patches of early successional habitat can represent a transition to new forest, or an alternative stable state that can persist for decades when maintained by frequent, ongoing disturbance. Historically, high severity fires (HSFs), despite their mortality impacts, contributed relatively high levels of post-fire structural complexity and within-patch spatial heterogeneity, including surviving islands of live trees, snags, and down logs. Post-fire patterns of understory plant communities were also structurally complex and horizontally diverse, reflecting varied micro-

sites. In recent decades, by some accounts, wildfires have become uncharacteristically large and severe, and there is growing concern that these newer fires are simplifying and coarsening the grain of the western US forest landscape. Observations suggest a relative absence of surviving tree islands, increased frequency of very large HSF patches, and a lack of post-fire conifer regeneration due to increased distance to seed sources. Little data exist on the area and size distributions of post-fire, early successional patches of pre-management era landscapes and how this varied by physiographic region and forest type. Here, we compare the area and patch size distributions of premanagement and modern era HSFs within several ecoregions of the eastern Washington Cascades. For the premanagement era, we use vegetation and seral stage reconstructions from early 20th century aerial photography. For the modern era, we use fire severity reconstructions based on MTBS data from 1985 to 2013. We show a strong trend toward increasing HSF area and patch sizes with modern era wildfires.

Presenter: Hickling, Graham

Title: Geographic gradients in Lyme disease risk in the eastern United States

Authors: Graham Hickling (University of Tennessee Knoxville);

Session: Landscape Change and Infectious Disease Ecology: Applications to Public Health

Abstract:

Presenter: Hilty, Jodi A

Title: Does it pay off to envision conservation at scale? Y2Y a 20-year retrospective

Authors: Jodi A Hilty (Yellowstone to Yukon Conservation Initiative);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: On-the-ground conservation has fundamentally expanded from a focus on protecting distinct populations and small areas to promoting conservation at landscape and seascape scales. The conundrum is that on-the-ground work is most often localized, which begs the question of whether it is effective to promote a vision at a larger scale and what impact such a vision can have. The Yellowstone to Yukon Conservation Initiative is one of the earliest large

landscape visions in the world. With twenty years having passed since its inception, we examine progress toward the vision of “An interconnected system of wild lands and waters stretching from Yellowstone to Yukon….” We quantify progress of increased land protection, awareness of the need to manage natural resources at scale, and discuss lessons learned. Twenty years ago, protected lands in the Y2Y region comprised 15 percent of the area and since that time 30 percent of the land area has seen increased protections of various types, although that is not to say that all those new designations fall into strictly protected areas. At the same time, locally to globally, Y2Y has been demonstrated to inspire other at scale conservation efforts. Despite all this progress, enormous hurdles remain to further the vision including skepticism, politics, and increased human activities as well as developments increasing at exponential pace in the region. Creating a collective vision has influenced the conservation agenda and achievements, but the enormity of the vision means that achieving it will require tackling compounding challenges into the future.

Presenter: Hoffman, Forrest M

Title: Detecting and tracking shifts in national vegetation composition

Authors: Forrest M Hoffman (Oak Ridge National Laboratory);Jitendra Kumar (Oak Ridge National Laboratory);William W Hargrove (USDA Forest Service);Steven P Norman (USDA Forest Service);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Understanding the composition, health, and dynamics of vegetated ecosystems is critical for forest and land management, to support forestry-based industries, and to maintain critical ecosystem services. Forests are under increasing stress and may be influenced by interannual climate variability and long term changes in climate, natural and anthropogenic disturbances, and land use/land cover change. Detecting and tracking biogeographic shifts can be accomplished through careful analysis of satellite remote sensing observations. We used MODIS-based land surface phenology for continuous monitoring and assessment of vegetation composition and changes at a national scale for the conterminous United States. We created phenological ecoregions, or "phenoregions", having similar patterns of annual phenology using an unsupervised clustering method over the period 2000-2013. These statistically derived phenoregions were reclassified to a suite of existing landcover maps using the "Mapcurves" algorithm. Mapping of interannual transitions in phenological classes indicate areas of vegetation disturbance and recovery. Because the area within the CONUS is fixed, land cover area changes are a zero-sum game, so changes in one land cover class must be accompanied by compensating changes in other classes. We will demonstrate a national-scale accounting

system for tracking not only area changes in land cover classes, and also other compensatory land cover class area changes that accompanied them. Area changes in the vegetation distributions, as well as compensatory gains, losses, and exchanges in area of other land cover types, were mapped and tracked annually for 2000-2013 a 250 m resolution. We will present preliminary results of this analysis as well as the data analytics techniques developed to mine this information from large volumes of MODIS data.

Presenter: Holland, Jeffrey D

Title: The shape of dispersal-scapes

Authors: Jeffrey D Holland (Purdue University);Insu Koh (University of Vermont);

Session: Connectivity

Abstract: Dispersal routes between habitats are often characterized by the landscapes that they cross. This can be done in many ways, such as by the land covers a straight line intersects or by the landscape within a buffer or rectangular belt between the habitats. We suggest that the size and shape of the area considered in assigning and summarizing landscape features onto dispersal routes or graph edges should be determined by the movement of the organism under consideration. We used a small set of parameters describing the movement of study organisms to generate rules for the size and shape of areas that should be considered when looking at movement between habitats. These rules can be used to assign connectivity or resistance to inter-habitat pathways in studies using edge theoretic or circuit theory approaches, for example.

Presenter: Holsinger, Lisa M

Title: Evaluating future success of whitebark pine ecosystem restoration under climate change using simulation modeling

Authors: Lisa M Holsinger (US Forest Service Fire Sciences Laboratory);Robert E Keane (US Forest Service Fire Sciences Laboratory);Mary Frances Mahalovich (US Forest Service Forestry Sciences Laboratory,);Diana F Tomback (Department of Integrative Biology University of Colorado Denver);

Session: Biogeography

Abstract: Declines of whitebark pine throughout its range in western North America from the combined effects of mountain pine beetle (Dendroctonus ponderosae) outbreaks, fire exclusion policies, and the exotic disease white pine blister rust caused by the pathogen Cronartium ribicola, has spurred many restoration actions. However, projected future warming and drying may compromise the long-term success of today's restoration activities and further exacerbate the species' decline. We conducted a comprehensive landscape simulation modeling experiment to evaluate the potential success of restoration treatments under future climate. The spatially explicit, ecological process model FireBGCv2 was used to simulate whitebark pine populations on two US northern Rocky Mountain landscapes under two climate, three restoration, and two fire management scenarios. Major findings from this modeling effort are that (1) whitebark pine can remain on some upper subalpine high mountain landscapes in a future climate albeit at lower numbers, (2) restoration efforts are needed to ensure abundant whitebark pine forests, and (3) climate change impacts on whitebark pine vary by local setting. Several general guidelines are presented to be used within a range-wide strategy to address climate change impacts for planning, designing, implementing, and evaluating fine-scale restoration activities for whitebark pine by public land management agencies.

Presenter: Holsinger, Lisa M

Title: The role of weather, fuel, and topography in regulating the spread of wildland fire in the western U.S.

Authors: Lisa M Holsinger (Aldo Leopold Wilderness Institute);Sean A Parks (Aldo Leopold Wilderness Institute);Carol Miller (Aldo Leopold Wilderness Institute);

Session: Poster

Abstract: Increases in fire activity in the western US in recent decades have heightened interest in quantifying the ability of wildland fire to act as a barrier to the spread of future fire. A few studies have explicitly documented the role of previous fires in limiting subsequent fire spread, and none have examined this effect in combination with the influence from topographic features (e.g., ridge tops and valley bottoms), weather, and vegetation conditions - particularly at landscape scales and across varied ecosystems. We investigated how these three factors influenced the progression of subsequent fire in four large wilderness areas: three in the Northern Rockies and one in the Southwest of the US. Results indicate that weather asserts the strongest influence in impeding fire spread in the Northern Rockies while topography has the most dominant effect in the Southwest. Past wildland fire limits subsequent fire spread, and this effect is strongest immediately after a fire and decays through time as fuels re-accumulate. More broadly our study demonstrates how biotic and abiotic factors act to regulate fire on

landscapes and that the influence of factors that impede fire spread varies according to ecosystem type and their associated fire regime.

Presenter: Horvath, Elena K

Title: Building a potential wetland restoration indictor for the U.S. EPA's EnviroAtlas

Authors: Elena K Horvath (ORISE-US EPA);Jay Christensen (US EPA);Megan Mehaffey (USEPA);Neale Anne (US EPA);

Session: Assessment II

Abstract: Wetland restoration has focused primarily on individual wetland creation, yet the greatest benefits have been achieved when restoration considers the watershed context. Identifying locations within a watershed that lend themselves to wetland restoration is key. We created an indicator of potential wetland areas (PWA), using nationally available data to identify characteristics that could support wetlands including: poorly drained soils and low-relief landscape positions. We then compared the National Wetland Inventory (NWI) from 11 states to our PWA to determine percent overlapped. The percentages of NWI inclusion directly overlapping the PWA ranged from 39-95% with an average of 81%. However, when we included NWI within 120m of overlapping wetlands the percentages increased to 61-100%. We then combined the national land cover database (NLCD) with our PWA indicator to identify agriculture lands amenable to wetland restoration (PRW-Ag). The PRW-Ag identified a total of over 46 million hectares with the potential to support wetlands. The largest concentrations of PRW-Ag occurred in the Upper Mississippi states from Ohio to the Dakotas and the Alluvial Mississippi Valley. The PRW-Ag layer could assist land managers in identifying sites that may qualify for enrollment in conservation programs, where planners can coordinate restoration efforts, or where decision makers can target resources to optimize the ecosystem services provided. We have made the PRW-Ag layer and numerous relevant companion layers, available in EPA's EnviroAtlas (http://www.epa.gov/enviroatlas).

Presenter: Howell, Paige E

Title: Integrating landscape resistance into spatial metapopulation models

Authors: Paige E. Howell (University of Georgia);Richard B Chandler (University of Georgia);Blake R Hossack (USGS);Erin L Muths (USGS);Brent H Sigafus (USGS);

Session: Amphibians in a changing landscape

Abstract: The fields of metapopulation and landscape ecology aim to understand how spatial structure influences ecological processes, yet the two disciplines address the problem using fundamentally different approaches. Whereas most metapopulation models ignore environmental heterogeneity between habitat patches, models used in landscape ecology include detailed descriptions of landscape structure and its effects on movement. The simplistic view of landscape structure used in metapopulation models has been defended as necessary to maintain connections to classical theories of population dynamics. We present a framework for unifying these disciplines by incorporating landscape structure into spatially explicit metapopulation models that allow for inference on landscape resistance to movement. We demonstrate the approach by fitting models to seven years of data from a study of Lithobates chiricahuensis (Chiricahua leopard frog) metapopulation dynamics. Results suggest colonization and extinction dynamics are determined primarily by the hydroperiod and spatial distribution of patches, with landscape topography playing a relatively minor role. However, the relative importance of patch and landscape variables in governing ecological processes may be species- and system-specific, which emphasizes the need for statistical models such as ours that are based on theory and generalizable to multiple systems.

Presenter: Hudak, Andrew T

Title: Longleaf pine forest overstory, understory, and surface vegetation structure as characterized from airborne LiDAR and field plot data

Authors: Andrew T Hudak (USFS Rocky Mountain Research Station);Benjamin C Bright (USFS Rocky Mountain Research Station);Scott M Pokswinski (University of Nevada);E L Loudermilk (USFS Southern Research Station);Joseph J O'Brien (USFS Southern Research Station);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: Longleaf pine forest management is typified by frequent fires, often prescribed. We related field plot measures of overstory, understory, and surface vegetation structure and composition to canopy height and density metrics derived from airborne lidar data collected across Eglin Air Force Base (AFB) in northwestern Florida. We explained ~50% of the variation in longleaf pine tree density and basal area using Random Forests as our predictive model. Imputation allowed us to simultaneously predict tree density, basal area, and dominant tree species along with understory and surface vegetation and fuel attributes. Because lidar is much more sensitive to overstory canopy structure than to understory or surface vegetation/fuel structure, the overstory structure attributes were used as the response variables while the

understory and surface vegetation/fuel attributes were predicted as ancillary variables having no weight in the imputation model. The Random Forests model trained from the plot data was applied to impute predictions to the lidar metrics gridded at 30m resolution across Eglin AFB (186,350 ha). Subsequent aggregation of these maps exhibited stronger correlations between overstory tree density and surface vegetation/fuel variables than was evident from the field plot measures alone. We conclude that spatial aggregation of the overstory, understory, and surface vegetation/fuel attributes by land management unit revealed functional relationships between multiple overstory, understory, and surface vegetation/fuel attributes and fire management. Therefore, maps of forest structure attributes derived from airborne lidar can help vegetation/fuel/fire managers make informed decisions to manage not just the trees, but also the understory and surface vegetation conditions.

Presenter: Huebner, Cynthia D

Title: Comparison of vegetation composition in response to disturbance versus local and regional physiography

Authors: Cynthia D Huebner (Northern Research Station, USDA Forest Service);David W McGill (West Virginia University);Gary W Miller (Northern Research Station, USDA Forest Service);

Session: Landscape Dynamics I

Abstract: Plant community composition is tied to regional (climate/soils) and local (aspect) physiography. Changes in initial floristic composition after a disturbance may be severe enough to change the successional trajectory predicted by physiography. Which is more important, disturbance or physiography, in determining vegetation composition? We evaluated understory vegetation of plant communities exposed to 4 disturbances (control, single burn (SB), diameter-limit cut (DLC), and first-year shelterwood (SHW)) 3 years post-disturbance. Study sites were located within each disturbance type on northeast and southwest aspects within the Allegheny Plateau (AP) and the Ridge and Valley (RV) regions. Vegetation composition was analyzed using nonmetric-multidimensional scaling and 2-way nonparametric MANOVA. Herbs/vines/shrubs composition differed by region and aspect; tree seedling composition differed only by region. Composition of herbs/vines/shrubs and trees differed by disturbance, but with a significant region interaction. Region and aspect were defined by several indicator species. No significant indicator species defined the controls. Four herbs/shrubs/vines (including Vaccinium stamineum and Epigaea repens) defined SB, 1 herb (Carex digitalis) and 1 tree (Betula sp.) defined DLC, and 9 herbs/shrubs/vines (including Rubus spp., Erechtites hieraciifolia, Phytolacca americana, and Verbascum thapsus) and 1 tree (Prunus pensylvanica) defined SHW. Epigaea repens C. digitalis V. thapsus were defined solely by disturbance. Though physiography was more important, some species served as disturbance indicators, differing by disturbance type.

As disturbance-indicator species replace regional-indicator species (Rubus spp.), successional trajectories may deviate towards recovery of native species that benefit from low-level disturbance (E. repens) or towards systems vulnerable to invasion by exotics (V. thapsus).

Presenter: Huettmann, Falk

Title: A Synthesis of machine learning software, and an outlook for scientific workflows: Beyond 'just' splines, entropy, CARTs, boosting, bagging, ensembles and batteries

Authors: Falk Huettmann (EWHALE lab, University of Alaska Fairbanks);

Session: Machine Learning and Data Mining Applications in Land- and Seascape Ecology: What it is, Why it matters, and Where the Progress Still Sits

Abstract: By now, Machine Learning has encroached virtually all aspects of the world, including the sciences and landscape ecology. However, the actual software details for the easily more than 100 algorithms can be confusing and tend not to be so clear. Here I present an overview about the major Machine Learning algorithms, the delivery schemes for the code, what they are applied for, and how they can be classified and grouped. There are many detailed steps and optimizations that make 'similar' Machine Learning algorithms performing very differently. Here I will discuss some of those aspects in the light of Landscape Ecology, patterns & processes, Remote Sensing, GIS, predictions and inference. Primarily, I focus on methods of splines, entropy, CARTs, boosting, bagging, ensemble models and model batteries. I present what these are, how they are applied, and their gains in regards to Landscape Ecology, for the sciences and for a globally sustainable management. I conclude with a new call for 'standardized workflow' publications and such automated tools for the sophisticated analysis of complex landscape-scale data. These workflows are to allow deep thinking, should be transparent and repeatable, and thus include open access, open source and online efforts, all based on peer-reviewed publication procedures for relevant global progress.

Presenter: Huettmann, Falk

Title: Introduction of machine learning and data mining: A review of spatial applications, model selection and a technical overview

Authors: Falk Huettmann (EWHALE lab- University of Alaska Fairbanks);

Session: Machine Learning and Data Mining Applications in Land- and Seascape Ecology: What it is, Why it matters, and Where the Progress Still Sits

Abstract: Machine Learning represents a major paradigm shift on how to do quantitative investigations; namely predictions and inference. Apart from virtually unlimited industrial applications it became the method of choice for advanced and complex data mining and landscape species predictions. Here I will present an overview about over 100 algorithm groups that are part of the Machine Learning discipline. Based on over 100 peer-reviewed publications from the international (Landscape Ecology) literature I then will present a summary review of the traditional Machine Learning applications, and contrast them with latest cutting-edge publications on this topic. Emphasize is put on 'patterns and processes', as well as creative and future applications of Machine Learning worldwide, beyond just climate change and impact predictions. I will briefly elaborate on the notion of Open Access and Open Source, as well as on human-coupled systems and inference, model selection, and how done in parsimonious and non-parsimonious frameworks and with statistical philosophies for a better management. An outlook is provided for Landscape Ecology how cloud computing could provide more progress and put a re-newed emphasize on sustainable management of the land- & seascape and the atmosphere.

Presenter: Huff, Emily S

Title: Changing behavior of family forest owners: A longitudinal analysis of the National Woodland Owner Survey

Authors: Emily S Huff (USDA Forest Service);Brett J Butler (USDA Forest Service);Marla Markowski-Lindsay (University of Massachusetts Family Forest Research Center);Sarah M Butler (University of Massachusetts Family Forest Research Center);Jaketon Hewes (University of Massachusetts Family Forest Research Center);

Session: Dynamics in landscapes dominated by family forests

Abstract: An estimated four million non-corporate individual and family forest owners make decisions about 117 million hectares of forestland in the United States. These decisions influence the current and future condition of forests and the many services they provide. The U.S. Forest Service's National Woodland Owner Survey is a tool to better understand the attitudes, behaviors, and general characteristics of this ownership group. We use two iterations of this tool, the 2006 and 2013 datasets, to explore change over time for family forest owners. Of the nine thousand common landowners contacted between the two time periods, over two thousand responded to both surveys. We used this sample of common landowners to analyze change over time using a linear mixed effects regression approach with many static and

dynamic predictors. We ran models for five key land management and land use decisions: timber harvesting, selling or subdividing land, participation in tax and incentive programs, the desire for the landowner's woods to stay wooded, and managing for wildlife habitat. Some of these land management and land use decisions have remained stable over time while others have shown a slight decrease in active management and increase in land transfer decisions. It is only by examining the stability and trends of land management and land use decisions over time that outreach efforts will be well informed to meet the needs of family forest owners.

Presenter: Iannone III, Basil V

Title: Evolutionary divergence conveys biotic resistance to invasion across multiple spatial scales

Authors: Basil V Iannone III (Purdue University);Kevin M Potter (North Carolina State University);Christopher M Oswalt (US Forest Service's Southern Research Station);Qinfeng Guo (US Forest Service's Southern Research Station);Songlin Fei (Purdue University);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: It is not well understood as to whether evolutionary relatedness among native species contributes to biotic resistance to biological invasions and which aspects of evolutionary relatedness most influence this resistance. Using a large, spatially-referenced data set (N = 42,626) collected across the forests of the eastern USA, we modeled plot-level estimates of invasive plant species richness and cover in response to the level of evolutionarily relatedness found among the native tree species within each plot. Statistical models accounted for potential spatial heterogeneity in invasive-native associations at two different geographic scales, thereby allowing us to detect cross-scale and sub-regional variability in associations. Metrics of evolutionary relatedness aiming to quantify evolutionary divergence (PSV and PSC) were negatively associated with both invasive plant species richness and cover, while those more strongly related to native tree species richness or evenness (PD and PSE, respectively) were positively associated to both invasion measures. The directionality of invasive-native associations were consistent across spatial scales and locations, whereas the magnitudes of these associations were not. Associations most indicative of biotic resistance (i.e., most negative) occurred in and around the contiguous forests of the Appalachian Mountains and in the fragmented forests of the agriculturally-dominated Upper Midwest. Limited cross-scale and spatial variability in association directions suggests that evolutionary divergence limits invasion consistently across spatial scales and environmental conditions via the same mechanism(s). Scale- and location-dependent variability in association magnitudes, however, reveals the need to better understand the factors that influence the degree to which evolutionary divergence limits biological invasions.

Presenter: Inman, Richard D

Title: A tale of two tortoises and tiny local t-values

Authors: Richard D Inman (Arizona State University);Taylor Edwards (University of Arizona);Stewart Fotheringham (Arizona State University);Janet Franklin (Arizona State University);Todd Esque (US Geological Survey);

Session: Conservation Biology I

Abstract: A central line of inquiry in basic ecology has been the study of species-environment relationships, which has proliferated substantially due to the rise and continued accessibility of species distribution modeling (SDM). SDM is a prominent method with which to investigate these species-environment relationships, though most SDM methods assume that these relationships remain stationary across a species' range. However, spatial non-stationarity may be appropriate when local populations deviate from a species' norm. Spatial non-stationarity may also arise when multiple processes influencing species-environment relationships act on different spatial scales, or when local conditions alter these relationships through biotic factors such as competition, predation or herbivory. This may be exemplified in hybrid zones between sister taxa. Geographically weighted regression (GWR) has become the dominant method to incorporate spatial non-stationarity in a regression framework, and uses local statistics to explore evidence of spatially varying relationships. Here, we use GWR to explore locally varying species-environment relationships between two species of North American tortoises, Gopherus agassizii and Gopherus morafkai, and in particular, focus on a hybrid zone where an apparent secondary contact zone has occurred between them after 4-8 million years of geographic isolation by the Bouse embayment, resulting in allopatric speciation. We find that populations in and around the secondary contact zone exhibit different species-environment relationships than do populations from either lineage separately, and that spatial patterns of these relationships do not conform to hypothesized differences between climate, physiographic and vegetation habitat factors.

Presenter: Iverson, Louis R

Title: Managing for a delicious ecosystem service under a changing climate: can sugar maple (Acer saccharum) syrup provision be maintained in a warming climate?

Authors: Louis R Iverson (US Forest Service, Northern Research Station);Stephen N Matthews (Ohio State University and US Forest Service);

Session: Ecosystem Services I

Abstract: Sugar maple provides timber and maple syrup throughout much of its range in the Midwest and Northeast US, as well as in Quebec, Canada, and sustaining these ecosystem services are of considerable interest. Besides current trends in maple decline, models project a loss of habitat throughout the century due to a changing climate, especially in the southern portion of its range. Managers seek strategies to combat the declines, or in certain locations, admit defeat and facilitate transition, but first need tools to assess risk at various locations and under various scenarios of climate change. We devised risk matrices to quantify likelihood of habitat change at any broad-scaled location against the adaptability of the species to deal with increasing disturbances associated with climate change for 2040, 2070, and 2100 according to a harsh and mild scenario of climate change. Exemplified by Vermont (ranking 1st in syrup) in northeast, Wisconsin (4th) in north central, and Kentucky (low production) in south central portion of sugar maple range, we evaluate risk of decline, and assuming habitat decline contributes also to syrup decline, potential costs required to put in additional taps to maintain production levels for periods ending in 2040, 2070, and 2100. For example, we estimate a 53-88% increase in Vermont taps (~$10.1-$16.9 m) will be required by 2100, depending on scenario, to equal 2012 syrup production, with an increase of 66-81% taps required in Wisconsin (~$2.6-$3.1 m) and 97-99% taps required in Kentucky (~$0.2 m).

Presenter: Iverson, Aaron L

Title: Maximizing biodiversity and ecosystem services in Puerto Rican agricultural landscapes

Authors: Aaron L Iverson (Cornell University/The Nature Conservancy);David J Gonthier (University of California-Berkeley);Damie Pak (Penn State University);Katherine K Ennis (University of California-Santa Cruz);John H Vandermeer (University of Michigan);

Session: Ecosystem Services I

Abstract: Ecologically complex agroecosystems often provide multiple conservation benefits. However, if conservation strategies are to be widely adopted, they must also be financially viable for farmers. Understanding the agricultural practices that favor biodiversity conservation, therefore, is a largely theoretical task unless we simultaneously demonstrate the economic impact of such practices. Furthermore, while farming systems are inherently multifunctional, in contemporary practice, strategies for their improvement are often one- or few-dimensional and, therefore, may not accurately depict reality. Here, we provide a detailed multifunctional

analysis of various ecosystem services thought to influence coffee farm profit in Puerto Rico, as well as of several biodiversity clades. We also assess how local and landscape environmental variables influence the ecosystem multifunctionality of farms. We found that although the various services and biodiversity clades responded differentially to local and landscape heterogeneity, more ecologically complex agroecosystems generally promote biodiversity. However, ecologically complex farms do not consistently promote farm profit-related ecosystem services, including coffee yield. Attaining farms that are both the most profitable and ecologically complex (i.e., harboring the most biodiversity) will open critical opportunities for rural livelihoods and conservation. Therefore, we explore various incentive schemes and determine that subsidy restructuring, improved premiums from certification, or a combination of premiums plus payments for ecosystem services can be realistic options for farms to meet this dual challenge.

Presenter: Jager, Henriette I

Title: Introductory Remarks on Bioenergy Landscaping / Can future US bioenergy production coexist with avian biodiversity?

Authors: Henriette I Jager* (Oak Ridge National Laboratory);Kristen Johnson* (Department of Energy);Nathan Sutton (Oak Ridge Associated Universities);Jasmine Kreig (Oak Ridge Associated Universities);Latha Baskaran (Oak Ridge National Laboratory);Gangsheng Wang (Oak Ridge National Laboratory);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: Our research seeks to understand how the future bioenergy landscape could change ecosystem services, including provision of energy, regulation of water quality, and support of habitat for biodiversity. We evaluated these ecosystem services under projections of biomass potential under two scenarios that contrast spatially intensive vs. extensive feedstock production. These scenarios were developed by manipulating future yield assumptions within the Policy Analysis System economic model (POLYSYS) for the US agricultural sector. We developed a tool, Bioenergy Ecosystem Services Tool (BioEST) to project future change in ecosystem services including energy feedstock yields and habitat for multiple species of grassland birds. As the first step, species distribution models (SDMs) were developed with climate, elevation, and land use as predictors. As the second step, we developed local landuse/landcover (LULC) effect models to estimate for habitat quality as a function of crop cover and management. LULC-effect models estimated marginal effects of different crops in the current landscape on species presence from fitted SDMs. We developed LULC-effect models for 2nd generation energy crops and for lands managed for residue removal by compiling relative densities between current LULCs and advanced bioenergy crops for each bird species. In

addition to local effects of each LULC, BioEST considers spatial juxtaposition with the surrounding matrix – i.e., habitat is considered suitable only if, together with surrounding parcels, it exceeds minimum habitat area for the species. Finally, we allocate bioenergy production among parcels within individual counties to achieve maximal potential habitat for representative species of grassland bird. Preliminary results demonstrated potential for finding landscape arrangements that support both biodiversity and bioenergy as complementary ecosystem services for this group of taxa.

Presenter: Jain, Atul K

Title: Implementation of a dynamic rooting depth and phenology into a land surface model: Evaluation of carbon, water, and energy fluxes in high latitude ecosystems

Authors: Atul K Jain (University of Illinois at Urbana-Champaign);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Recent studies and observations have shown that northern high latitude ecosystems (NHLE) are strongly responsive to environmental changes, particularly warming temperature. Ecosystem models are important tools that help us to understand and assess the impact of environmental changes in NHLE. However, models lack processes that are essential for modeling ecosystem dynamics for NHLEs. In this study, NHLE-specific dynamic phenology and dynamic rooting distribution and depth parameterizations was implemented in a land surface model, the Integrated Science Assessment Model (ISAM), to improve the estimated carbon, water, and energy fluxes in the NHLs. These parameterizations account for light, water, and nutrient stresses while allocating the assimilated carbon to leaf, stem, and root pools. The model parameters related to these processes were calibrated and evaluated using measured data from 16 sites (12 flux net sites and 4 non-flux net sites) representative of the dominant NHLEs. By including these dynamic processes, ISAM was able to capture the measured seasonal variability in leaf area index (LAI) and root distribution in the soil layers. The evaluation of the model results suggested that without including the dynamic processes, the modeled growing season length (GSL) in the NHLE was almost two times higher, as compared to measurements. To quantify the implication of these processes on the C, water, and energy fluxes, we compared the results of two different versions of ISAM, a dynamic version that include dynamic processes (ISAMDYN) and a static version that does not include dynamic processes (ISAMBC), with measurements from 12 eddy covariance flux sites. The results showed that ISAMDYN, unlike ISAMBC, was more capable to capture the flux site-based seasonal variability in GPP, water, and energy fluxes. Regional analysis revealed that the growing season length increased on average by about 5 days in the NHLs in the 2000s compared to 1990s.

Presenter: Jamei, Elmira Eli

Title: Street design and outdoor thermal comfort

Authors: Elmira 0 Jamei (Deakin University);Priyadarsini Rajagopalan (Deakin University);

Session: Urban II

Abstract: ¬Australia is one of the highly urbanized nations in the world, as 75 to 82 % of its population live in urban areas. Melbourne is the second largest city in Australia, and its population is anticipated to reach 6.5 million by 2050. In the past two decades, Melbourne has undergone a tremendous transformation, due to city-center regeneration and outer-suburban development. Nowadays, the city is experiencing rapid growth mainly in its central area. One of the areas which is under renewal and development is City North, located in the northern part of Melbourne. One of the strategies to accommodate the growth in this area is proposing different street hierarchy and typologies. Street profiles were changed in terms of pedestrian walkway width, building height at both sides of the streets, tree canopy coverage and green roofs. This study examines the thermal condition of various street typologies at their existing and future scenarios via three dimensional modeling system, ENVI-met 3.1. The relationship between the street characteristics (H/W ratio, orientation, SVF, vegetation coverage and pavement material) diurnal and nocturnal thermal condition was studied at an extremely hot summer day in Melbourne. The study aims to examine whether the future planning guidelines in the streets, located in City North would result in improved thermal condition and pedestrian thermal comfort. The findings of this study would provide a framework for planners and designers in implementing climatic knowledge in the preliminary stages of planning schemes.

Presenter: James, Patrick MA

Title: Landscape community genomics and the mountain pine beetle outbreak system

Authors: Patrick MA James (Université de Montréal);Cathy Cullingham (University of Alberta);

Session: Genetics

Abstract: Analysis of spatial genomic variation can help us to better understand the processes that influence population dynamics of outbreaking species. Outbreaks of forest insect pests

such as the mountain beetle (MPB) represent a major forest disturbance that has significant economic and ecological consequences. MPB outbreaks are the result of community interactions among beetles, fungal symbionts, host pines, and spatial context. Management of outbreaks could benefit from more detailed information on community level genomic interactions. Indeed, neutral genetic markers have been used previously to describe dispersal, effective population size, and functional connectivity. Additionally, adaptive genomic variation can illuminate how spatially variable intra- and inter-specific evolutionary interactions affect outbreaks. Here, we present a framework to integrate and reciprocally model spatial adaptive genomic variation in multiple taxa. In this framework we model genetic and environmental correlations among the MPB and two species of symbiotic fungi using putatively adaptive SNP loci and multivariate analyses. Our goal was to identify groups of loci from different taxa that are found together more often than expected by chance and whether different such groups are found in different regions. Spatial genomic variation in beetles and fungi are associated with climate, which suggests adaptation as the MPB expands into new regions. We also identified correlations between loci in the MPB and fungi which may reflect to co-adaptation. This integrated framework has the potential to improve our understanding of spatial community genetics and to determine the nature of the spatial evolutionary processes influencing forest insect outbreaks.

Presenter: Jantz, Claire A

Title: Developing future land use scenarios for the Delaware River Basin

Authors: Claire A Jantz (Shippensburg University);Scott A Drzyzga (Shippensburg University);Alfonso Yanez (Shippensburg University);Antonia F Price (Shippensburg University);Joshua Barth (Shippensburg University);

Session: Planning

Abstract: The Delaware River Basin (DRB) is an important region that hosts more than 8.2 million residents and provides ecosystem services that support multiple commercial, industrial, recreational and residential uses. Watershed planning is particularly difficult because so few watershed boundaries are co-located with or nested within political boundaries. Maintaining and restoring water quality requires balancing stakeholder interests and considering alternate short- and long-term futures. To address this need, we are developing future land use scenarios for the DRB out to the year 2070. Our approach to forecasting land use change is both community driven (i.e. we incorporate information from a wide variety of stakeholder groups) and data driven, informed by quantitative analyses of past land use change and the best available data sources for future trends. Through a series of stakeholder workshops, we have learned that stakeholders: 1) perceive strongly that their regional identity is fragmented across

multiple sectors: economics, land use change trajectories, land use management objectives, and water resource management objectives; 2) recognize several future opportunities (i.e., recreational development) and threats (i.e., climate change), but divergent opinions on how they might play out within the watershed. These perceptions are largely validated by our own analyses of employment, population, housing, and land use change trajectories, which reveal highly heterogeneous patterns. We present this foundational work and share some discussion of the next phase of our project: translating our workshop findings into scenario narratives and, ultimately, into quantitative modeling inputs.

Presenter: Jenerette, G. Darrel

Title: Sustainable landscapes at the frontier: Hot arid regions as a model for the future

Authors: G Darrel Jenerette (University of California Riverside);

Session: Climate change and landscape sustainability of global drylands

Abstract: Dryland environments where air temperatures regularly exceed 40 C pose multiple sustainability challenges. Ecohydrological dynamics in these hot and dry conditions are accelerated and in many cases functionally distinct from cooler and more mesic environments. Increasing temperatures affect both hydrologic and ecologic processes directly through the temperature dependence of evaporative demand and most biological reactions. Further, as dry periods are common most ecological dynamics occur through pulses of activity following discrete wetting events. Using examples from both urban and agricultural land uses, I show how ecohydrological variation can influence ecosystem services and disservices to local residents. In hot urban environments, the vegetated cooling can provide a valuable ecosystem service, yet requires extensive water resources to sustain vegetation activity. In hot agricultural environments, accelerated nitrogen cycling can have large impacts on reactive nitrogen emission rates with potential effects on air quality. Balancing ecohydrological trade-offs is an essential challenge for designing more sustainable landscapes. With the expansion of high temperature regions throughout the world, regions with current high temperature provide a valuable model for adapting to a warmer earth.

Presenter: Jobin, Benoît

Title: Change in avian habitat capacity is mediated by land cover changes in the Lake Saint-Pierre region, Québec

Authors: Benoît Jobin (Canadian Wildlife Service, Environment Canada);Diane Dauphin (Canadian Wildlife Service, Environment Canada);

Session: Poster

Abstract: The Lake Saint-Pierre (Québec, Canada), a natural enlargement of the St. Lawrence River, and its associated floodplain, holds wetlands and other wildlife habitats of exceptional biodiversity. However, in recent decades, anthropogenic activity has led to the loss or modification of wildlife habitats causing sharp declines in populations of wildlife species. We quantified land cover changes in the Lake Saint-Pierre floodplain with aerial photographs from 1950, 1964, 1997 and 2014 and estimated changes in wildlife habitat capacity using threshold values of avian habitat selection criteria for a suite of habitats. The selected thresholds used to compare habitat availability among years focused on forest habitat (including forest interior habitat), marsh, shrub swamp, bog, shrubland, and perennial crops. The most notable change was the conversion of thousands of ha of perennial crops (pasture and hayfields) to annual crops (corn and soybean), and a reduction in the cover of wet meadows. The integrity of wildlife habitats has also been reduced following an increase in anthropogenic and managed habitats throughout the study area. Grassland birds and waterfowl breeding habitat capacity has been reduced accordingly with a massive reduction in suitable grassland cover. Other wildlife has also suffered from the observed land use changes, including the yellow perch which shows large local population declines. Restoration of essential habitats and changes in farming practices are needed to support the recovery of declining species in the Lake Saint-Pierre and its floodplain.

Presenter: Johnson, Kristen E

Title: Strategies to Integrate Sustainable Bioenergy in Landscape Designs and synthesis of priorities for action to accelerate the transition to a bio-based economy

Authors: Kristen E Johnson (US Department of Energy (USDOE), Bioenergy Technologies Office (BETO));Keith L Kline (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: The Department of Energy Bioenergy Technologies Office (BETO) is committed to developing and applying scientific approaches to quantifying bioenergy sustainability and promoting continuous improvements across multiple environmental, economic, and social objectives. BETO conducts strategic planning to address barriers and build on opportunities to enable sustainable, commercially viable production of bioenergy and other products from

domestic biomass resources. Considering sustainability indicators at a landscape scale to set targets and assess effects of energy production systems offers several advantages. This presentation summarizes key efforts to help overcome barriers to a Bioeconomy. Resources to support continual improvement will be shared using examples of cellulosic feedstock production at fuel shed scales and collaborations with industry, national laboratories, universities, and other federal agencies. The Paris Agreement on climate change requires better management of terrestrial systems to promote productive landscapes, accelerate carbon sequestration, and meet needs for food and materials while reducing fossil fuel combustion. The capacity for bioenergy to contribute to climate change goals depends on whether many challenges discussed during this Conference can be overcome. The second half of this session provides a synthesis of opportunities identified by prior speakers for meeting long-term energy needs via a more sustainable Bioeconomy. The list of recommendations will be discussed by symposium participants in terms of which are top priorities and why.

Presenter: Jones, Chris M

Title: Fire and disease interactions in the Sudden Oak Death system in Big Sur, California

Authors: Chris M Jones (University of North Carolina at Chapel Hill);Aaron Moody (University of North Carolina at Chapel Hill);Ross K Meentemeyer (North Carolina State);Francesco Tonini (North Carolina State);

Session: Poster

Abstract: Forest pathogens are a serious threat to forested ecosystems around the world and can have a serious impact on other disturbances. One such pathogen is Sudden Oak Death (SOD). SOD is responsible for the mortality of true oak species and tanoaks in California and Oregon. The spread of the pathogen is strongly influenced by the spatial heterogeneity, and asymmetric host competence and susceptibility. Additionally, it has been shown to influence fire severity based on the stage of the disease during the large Basin Complex fire in the Big Sur area of California. However, the effects of the disease on the long term fire regime and species composition are poorly understood. This study aims to understand the impacts of the disease on both the fire regime and species composition. In order address the interaction of these multiple disturbances (fire and disease) at the landscape level and over long time scales LANDIS II, a forest ecosystem model, is used. Specifically, a new process based pathogen extension is combined with the Dynamic Fuel and Fire extension and Century Succession extension. The model will utilize 4 scenarios: (1) a baseline with no disturbance, (2) only fire, (3) only disease, and (4) both fire and disease. This allows for the analysis of how the disease influences fire and vice versa. Preliminary results will be shown.

Presenter: Kidd, Anjelika D

Title: Movement ecology of American White Ibis (Eudocimus albus) in South Florida, USA

Authors: Anjelika D Kidd (Warnell School of Forestry and Natural Resources, University of Georgia);Jeffery Hepinstall-Cymerman (Warnell School of Forestry and Natural Resources, University of Georgia);Sonia M Hernandez (Warnell School of Forestry and Natural Resources, University of Georgia);

Session: Poster

Abstract: Human land uses can affect wild populations by introducing novel species interactions, resources, and parasites and alter behaviors such as resource use, habitat selection, and movement between habitat patches. In South Florida, the American White Ibis (Eudocimus albus) is a nomadic wading bird that undergoes daily long-distance flights from roost sites to foraging locations. Some South Florida Ibis flocks are found in urban areas such as parks and zoos, rather than in their natural wetland habitats. Urban habitat use exposes individuals to species and resources, such as anthropogenic food sources, that they would normally not come into contact with in natural habitats. The goals of this project are to analyze seasonal movement patterns and space use to examine movement distance based on habitat type and to determine fidelity to habitat types and locations. As part of a larger effort, our project deployed 16 GPS transmitters (14 at urban sites, 2 at natural sites) on Ibis captured in Palm Beach and nearby counties, Florida. Initial location data reveal two patterns of activity related to resource use. Individuals associated with anthropogenic resources move shorter distances and use fewer locations, while individuals spending more time in natural habitats travel further and use more locations. GPS data will improve knowledge of Ibis movement in a mosaic of natural and anthropogenic land cover. This project is part of a larger effort to study the influence of anthropogenic resource use on Ibis health and disease transmission.

Presenter: Kim, Daehyun

Title: Trees under wind stress: Spatial pattern explains susceptibility to hurricane damage

Authors: Daehyun Kim (University of Kentucky);Andrew C Millington (Flinders University);Charles W Lafon (Texas A&M University);

Session: Forests, Weather and Climate

Abstract: Direct damage during a catastrophic wind disturbance occurs to tall, canopy trees, whereas short, sub-canopy individuals are sheltered from such direct tree–wind interactions and prone to occasional indirect damage caused by the fall of another tree. On top of this general idea, we hypothesized that not all large, canopy trees have the same probability of undergoing direct wind damage, and that the susceptibility depends on, among others, their pre-storm distribution. After Hurricane Rita of 2005 passing through the Big Thicket National Preserve in east Texas, we established five 40 m × 50 m plots across the preserve and recorded the spatial coordinate of all individual stems with diameter at breast height ≥ 5 cm. In each plot, we classified two groups of tall, canopy trees: (1) those experienced direct damage by Rita and (2) the undamaged individuals whose height to top (HTT) equaled or greater than the average HTT of the direct-damaged ones. Using a suite of spatial point pattern analyses based on pair-correlation function g(r), we found clear density-dependence in the pattern of direct damage by Rita: the direct-damaged trees had significantly fewer similar-sized neighbors than the undamaged tall, canopy counterparts at various spatial scales. These results indicate that wide spacing of mature, canopy trees can enhance the risk of direct damage by a windstorm through inducing (1) greater forces on trees driven by accelerated air flows within the open canopy and (2) more swaying of individual stems due to lack of similar-sized neighbors.

Presenter: Kissick, Ashley L

Title: Beetle functional diversity responds at different spatial foci

Authors: Ashley L Kissick (Purdue University);Jeffrey D Holland (Purdue University);

Session: Connectivity

Abstract: Habitat fragmentation affects woodboring beetles (Coleoptera: Cerambycidae) and their beetle predators differently with respect to their edge behavior and dispersal patterns. However, a functional diversity approach has not been used to explore landscape and local-scale responses to habitat fragmentation among these communities. We used ecological traits of cerambycid beetle species their beetle predators to categorize these into functional groups. Abundance data on these species were collected throughout the state of Indiana among sites representing a gradient of forest fragmentation. We assessed the landscape with landscape metrics describing habitat fragmentation measured at multiple spatial foci. Functional groups and functional diversity indices that measure functional trait space and how species are dispersed within it were calculated with trait and abundance data for these communities. We used redundancy analysis to investigate changes in the functional diversity indices of beetle communities and multiple regression to examine changes in functional redundancy and response diversity of functional groups along the landscape gradient. Results/Conclusions We

found that predator and prey functional diversity respond to changes in landscape pattern at different spatial foci. Overall, fragmented Indiana forests harbored woodborer communities that were more functionally similar, but predator communities were more functionally diverse. Response diversity and functional redundancy to landscape pattern varied both between functional groups and specific spatial foci.

Presenter: Kovach, Adrienne I

Title: Functional connectivity of an early successional specialist

Authors: Adrienne I Kovach (University of New Hampshire);Michael Palace (University of New Hampshire);Katrina E Amaral (USFWS);Lindsey E Fenderson (University of Adelaide);Kathleen M O'Brien (USFWS);

Session: Connectivity

Abstract: Landscapes consisting of early successional habitats pose connectivity issues for specialist species. Ephemeral habitat patches are located within a heterogeneous landscape matrix variably permeable to dispersal of specialist species. These systems provide an ideal framework for testing hypotheses about fragmentation. We used a landscape genetics approach to identify landscape influences on dispersal of an early successional obligate of conservation concern, the New England cottontail. Using least cost path and circuit analyses we modeled landscape influences on gene flow and compared populations from three study areas in a fragmentation gradient. We used ecological niche modeling with Maxent to model habitat suitability. We found that both anthropogenic and natural shrubland habitats facilitated dispersal, while all other landscape features impeded it. Linear anthropogenic features, including roadsides, railroad and powerline corridors were important dispersal conduits and we identified specific corridors for restoring connectivity between isolated populations. Roads functioned as both facilitators and barriers to dispersal and we developed a model to simultaneously model these dual influences. LiDAR-identifed habitats of 1-3 m height vegetation improved our connectivity models. Barrier features were more influential on gene flow in the more fragmented sites and facilitating features more influential in the least fragmented landscape. Features that described habitat suitability in the context of patch occupancy differed from those that were important for connectivity. Circuit analyses of habitat suitability identified a greater number of potential movement corridors in comparison with dispersal models. These results provide insight to guide ongoing restoration activities for early successional landscapes specialists.

Presenter: Kreig, Jasmine AF

Title: Designing bioenergy landscapes to improve water quality through spatial allocation of conservation practices

Authors: Jasmine AF Kreig (Oak Ridge Associated Universities);Henriette I Jager (Oak Ridge National Laboratory);Latha M Baskaran (Oak Ridge National Laboratory);Michael R Hilliard (Oak Ridge National Laboratory);

Session: Poster

Abstract: Concerns about the effect of future bioenergy production on water quality in the US stem from historical effects caused by agriculture. Extensive agriculture and use of fertilizers in the Mississippi River Basin has contributed to hypoxia in the Gulf of Mexico. To avoid similar outcomes from bioenergy production, we identified context-specific management practices to increase the yield of bioenergy feedstocks and improve water quality. We used an optimization approach (complete enumeration) to quantify the trade-offs and complementarities among water quality and quantity (WQQ) indicators (i.e., nitrate, total phosphorus, total suspended sediment, and water yield) and production of bioenergy feedstocks by allocating management practices to 8-digit watersheds across our study region, the Arkansas-White-Red (AWR) river basin. The spatial distribution of future (2040) bioenergy crops were defined by an economic model for the agricultural sector that included cellulosic feedstocks including switchgrass, high yield sorghum, Miscanthus, and winter wheat with a farmgate price of $60/dt and 1% annual yield increases. We used the Soil Water Assessment Tool (SWAT) to simulate WQQ outcomes associated with different combinations of management practices (decision variables: plugging of tile drains, amount of fertilizer applied to and tillage of dedicated bioenergy crops (mainly deep-rooted perennials), proportion of stover removed from and use of cover crops with conventional crops, and use of a cover crop with winter wheat). We developed a visualization tool that allows stakeholders to set WQQ thresholds and evaluate the biomass yield spatial distribution of management practices leading to sustainable outcomes. From these results, we will extract generalizable guidelines for optimal placement of management practices. For example, guidelines might consider adapting practices to site specific locations by taking into account land characteristics, such as land use, soil type, and slope, as well as climate variation to assist farmers in realizing both their production and water-quality goals.

Presenter: Ku, Chen-Chia

Title: The 23 years relationship between the climate data and the aboveground biomass in subtropical forest at Lanjenchi, southern Taiwan

Authors: Chen-Chia Ku (Department of Forestry and Natural Resources, National Chiayi University);Guo-Zhang Michael Song (Department of Soil and Water Conservation, National Chung Hsing University);Jhh-Min Chiang (Department of Life Science, Tunghai University);Jianwu Tang (The Ecosystems Center, Marine Biological Laboratory in Woods Hole, Massachusetts & California University, Berkeley);Wei-Chun Chao* (Department of Forest and Nature Resources, National Chiayi University);

Session: Forests, Weather and Climate

Abstract: The response of long-term forest vegetation census data to a globally changing environment is important to predict the future levels of atmospheric carbon dioxide. To explore the relationship between long-term biomass change and climate data in a spatially heterogeneous plot, we utilized four times regular surveyed data from Lanjenchi Forest Dynamic Plot, which situated in southern Taiwan and was greatly affected by strong northeast monsoon winds and typhoon annually. Every tree was identified, measured, tagged and mapped in the plot. Aboveground biomass was calculated to examine the relationship with climate data. Our result shows that temperature, precipitation and wind velocity have a significant change between 1950 and 2014. In particular, the Northeast monsoon wind have an obvious decreased from 64 years. Within 23 years census data, aboveground biomass increased significantly despite an obvious decreases in stem number. The increasing minimum temperature and the decreasing wind velocity make more aboveground biomass and less stem density. Due to the decreasing impact of Northeast monsoon wind, the individual will self-thinning to make more space to grow. The diversity of the species may brunt by this phenomenon, and make species diversity change under the changing climate in the future.

Presenter: Kuhn, Anne

Title: Multi-scale trends analysis of landscape stressors in an urbanizing coastal watershed

Authors: Anne Kuhn (US EPA);Michael A Charpentier (CSRA);

Session: Coastal and Marine

Abstract: Anthropogenic land based stressors within a watershed can deliver major impacts to downstream and adjacent coastal waterways affecting water quality and estuarine habitats. Our research focused on a subset of non-point sources of watershed stressors specifically, human population density and land use land cover (LULC). We evaluated recent trends in stressors (1985-2005) that correspond to available response data in the Narragansett Bay Watershed (NBW), one of the most densely populated watersheds in the United States. We focused on four scales to summarize and aggregate stressors across the watershed with

increasing resolution: 1) the entire NBW; 2) the sub- watersheds of the six main tributaries; 3) NBW hydrological unit code (HUC) 10 sub-watersheds; 4) NBW HUC 12 sub-watersheds. This multi-scale approach allows us to analyze trends in a spatially-explicit manner and enable trends analyses to focus on specific areas of the estuary based on watershed drainage. Overall, considering gross and net LULC changes based on the combined MA and RI state-level LULC data for the 1985-2005 time period, the entire NBW experienced significant increases in urban or developed land and a concomitant loss in agricultural and forested land. Between 1985 and 2005 developed lands increased by 324 km2 or a net percentage change increase of 24.7%, while agricultural lands decreased by 124 km2 or a net percentage change decrease of 37.8%. We used a geospatial daysmetric population modeling technique with census data from 1990-2010 to estimate an overall increase of 143,049 people, a net positive change of 8.05%.

Presenter: Kumar, Jitendra

Title: Characterization and classification of vegetation canopy structure and distribution within the Great Smoky Mountains National Park using LiDAR

Authors: Jitendra Kumar (Oak Ridge National Laboratory);Jon Weiner (University of California Berkeley);William W Hargrove (USDA Forest Service);Forrest M Hoffman (Oak Ridge National Laboratory);Steven P Norman (USDA Forest Service);Doug Newcomb (US Fish and Wildlife Service);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: Vegetation canopy structure is a critically important habit characteristic for many threatened and endangered birds and other animal species, and it is key information needed by forest and wildlife managers for monitoring and managing forest resources, conservation planning and fostering biodiversity. Advances in Light Detection and Ranging (LiDAR) technologies have enabled remote sensing-based studies of vegetation canopies by capturing three-dimensional structures, yielding information not available in two-dimensional images of the landscape provided by traditional multi-spectral remote sensing platforms. However, the large volume data sets produced by airborne LiDAR instruments pose a significant computational challenge, requiring algorithms to identify and analyze patterns of interest buried within LiDAR point clouds in a computationally efficient manner, utilizing state-of-art computing infrastructure. We developed and applied a computationally efficient approach to analyze a large volume of LiDAR data and to characterize and map the vegetation canopy structures for 139,859 hectares (540 sq. miles) in the Great Smoky Mountains National Park. Using existing vegetation maps for the park we analyzed the canopy structures for various vegetation types. This study helps improve our understanding of the distribution of vegetation and animal habitats in this extremely diverse ecosystem.

Presenter: Lacher, Iara L

Title: Potential future landscapes within the Blue Ridge Region of northern Virginia

Authors: Iara L Lacher (Smithsonian Conservation Biology Institute);William McShea (Smithsonian Conservation Biology Institute);Tom Akre (Smithsonian Conservation Biology Institute);Jonathan Thompson (Smithsonian Conservation Biology Institute);

Session: Planning

Abstract: The human population is growing, increasing the demand for life-sustaining resources such as clean water, food, and energy. The current demand is unsustainable for human existence and has devastating impacts on the natural environment. In order to ensure access to these resources for the long-term, we need to consider the potential impacts of regional planning efforts on surrounding ecologic or socio-economic environments. This project uses land use change models to project potential future impacts of land use decisions in order to better inform planning decisions made across the Blue Ridge region of Northern Virginia. We used Dinamica EGO, an environmental modeling platform, R, and ArcGIS to identify past and current spatial and temporal relationships within a diverse array of data. These data describe land use, physiography, ecology, socio-economic factors, and regional preferences. We then created land use change models, informed by these relationships, and projected potential future land use under a “business-as-usual” scenario which assumes future rates and patterns of land use change will mirror that of the past. Results highlight the heterogeneity of landscape change and illustrate the importance in considering broader, regional impacts in planning efforts. We will use outcomes of the business-as-usual model in developing alternative scenarios and models that represent additional plausible trajectories of land use. Modeled projections from the business-as-usual scenario as well as subsequent scenarios can serve as a tool to guide land use decisions and conservation priorities towards a economically and ecologically balanced and healthy future.

Presenter: Langeveld, Johannes WA

Title: Bioenergy opportunities to increase resource management efficiency: Effects on land use within a landscape perspective

Authors: Johannes WA Langeveld (Biomass Research);Mirjam S Breure (Biomass Research);Petra MF Quist-Wessel (Agriquest);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: Bioenergy offers opportunities for farmers and managers to make more efficient use of available land resources as the demand for biomass increases. Dynamics of land use are studied in the EU and USA both before and after introduction of biofuel policies which seem to reduce speed of agricultural land loss while speeding up increases in forest area. While there is large potential for bionenergy in waste and residues, their mobilisation so far has been limited; most feedstocks being sourced from existing food crops. In terms of land use, the conversion of permanent pastures seems to have increased in the EU but not in the USA where pasture area still is growing at the extent of arable land. Major changes in the USA are increased double cropping and reduction of fallow area. Additional changes in cropping patterns are also observed, all potentially adding to an increased resource efficieny. It is concluded that emerging bioenergy production increases efficient land use but loss of agricultural land still continues. Although indirect effects (e.g. affecting land use changes elsewhere) are often assumed, no concrete evidence for this could be found. Barriers for further bioenergy development are following from inconsistent policies and an incomplete understanding of land use dynamics.

Presenter: Langeveld, Johannes

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bioenergy production increases efficient land use but loss of agricultural land still continues. Although indirect effects (e.g. affecting land use changes elsewhere) are often assumed, no concrete evidence for this could be found. Barriers for further bioenergy development are following from inconsistent policies and an incomplete understanding of land use dynamics.

Presenter: Langford, Zachary L

Title: Mapping vegetation distributions in Arctic ecosystems for parameterizing models using satellite-derived phenology

Authors: Zachary L Langford (Oak Ridge National Laboratory and University of Tennessee);Jitendra Kumar (Oak Ridge National Laboratory and University of Tennessee);Forrest M Hoffman (Oak Ridge National Laboratory);Stan D Wullschleger (Oak Ridge National Laboratory);Colleen M Iversen (Oak Ridge National Laboratory);Richard J Norby (Oak Ridge National Laboratory);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Arctic vegetation is sensitive to warming conditions and is expected to exhibit significant shifts in community composition, phenology, distribution and productivity. Modeling of Arctic tundra vegetation requires representation of individual plant functional types (PFTs) in the heterogeneous tundra landscape. Vegetation exhibits unique spectral characteristics that can be observed to help in the discrimination of PFTs and develop quantitative vegetation indices. In this study we employ high resolution (~2m) multi-spectral remote sensing from WorldView–2 and LIDAR–derived digital elevation models to characterize Arctic PFTs within the Barrow Environmental Observatory, a research reserve located on the Alaskan Arctic Coastal Plain. A field campaign was conducted during peak growing season (June - August) in 2012 to collect vegetation surveys from 48 of 1m × 1m plots, which were then employed to estimate the distributions of evergreen shrub,deciduous shrub, grass, sedge, forb, moss and lichen PFTs using spectral and topographic characteristics. We describe two versions of up-scaled PFTs: 1) a version computed from multiple imagery through the growing season and 2) a version computed from a single image in the middle of the growing season.The approach allowed us to quantify the degree to which including phenology helps us estimate PFT distributions. We also guidedground-truthing samples through a representativeness metric, which measures the Euclidean distance of every PFT in data space. This allows us to view how similar or dissimilar each PFT is across the study domain. Ground-truthing performed for PFTs indicates a high accuracy ($R^2 = 0.75$) for the phenology included classification.

Presenter: Langholtz, Matthew H

Title: Historical review of potential landscape implications of US “Billion-Ton” supply assessments

Authors: Matthew H Langholtz (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Keith Kline (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Laurence Eaton (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Maggie Davis (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: Resource assessments suggest that the U.S. has enough potential biomass resources to displace upwards of 30% of domestic petroleum consumption. Potential strategies for biomass production include using residues, dedicating land to energy crops, and integrating multi-use land management, with associated differences in potential impacts on the landscape. We review potential biomass production strategies and landscape implications.

Presenter: LaRue, Elizabeth A

Title: Incorporating geographic variation in dispersal in order to better predict species’ distributions

Authors: Elizabeth A LaRue (Purdue University);Mark R Christie (Purdue University);Jeff D Holland (Purdue University);Nancy C Emery (University of Colorado, Boulder);

Session: Genetics

Abstract: Dispersal is a key process that influences the geographic extent of species’ ranges. Species distribution models (SDMs) are commonly used to predict the future location of species’ ranges in response to land-use or climate change. However, SDMs commonly assume that all populations within species have equal dispersal kernels, despite evidence that dispersal traits can vary due to genetic or environmental differences among populations. We evaluate this assumption to understand the range dynamics of Cakile edentula var. lacustris (American searocket), an annual plant restricted to beaches of the Great Lakes in North America. This species has a dimorphic fruit that may generate a bimodal dispersal kernel: a proximal fruit segment that stays attached to the mother plant, and a distal fruit segment that disperses short, local distances via wind and long distances via water. We collected phenotypic data on

dispersal traits from 30 sites across this species' geographic range, and found a significant relationship between many dispersal traits and latitude. Common garden and greenhouse experiments indicate that a proportion of this variation is due to genetic differences among sites. These results indicate that dispersal traits vary significantly, and even predictably, across the range of this species, and we hypothesize that this variation may have major implications for range dynamics in response to climate change. To test this hypothesis, we are developing an individual-based, spatially explicit SDM that will incorporate latitudinal variation among populations in traits that influence local and long-distance dispersal.

Presenter: Lear, Kristen M

Title: "Bat-friendly" tequila and mezcal as a new agent for bat conservation in a telecoupled system

Authors: Kristen M Lear (University of Georgia);Jose J Flores Maldonado (Especies, Sociedad y Habitat, A.C.);Laura German (University of Georgia);Elizabeth G King (University of Georgia);Jeffrey Hepinstall-Cymerman (University of Georgia);

Session: Conservation Biology I

Abstract: We are investigating pollinating bats and the production of tequila and mezcal as a telecoupled system in Mexico and the United States. Every year, several species of threatened or endangered pollinating bats migrate over 1000 km between central Mexico and northern Mexico and southwestern United States. During migration, they rely on agave plants (Agave spp.) for nectar and pollen and have historically been important pollinators of agaves. In central Mexico, tequila and mezcal are produced from agaves on a vast scale for domestic and international sale. The current commercialized production of these beverages does not allow for pollination by bats (cause), which has led to declines of bat populations, a decrease of agave genetic diversity, and an increase in pest and disease outbreaks among Mexico's agave crops (effects). Using the telecoupling framework (socioeconomic and environmental interactions over distances), this project will assess the newly-created "bat-friendly" tequila and mezcal label that serves as a new link between these two sending and receiving systems through the market, and the potential for this labeling mechanism to serve as an agent to facilitate the flows associated with each system (i.e. bat populations and migrations and tequila and mezcal trade). This work is part of an integrative conservation PhD program and is being done in collaboration with natural and social science researchers and local Mexican conservation organizations, and it will provide unique insight into the development of the "bat-friendly" tequila and mezcal label, potentially benefitting both threatened bat species and the people who utilize agaves.

Presenter: Lee, Peter S

Title: New approach to a fragmentation-based estimation of development impact on forest in South Korea

Authors: Peter S Lee (Hanyang University);Sanghyuk Lee (Chungnam National University);Seung Yong Ji (Chungnam National University);Jaeyong Choi (Chungnam National University);

Session: Fragmentation

Abstract: Because of consistent and increasing forest development in South Korea, it is necessary to effectively and properly estimate development impact in order to sustainably manage forest. Targeting forest development in one heated developing region, Gyunggi Province, we selected two development types: golf courses and industrial complexes. We analyzed fragmentation effect for each type using Fragstats 4.2, and their fragmentation patterns by size of forest area within project sites with buffer zone ranging up to 2000m. As a result each development type has a group of fragmentation indexes: CA, NP, PD, TE, LSI and CONNECT for golf courses; CA, NP, PD, LSI, SIMI and CONNECT for industrial complexes. NP, PD and TE of golf courses were considered as representative indexes reflecting the average of impact ranges each sub-group by forest area. In the case of industrial complexes, NP, PD and CONNECT were the representatives. Golf courses showed a distinctive pattern of impact range that smallest group of forest area had larger impact range than the larger one. As for industrial complexes impact range became larger with forest area. Although individual sites presented the variations of impact range, they were in general consistent with the main pattern. In the comparison with growth rate of tree stem volume, our preliminary finding was tree growth were better in the vicinity of smaller projects and at the nearest buffer zones for both types. To effectively manage forest development, further research on analyzing other forest development types and the relations with ecological factors is needed.

Presenter: Lee, Danny C

Title: Remote tracking of forest dynamics using satellite imagery: Implications for sustainable forest management in the Southeast

Authors: Danny C Lee (USDA Forest Service);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: The use of woody biomass for energy has the potential to quickly become one of the more influential factors affecting forests throughout the southeastern United States. Rapid growth in the biomass industry could easily outpace conventional inventory and monitoring programs designed to track long-term forest changes. Agencies and stakeholders concerned with the sustainability of the region's forests need new monitoring tools that can keep pace with changes in the forest sector. Compounding the problem are the confounding and interacting effects of factors such as climate change, exurban development, insects and disease, and others. Recent advances in remote sensing and our computational ability to analytically summarize and interpret massive data sets offer novel means for tracking forest dynamics and parsing the impacts of a developing bioenergy sector. The Eastern Forest Environmental Threat Assessment Center has worked with NASA, Oak Ridge National Laboratory, UNC Asheville, and others to develop a suite of tools that can continuously monitor and quantitatively analyze landscape dynamics using a combination of MODIS imagery, statistical processing, and information theoretic measures of ecosystem dynamics. This presentation will briefly summarize these tools, and demonstrate their potential use in planning and adaptive management across landscapes within the context of bioenergy development.

Presenter: Leonard, Paul B

Title: From conservation planning to conservation design: The central and southern Appalachians

Authors: Paul B Leonard (Clemson University);Robert F Baldwin (Clemson University);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: Less than 14% (77,000 km2) of lands within the Appalachian LCC are currently under some level of protection against development. Most of this protected land is managed for multiple land uses leaving its long-term utility for biodiversity conservation largely unclear. To address these concerns, we began a systematic conservation planning and design exercise to identify strategic places on the landscape that warrant conservation action based on landscape-scale conservation targets. Using available data and modeling approaches, we developed candidate scenarios and conservation targets / goals and presented them to multiple expert-driven technical teams across the region. Through this exercise we developed site optimization, threats analysis, and landscape connectivity maps to capture conservation opportunity and priority areas at multiple scales across central and southern Appalachia. Finally, in order to move from complex model outputs to a network design that promotes participation and can be

easily communicated, we identified five conservation design elements covering many critical ecological processes and patterns. These elements include large interconnected regions as well as the broad landscapes that connect them. We also map small areas that are likely to contain larger ecological significance than their size would suggest. We provide examples of multi-scale aquatic and terrestrial conservation targets that are represented by our design elements. However, the success of this or any conservation planning and design enterprise is dependent on human communities and the LCC system provides a great model for bringing multiple parties together to form a unique and comprehensive conservation vision across the region.

Presenter: LI, Yangfan Y

Title: Coupling coordination assessment between urbanization and environmental systems

Authors: Yangfan Y Li (Xiamen University);Wenxun Lu (Xiamen University);

Session: Assessment II

Abstract: Urbanization has direct as well as indirect spatial effects on the farmland and environmental systems such as urban sprawl, excessive uses of fertilizers and pesticides etc. It is crystal clear that urbanization, farmland availability and environmental sustainability are the complicated tele-coupling system and nonlinear relationship. Most of research about coordination of coupled systems now concentrates on interactive relationship between two systems, such as coupling system of urbanization and environment and urbanization and economic development. Therefore, the present study introduces the framework of tele-coupling, which can help to analyze system components and their interrelationships, and regards urbanization as sending system, farmland availability as receiving system, and environmental sustainability as spillover system in order to establish an assessment system about coupling coordination degree. From the perspective of general system theory, coupling relations between three systems above belong to the category about system evolution. The degree of nonlinear system evolution may be characterized by state equation of the general system, which is rectified by Lyapunov first approximation. This study fitted equations of evolved state of three systems, and found the rates of systems evolution defined as VA, VB and VC which are defined along x-axis, y-axis and z-axis of three-dimensional reference system. After that, different scenario (urbanization rate, economic development and policy) simulations were applied to measure the degree of coordinate development of three systems above by analyzing the angle between the practical plane formed through VA, VB and VC along with drawing the synthetic standard plane. Providing a case study of a coastal city of China (Lianyungang, Jiangsu Province), the tele-coupling relationship among three systems was assessed from 2000 to 2014. Tele-coupled based landscape assessment approach can

contribute to sustainable solutions by an integrated analysis of farmland availability and the assessment of the tradeoffs associated with urban expansion and environmental conservation.

Presenter: Li, Han

Title: Landscape scale analysis of urbanization effects on bat distribution in North Carolina

Authors: Han Li (University of North Carolina Greensboro);Katherine Caldwell (North Carolina Wildlife Resources Commission);Matina Kalcounis-Rueppell (University of North Carolina Greensboro);

Session: Urban I

Abstract: Bat species respond to urbanization differently. In the US common bat species such as Mexican free-tailed bat (Tadarida brasiliensis) and big brown bat (Eptesicus fuscus) can adapt to urban areas. However, it is unclear to what extent the urban landscape is used by threatened and endangered species such as northern long-eared bat (Myotis septentrionalis) or gray bat (Myotis grisescens). Using the driving transect survey protocol in the North American Bat Monitoring Program (NABat), we investigated the landscape scale effects of urbanization on bat community structure. In 2015 between June and July, we sampled 32 NABat grids (10km by 10km) across North Carolina. Red bat (Lasiurus borealis) was the most common species, and was detected in all grids independent of urbanization. Big brown bat was detected more frequently in grids that included some urban development. Preliminary results suggest that the northern long-eared bat was detected in grids that were both near major urban centers and isolated from urban development. With predictors such as urban development composition, urban development configuration, and distance to major urban centers, we are constructing and will present a spatial model to explain bat community responses to urbanization across the landscape.

Presenter: Li, Mengmeng

Title: Urban land cover and land use extraction from very high resolution remote sensing imagery

Authors: Mengmeng Li (Faculty of Geo-Information Science and Earth Observation);Alfred Stein (Faculty of Geo-Information Science and Earth Observation);Wietske Bijker (Faculty of Geo-

Information Science and Earth Observation);Kirsten M. de Beurs (Department of Geography and Environmental Sustainability, University of Oklahoma, USA);

Session: Urban IV

Abstract: Urban land cover and land use information is essential for many urban-related applications. Remote sensing images can be used to extract urban land cover and land use information and to monitor change at local, regional, and national scales. In particular at local scale, the growing availability of Very High Resolution (VHR) remote sensing images has resulted in a considerable increase in both scientific and real-world applications associated with urban land cover and land use extraction. This paper presents a novel method for urban land cover extraction from VHR images, and models the link between land cover and land use. From a methodological point of view, we focus on building roof extraction from single VHR imagery by making use of the directional relationship between a building roof and its shadow. For modelling the link, we provide a novel way to statistically quantify the spatial arrangement of land cover elements for characterizing urban land use. Then, urban land use classification is conducted. We applied our proposed method to a subset of a Pleiades image for an urban area of Wuhan, China. We conclude that our proposed method can provide an effective means for urban land cover and land use extraction.

Presenter: Li, B. Larry

Title: Towards a thermodynamically-sounded approach to ecological landscape dynamics

Authors: B Larry Li (University of California, Riverside);

Session: Implications and applications of thermodynamics in landscape ecology

Abstract: In equilibrium thermodynamics, the second law (i.e. the law of free energy decrease and entropy production) enables stable states to be distinguished in a definite way: in a stable state the free energy has at least a local minimum, and the entropy, at least a local maximum. In the theory of open systems, the second law of thermodynamics is no longer of help, since in non-equilibrium stationary states the free energy need not have a minimum, nor the entropy a maximum. Near-equilibrium laws of nature are universal, but when they are far from equilibrium, they become mechanism-dependent. Considering ecological landscapes under constant influence of stresses and disturbances, the systems definitely are in a state far from thermal equilibrium. However, current energetic and thermodynamic perspectives of landscape theories, if not all, are based on non-equilibrium, but linear thermodynamics. We have to rethink some of the fundamental assumptions of physical laws for complex ecological landscapes accordingly. In this talk, I started with my early proposed four basic principles on

which to build landscape ecology (Li, 2000), that is, 1. landscape wholeness and hierarchy (or 'holarchy'), 2. landscape antagonism, 3. landscape instability or multistability, and 4. landscape selection. These four principles usually work together. Other secondary principles can be derived from the above fundamental principles. Then, I will use landscape image and transect data to demonstrate how we can use far-from equilibrium thermodynamic approach to better understand landscape dynamics.

Presenter: Li, Jingwei

Title: Are the drylands in northern China sustainable？A perspective from Ecological Footprint dynamics from 1990 to 2010

Authors: Jingwei Li (Beijing Normal University,China);Zhifeng Liu (Beijing Normal University,China);Chunyang He (Beijing Normal University,China);

Session: Poster

Abstract: The drylands in northern China (DNC) is crucial for China's sustainable development in the context of rapid urbanization, characterized by water scarcity, high climatic variability and infertile soil. However, few studies have systematically investigated its sustainability. Our objective was to assess the sustainability of the DNC according to the Ecological Footprint (EF) dynamics from 1990 to 2010. We analyzed EF in the DNC at multiple scales ranging from the whole, four sub-types to the drylands within each province. We found that the total EF in the DNC increased from 3.48×108 global hectare (gha) in 1990 to 1.26×109 gha in 2010 with a growth of 2.63 times, bringing over 14 times increase of ecological deficit (ED) from 6.26×107 gha to 9.63×108 gha. Meanwhile, the water withdrawal increased from 133.29 km3 to 153.23 km3 with a growth rate of 14.96%, while Human Development Index (HDI) grew from 0.62 to 0.79. We concluded that the DNC has already been unsustainable after the rapid increases of ED and water withdrawal from 1990 to 2010. We argue that effective managements are needed to maintain and improve the environmental sustainability of the DNC.

Presenter: Li, Kevin

Title: Mice in a maze of coffee: How agricultural management affects genetic structure of a forest rodent

Authors: Kevin Li (University of Michigan);Beatriz Otero-Jimenez (University of Michigan);

Session: Poster

Abstract: Land-use changes for agricultural production represent the majority of anthropogenic land transformations. The associated loss and fragmentation of natural habitat is considered the main driver of population declines and loss of biodiversity. Understanding the effect of agricultural matrix composition on dispersal of species is essential for the development of successful conservation plans. Our study uses genetic and landscape data to determine how agricultural landscape features may impede or promote dispersal of a common tropical forest rodent (Heteromys desmarestianus). Using microsatellite markers we evaluate the genetic structure of H. desmarestianus in a forest fragment surrounded by a coffee agricultural matrix in southern Mexico. We sampled 136 individuals from one forest fragment and 3 coffee farms representing varying degrees of management intensity within an area of 10 km2. To identify agricultural landscape characteristics that may be driving genetic structure we used presence/absence data from trapping surveys to model habitat suitability for H. desmarestianus by landcover, distance from stream, elevation, and slope. The suitability models were the basis of optimized resistance surfaces that we fitted to pairwise genetic distances between individuals. Our results suggest that the coffee agricultural matrix may be permeable enough to facilitate H. desmarestianus dispersal and gene flow, but that the degree of permeability varies with management intensity. These methods can be applied to other mobile organisms in the agricultural matrix to gain a fuller understanding of the impact of alternative systems of agriculture on wildlife conservation at a landscape scale.

Presenter: Lieske, David J

Title: Ensemble of ensembles: Combining the predictions from multiple machine learning methods

Authors: David J Lieske (Mount Allison University);

Session: Machine Learning and Data Mining Applications in Land- and Seascape Ecology: What it is, Why it matters, and Where the Progress Still Sits

Abstract: Tree-based modelling techniques, e.g. Random Forest (RF) and Boosted Regression Trees (BRT), employ binary recursive partitioning to generate predictions. Tree models do not require a functional form for the predictors, are very flexible in handling missing data, and can capture complex, non-linear interactions. They can be used to assess patterns, evaluate the impact of different predictor variables, and provide predictions in a standalone form or as part of an ensemble of other predictions. They are ideally suited for "mining" large, complex data sets, especially when little prior knowledge about the system exists. Despite these advantages,

ML techniques are not as widely used as they could be, perhaps due to a lack of familiarity, or perception that they are "black boxes" and, hence, harder to interpret. While highly flexible, machine-learning (ML) algorithms are also more sensitive to the idiosyncracies of particular data sets, a characteristic that can render it difficult to determine, a priori, the optimal set of tuning parameters to guide the model building process. The results reported here, for data sets of typical dimensions (in terms of number of covariates and sample size) illustrate that external validation can help suggest parameter settings that maximize the generalizability of the predictions, and that ensembles of predictions from multiple ML techniques can yield high accuracy while suffering less from overfitting.

Presenter: Lin, Laurence

Title: Modeling study of catchment water yield under different forest management practices

Authors: Laurence Lin (Institute for the Environment at UNC-Chapel Hill);Lawrence E Band (Institute for the Environment at UNC-Chapel Hill);

Session: Watersheds and Hydrology

Abstract: Common practices in forest management practices in Southeast United States include thinning aboveground biomass for preventing fire risk in public land, and plantation for in private land commercial sale. These practices are believed to have significant influences to the hydrology at hillslopes and to the water balance at catchment. In this study, we used a spatially distributed hydro-ecological model, the Regional Hydro-Ecologic Simulation System (RHESSys), to simulate several mostly-forested catchments (e.g., Cane Creek) in Chapel Hill, NC. In the simulation, we implemented forest thinning and plantation, and quantified the corresponding changes in hillslope hydrology during baseflow and storm event, in catchment water balance, and in catchment water yield. Our results showed that forest thinning increased summer baseflow and yielded more water whereas pine plantation reduced winter baseflow and yield less water due to the changes in evapotranspiration. Spatial location where these forest management practices occurred may also modify the hillslope hydrology and the catchment water balance.

Presenter: Lituma, Christopher M

Title: Multi-scale assessment of wildlife sustainability in switchgrass biofuel feedstock production

Authors: Christopher M Lituma (The University of Tennessee);Patrick D Keyser (The University of Tennessee);Charles Kwit (The University of Tennessee);Joseph D Clark (The University of Tennessee);Elizabeth D Holcomb (The University of Tennessee);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: As energy needs continue to grow for the United States, utilizing alternative energy sources through sustainable biomass becomes more important. Switchgrass (Panicum virgatum) is a native warm-season grass that is planted as biomass for biofuel, but grows in bunches typical of native grass species which could provide habitat for grassland nesting birds and insect pollinators. Our objectives were to assess differences in avian abundance, nest success, and pollinator species richness between switchgrass biomass fields, and matrix fields which are representative of the surrounding landscape. We conducted avian point counts, nest searched, and insect sampled in 10 fields of each type in Kansas, Pennsylvania, and Tennessee from May-July 2014 and 2015. We used package unmarked in program R to assess differences in avian abundance, package RMark to assess differences in avian nest survival, and the Shannon-Weiner index to assess differences in pollinator species evenness between field types. Eastern meadowlark (Sturnella magna) and western meadowlark (Sturnella neglecta) abundance was always greater on matrix fields than on biomass fields; this difference was greatest for western meadowlarks (56%) in Kansas. The opposite was true for red-winged blackbird (Agelaius phoeniceus) abundance which was always greater on biomass fields and positively related to percent forb cover. In Tennessee insect abundance was 65% greater on biomass fields than on matrix fields. Results will inform future ecological landscape impacts of biomass field plantings on grassland bird and pollinator populations.

Presenter: Liu, Xiaoqian

Title: A graph theory-based framework for evaluating spatial resilience: Linking disturbance, landscape and adaptive management in case of the ecological risks caused by coal mining

Authors: Xiaoqian Liu (Institute of Geographic Sciences and Natural Resources Research, CAS);Yanglin Wang (Peking University);Tao Pei (Institute of Geographic Sciences and Natural Resources Research, CAS);

Session: Assessment I

Abstract: This paper deals with a new method in coping and adaptation to natural hazard and anthropogenic disturbances through a spatial resilience management. Some measures and methods were critically reviewed with respect to the theoretical source and potential

application that this method might imply for additional ecosystem management. Landscape dynamic model were built and applied in Ku-ye watershed. Spatial dynamic model were used to simulation future landscape changes under the disturbance of coal mining activities. Comprehensive landscape risk evaluation and risk resistance surface were built to analyze the spatial heterogeneity of disturbance. Scenarios were built upon sensitivity analysis of key system indicators, such as the coal mining extraction rate, ecological capacity on urban population density, and impact of ecological protection policy. After the modeling and multi scenario simulation, a landscape indexed based spatial resilience evaluation framework was constructed. We found that, firstly, Ku-ye River Basin is facing with a variety of land desertification, geological disasters, environmental pollution and soil erosion related ecological risks, and rivers played the main function in risk proliferation and key corridor connectivity function. Secondly, landscape spatial-temporal dynamic simulation shows that overall landscape heterogeneity will substantially decrease, building land and unused land (including desert and bare land) will dominant, bring a draft decrease of system resilience in next 20~30 years. Land degradation situation is grim in the near decade. Measures on control of landscape transition possibility is not effective enough to protect ecological landscape from degradation, more targeted spatial adaptive measures should be taken to prevent risk diffusion.

Presenter: Liu, Luyi

Title: Formation mechanisms of ecosystem services: A preliminary review of a decade (2005-2015)

Authors: Luyi Liu (Henan University);Shengyan Ding (Henan University);

Session: Ecosystem Services I

Abstract: As one hot topic of ecology in decades, the research on ecosystem services (ES) has been brought to a climax by Millennium Ecosystem Assessment (MA) in 2005. Relevant studies such as ES classification, valuation, trade-offs and coordination, ES flow etc. have increased rapidly, which make ES research has entered a new phase. However, to know ES better and explore much deeper, it is essential to disentangle the formation mechanisms of ES. From the statistic results of published papers, it can be found that although many researchers have already realized the importance of knowing the formation mechanisms of ES, few papers documented their thoughts directly. Here, we suggested two types of mechanisms, which are theoretical mechanisms and executive mechanisms, and filled their contents by reviewing previous literatures from 2005 to 2015. Moreover, there are also some problems need to be solved in further studies, like, the scale-dependence and hierarchy in the formation of ES, and how can we get the experimental evidence of these problems. We hope that this article could

attract more valuable systematic research efforts on formation mechanisms of ES, and thus forming a research paradigm of this area in the future.

Presenter: Liu, Yupeng

Title: The multi-scale effects of socioeconomic and climatic factors on air pollution: A case study in the Beijing-Tianjin-Hebei region and the Agro-pastoral transition zone, China

Authors: Yupeng Liu (Beijing Normal University);Jianguo Jingle Wu (Arizona State University/Beijing Normal University);

Session: Urban II

Abstract: China's tremendous economic achievements in the past three decades have resulted in a number of environmental problems, including the deterioration of air quality. In particular, fine particulate matter (PM) has received increasing attention from scientists, governments, and the public due to its adverse impacts on human health. However, it remains poorly understood what major factors influence the spatial pattern of air pollution in China on different time scales. To address this question, we first quantified the spatiotemporal patterns of air quality in the Beijing-Tianjin-Hebei region and the Agro-Pastoral Transition Zone (APTZ) of North China, and then examined the relationship of air pollution to several socioeconomic and climatic factors. Statistical analysis was conducted on the daily and annual scales, using constrain line analysis, correlation analysis, and stepwise regression. At the daily scale, the air quality index (AQI) was correlated negatively with wind speed and sunshine duration, but positively with relative humidity in the Beijing-Tianjin-Hebei region. In the APTZ, the AQI increased with wind speed, relative humidity, and sunshine duration first, then began to decrease. At the annual scale and for most cities in the Beijing-Tianjin-Hebei region and the APTZ from 1999 to 2011, the most important factors deteriorating air quality were socioeconomic factors, such as energy consumption and GDP in 2nd industry, followed by climatic factors. Our study demonstrates that multi-scale analysis is important and effective in assessing the effects of socioeconomic and climatic factors on air pollution.

Presenter: Liu, Yanxu

Title: The spatial resilience of urban green landscape in Shenzhen City, a fast growing metropolis of China

Authors: Yanxu Liu (Peking University);Jian Peng (Peking University);

Session: Urban IV

Abstract: Facing the huge social and ecological risk triggered by the worldwide rapid urbanization, urban resilience has never been a more important issue now. Spatial resilience, which emphasis the geographical location, landscape connectivity, and temporal renewing ability, is effective to identify the urban resilience on a land use perspective. In the past 30 years, Shenzhen City has experienced fast speed of urbanization and significant landscape transformation. In order to control the urban sprawl, a “basic ecological protection boundary” was brought into legal regulation in 2005. To find the effectiveness of this ecological boundary, in this study, multi-source remote sensing images were used to identify the landscape transformation and the change of greenness. The result showed the landscape change inside the boundary was a little, whereas the green landscape was in apparent fragmentation and easy to reconstruct outside the boundary. Facing the urban heat island, the green landscape inside the boundary mostly performed better cooling effect. When suffered heavy rain, the decrease of green landscape inside the boundary could cause higher flooding risks. Moreover, the green landscape inside the boundary played an important role to the balance between carbon and oxygen in metropolis. According to the huge structure-function difference of the green landscape in Shenzhen City, a controlling boundary supported by policy in landscape planning is effective to strengthen the spatial resilience, which can benefit the social well-being by reducing the ecological risks.

Presenter: Liu, Jianguo

Title: Landscape networks as telecoupled human and natural systems: An introduction

Authors: Jianguo Liu (Center for Systems Integration and Sustainability);Vanessa Hull (Center for Systems Integration and Sustainability);

Session: Landscape networks as telecoupled human and natural systems

Abstract: Landscapes around the globe are increasingly connected to other distant systems through flows of information, matter, energy, organisms, goods and products, financial capital, and people. Traditional place-based approaches fall short of understanding, modeling, and managing such complex distant processes that cause immense landscape changes in the Anthropocene. The new umbrella concept called "telecoupling" overcomes this shortcoming by explicitly analyzing socioeconomic and environmental interactions over distances. The telecoupling framework treats each landscape as a coupled human and natural system, and a network of landscapes as telecoupled human and natural systems. It analyzes the diverse

agents, flows, causes, and effects of interactions between the distant systems. In this presentation, we briefly introduce the telecoupling framework and explore its applications to address important issues relevant to landscape changes, such as distant supply of and demand for natural capital, ecosystem services, conservation, migration, international trade, and sustainability across local to global scales. We also highlight the capacity for the framework to detect and understand hidden mechanisms behind landscape changes, some of which arise due to "spillover" effects that occur when systems are indirectly impacted in surprising ways by interactions among other coupled systems. Finally, we provide an overview of the remaining presentations in this symposium. It is our hope that this symposium will stimulate further research on this rapidly progressing frontier and provide useful information for more effective landscape management.

Presenter: Lonsdorf, Eric V

Title: Combining common sense and a landscape model to determine where we need more habitat for wild bees

Authors: Eric V Lonsdorf (Franklin and Marshall College);Taylor Ricketts (University of Vermont);Insu Koh* (University of Vermont);Claire Brittain (UC Davis);Neal Williams (UC Davis);

Session: The Landscape Ecology of Pollination Mutualisms

Abstract: Many crops benefit from pollination services of wild. However, habitats with consistent floral and nesting resources to support wild bees in agricultural landscapes are often lacking. Indeed, a recent report from the White House's Pollinator Health Task Force recommended that the United States "restore or enhance 7 million acres of land for pollinators over the next 5 years through Federal actions and public/private partnerships." This recommendation begs asking: where should these restorations and enhancements be placed? We address this question using an ecologically-scaled model of wild bee habitat to locations that would benefit most from adding pollinator habitat at two linked scales. First, we identify counties within the US that would benefit most, and then use a cost-benefit analysis to identify pollinator-dependent crop fields within the selected counties that would benefit. We find that counties that have relatively low supply of habitat for wild bees and have large of amounts of pollinator-dependent crops, i.e. high demand, should be targeted for restoration. Within these counties, larger fields of pollinator-dependent crops embedded in landscapes poor bee habitat will benefit more than small fields in relatively high quality landscapes. Our results are consistent with a common sense approach to the problem – we should create pollinator habitat in areas of mismatch, i.e. where the current supply is low and demand is high. Continued research is needed to improve the landscape model's predictive ability and build confidence in its link to pollination service in order to confidently identify areas of mismatch.

Presenter: Lookingbill, Todd R

Title: Battlefield landscapes and the ecosystem services they provide

Authors: Todd R Lookingbill (University of Richmond);

Session: Ecosystem Services I

Abstract: Warfare and related military actions have profound, long-term impacts on landscapes. Civil and Revolutionary War battlefields provide useful model systems to examine these impacts. Through time, these sites take on cultural and historical significance, often leading to formal memorialization and protection. Although typically not part of their mission value for being protected, once set aside, the sites perform a variety of landscape functions. Drawing on the military concept of collateral damage, these ecosystem services can be thought of as collateral values. This study uses landscape analysis tools to quantify landscape change in and around four National Battlefield Parks in Virginia and Maryland (Yorktown, Petersburg, Richmond, and Antietam Battlefields). The sites are characterized by a mosaic of forest and historic field patches, and are frequently located in areas of increasing suburban development. The role of the parks in water provisioning, green infrastructure, and recreation is quantified and compared along an urban-suburban gradient. The value of the sites to promoting ecological connectivity is emphasized. The strategic location of the battles on the outskirts of cities translates to the potential for the battlefield parks to serve as the backbone of a regional conservation network at the urban fringe. A more intentional rather than opportunistic approach is proposed that prioritizes the combined cultural and natural resource values of sites considered for future land acquisitions by the parks.

Presenter: Lopez-Hoffman, Laura L

Title: A telecoupling model to account for spatial subsidies of ecosystem services provided by transboundary migratory species in North America

Authors: Laura L Lopez-Hoffman (University of Arizona);Ruscena P Wiederholt (University of Arizona);John Loomis (Colorado State University);

Session: Landscape networks as telecoupled human and natural systems

Abstract: In complex coupled natural-human systems, drivers of change in one location can have profound effects on human well-being in distant locations, often across international borders. While the conceptual framework of telecoupling describes these interactions across space, analytical approaches are necessary to quantify feedbacks between ecosystem change in one area and societal benefits in other areas. Here, we use a new approach—spatial subsidies—to operationalize the concept of telecoupling by measuring the degree to which a migratory species' ability to provide services in one location depends on habitat in another location. We calculate spatial subsidies for two North American migratory species: Mexican free-tailed bats Tadarida brasiliensis mexicana and Northern Pintails Anas acuta. For each species, we model habitat distribution and dependence, and assess the economic value of ecosystem services provided by these species (pest control and recreational and subsistence hunting, respectively). We then assess spatial subsidies under current conditions and global change scenarios of wind energy development and hunter declines. Our goal is to present managers with modeled scenarios of impacts on services and spatial subsidies to identify how they might alter land-use and conservation actions in response, and understand how the spatial subsidies concept might support the objectives of international cooperation to protect migratory species.

Presenter: Loudermilk, E. Louise

Title: Landscape patterns of fine-scale plant diversity: Linking overstory structure and site characteristics to the understory community

Authors: E. Louise Loudermilk (USDA Forest Service);Joseph J O'Brien (USDA Forest Service);Andrew T Hudak (USDA Forest Service);Lee A Dyer (University of Nevada-Reno);Scott M Pokswinski (University of Nevada-Reno);

Session: Wildland Fire II

Abstract: Overstory structure in longleaf pine (Pinus palustris) woodlands determine patterns of fuel distribution and with frequent low-intensity fire, maintains diversity patterns in the understory plant community. Site characteristics, particularly current and historic fire regime also play a role, as fire regulates plant competition and stature, consumes fuel, and creates a mineral soil bed for new germinants. In this study, we explore the effects of overstory structure from aerial LiDAR coupled with site characteristics (land use, soils, elevation, and distance to nearest stream) as well as fire regime on patterns of understory plant diversity in reference condition longleaf pine sites at Eglin Air Force Base, NW Florida, USA. Small 1 m x 3 m plots are set up in three canopy densities of high (3), low (1), and no adult pine tree within 5 m from each plot. Plant mortality, survival, and birth are recorded at fine-scales (10 cm x 10 cm) within these plots every Spring and Fall since 2012 and burned every other year. From our analysis, we extrapolate plant dynamics across Eglin's longleaf pine area. We test our extrapolated

predictions on independent plots with similar overstory structure, site characteristics, and burn regime. This study provides a means to model fine-scale plant community dynamics at scales relevant to management, which can be developed for other longleaf pine sites.

Presenter: Lovette, John P

Title: Spatial analysis of riparian features for nutrient retention: Implications for ecosystem management

Authors: John P Lovette (Univ of North Carolina, Chapel Hill);Jon M Duncan (Univ of North Carolina, Chapel Hill);Lawrence E Band (Univ of North Carolina, Chapel Hill);

Session: Poster

Abstract: Hot spots and hot moments of nutrient transformations and transport have typically been limited to small scale intensive field campaigns. However, effective watershed management and policy is necessarily at larger spatial scales and requires spatially extensive coverage, in turn creating a divide between process-level research and large scale policy. Combining large scale datasets and model results as demonstrated here holds great promise for the enhanced prediction of biogeochemical hotspots and hot moments. Large scale, spatially extensive models such as the USGS SPAtial Regression On Watershed Attributes (SPARROW) model uses catchment characteristics that alter the landscape to water delivery of nutrients. Floodplain wetlands are included as one of the many significant variables for nitrogen and phosphorus retention. The biogeochemistry of these areas has proven very effective for increasing nutrient retention through denitrification, biological assimilation, and deposition. By combining hydraulic flood routing model data (HEC-RAS) with SPARROW model nutrient information at small watershed (NHD+) scales for entire hydrologic/ecological units, it is possible to begin quantifying the coupled effects of hotspots in floodplain biogeochemistry. We will explore a range of floodplain parameters, namely over bank flow and other geomorphic indices of floodplain connectivity. We hypothesize that watersheds where SPARROW overpredicts modeled stream nutrient flux have more extensive floodplains and higher degrees of floodplain connectivity where higher discharges can access greater amounts of floodplain and therefore retain higher amounts of nutrients than the model predicts.

Presenter: Luck, Matt A

Title: A near real-time global monitor and applications of historical and medium- to long-term forecasts of hydroclimate and indicators of water stress

Authors: Matt A Luck (ISciences, L.L.C.);Thomas M Parris (ISciences, L.L.C.);Jonathan W Boright (ISciences, L.L.C.);R. Matthew Landis (ISciences, L.L.C.);

Session: Climate change and landscape sustainability of global drylands

Abstract: ISciences has constructed a capability to routinely monitor and forecast water anomalies worldwide. This capability is based on a Water Security Indicators Model (WSIM) that produces near-real-time monthly forecasts of indicators of hydroclimate and water stress. WSIM is a reduced form land surface model that is driven by monthly precipitation and temperature datasets and an ensemble of 1-9 month lead time forecasts produced by NOAA's Climate Forecast System V2. Products include current monitoring of several measures of water surplus and deficit relative to a 1950-2009 climatology and 1-9 month lead forecasts of monthly deficit and surplus anomalies (return frequencies) within 15 days after the close of each month. We used a similar approach to estimate water stress (calculated as the demand vs. supply of available water taking into account upstream losses) based on an ensemble of long-term climate projections. Highlights of our approach include a basin-centric (as opposed to pixel) spatial unit and estimation of water use by sector (agricultural, domestic, and industrial). Ongoing work includes estimation of loss of electrical generating capacity due to effects of the interaction of water and temperature anomalies on electrical production and demand, and impacts of water anomalies on agricultural production.

Presenter: Ma, Zhao

Title: Engaging family forest owners in the prevention and control of invasive plants in privately-owned forest landscapes: Challenges and opportunities

Authors: Zhao Ma (Purdue University);Mysha Clarke (Purdue University);Stephanie Snyder (US Forest Service Northern Research Station);Kristin Floress (US Forest Service Northern Research Station);

Session: Dynamics in landscapes dominated by family forests

Abstract: Invasive plants present significant threats to forest ecosystem health. The attitudes and behaviors of family forest owners are critical for controlling the spread of invasive plants. By analyzing data from semi-structured interviews and a mail survey of family forest owners in Indiana, we assess forest landowners' awareness, attitudes, and behaviors towards invasive plants at the property, community, and landscape scales, as well as the role of social influence

in shaping their awareness, attitudes, and behaviors. Our results show that a majority of landowners are not aware of invasive plants and their impacts. Among those who are aware, few have taken actual measures on their property. Major reasons for inaction include lack of awareness and the financial cost and time commitment involved in prevention and control, as well as the differentiated perceptions of landowners towards invasion risk and management responsibilities across scales. Specifically, most landowners believe that individuals are responsible for controlling invasive plants on private properties, while the government is responsible for controlling on public lands. Some expressed disapproval of using legislation to force individuals to control invasive plants, while others expressed disapproval of using taxpayer money to control on private properties. Evidence suggests little potential for cooperation among Indiana landowners; instead, individual-based approach seems more plausible. Overall, our study points to a gap between family forest owners' perceived invasion risk and actual landscape-level invasion risk. Our results can inform the development of policy strategies for enhancing family forest owners' willingness and capacity to control invasive plants.

Presenter: Mangiante, Michael J

Title: Stream hydrologic response to increased urbanization in Mid-Atlantic watersheds

Authors: Michael J Mangiante (US EPA);ORISE Participant) (US EPA);

Session: Urban IV

Abstract: Urban development alters stream hydrology; resulting in increases in the Richard-Baker Flashiness index, peak flow, and the number of flood events for many watersheds throughout the U.S. To better understand and predict the relationship between stream flow patterns and watershed characteristics, we evaluated the influence of nationally available anthropogenic and watershed factors on streamflow metrics and determined a measurable threshold at which urbanization affects watershed hydrology. Average annual Richard-Baker Flashiness, Mean Flow, Peak-Flow, Low-Flow, and the 7Q2 were calculated using daily mean flow observations between 1970 and 2014 from 151 U.S. Geological Survey stream gages across the Mid-Atlantic States. Streamflow calculations were aggregated to five year windows around 1984, 1992, 2001, 2006, and 2011 and compared to watershed edaphic characteristics and urbanized land cover calculated from the North American Landscape Characterization program and the National Land Cover Dataset for those same time periods. Urbanization was highly correlated with stream flashiness and mean-flow for watersheds with greater than 30% urbanization. Additionally, watershed road area accurately predicted percent developed area and was highly correlated with streamflow metrics. A secondary trend was identified with lower than expected flashiness at high rates of urbanization which could be attributed to effective

storm water runoff best management practices. The results of this research depict how hydrology responds to landscape change and provide a guide with which to evaluate the effectiveness of storm water management systems to reduce stream flashiness.

Presenter: Mao, Jiafu

Title: Natural and human impacts on global vegetation growth tendency

Authors: Jiafu Mao (Oak Ridge National Laboratory);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: We investigated how climate change, atmospheric CO2 concentration, anthropogenic nitrogen deposition, and land use/land cover change influenced terrestrial vegetation growth over the past 3 decades using multiple models and satellite products. Globally, the latitudinal pattern of annual vegetation growth can be primarily attributed to the asymmetry of land temperature variations. Elevated atmospheric CO2 concentration was simulated to be the dominant driver for the enhanced vegetation growth. The roles of other factors, such as nitrogen deposition and land use change, are less pronounced and regionally dependent. Our results highlight how non-climatic factors mitigate or exacerbate the impact of climates on terrestrial vegetation growth, particularly across regions with intensive human activity.

Presenter: Marr, Paul G

Title: Primary productivity trends of human-managed high-altitude cushion bogs (bofedales) in the Central Andean Puna, 2001-2013

Authors: Paul G Marr (Shippensburg University);Claire A Jantz (Shippensburg University);

Session: Arid Landscapes

Abstract: The central Andean dry puna ecoregion occupies the arid montane grasslands of northern Chile and Argentina and western Bolivia. Peat forming wetlands, known regionally as bofedales, are actively managed by indigenous Aymaran agro-pastoralists, who depend heavily on this keystone ecosystem as a means to provide camelid pasture and irrigation for quinoa farming. The focus of this research is to quantify the level to which Aymaran management

impact these wetlands, and we hypothesized that increased human activity will positively influence primary productivity. We also hypothesized that increases in activity will result in decreases annual variation in productivity. Monthly MODIS EVI images from 2001-2013 were obtained and primary productivity data for 100 bofedal sample points were compiled resulting in 156 observations per bofedal. These data were then decomposed and the trend component extracted and averaged over the study period. An index was then developed that captured the level of human activity at each of the 100 bofedal sample sites. There was a significant positive partial correlation between human activity and the average bofedal primary productivity trend (rho = 0.543, $p < 0.001$) when controlling for both watershed and bofedal size. However, there was also significant positive correlation between the level of human interaction and the EVI trend variability (rho= 0.520, $p < 0.001$). These results suggest that Aymaran management practices improve primary productivity of the bofedales and increase annual productivity variation. The data indicate that Aymaran management increases seasonal productivity highs to a much greater extent than seasonal productivity lows.

Presenter: Marrec, Ronan

Title: Multi-scale environmental and spatial processes drive the metacommunity structure of spruce budworm's (Choristoneura fumiferana) associated parasitoids

Authors: Ronan Marrec (Université de Montréal);Olivier Pontbriand-Paré (Université de Montréal);Simon Legault (Université de Montréal);Patrick MA James (Université de Montréal);

Session: Forest Pests

Abstract: Outbreaks of the spruce budworm (SBW - Choristoneura fumiferana) represent a major forest disturbance in North America, and having a better understanding on how to control this pest is of main concern to protect forests. One proposed mechanism is linked to the role of natural enemies, especially parasitoids, as control agents. Despite the large literature studying SBW associated parasitoids, little is known about how regional processes, such as dispersal, combine with local dynamics, such as species' interactions and environmental filtering, and stochastic events of colonization and extinction affect species' coexistence across scales. The present study proposes to determine the patterns of theoretical community structure and environmental influences followed by the parasitoid community associated to the SBW. The originality of our approach is to focus on emergent patterns at the metacommunity level through applying two complementary statistical tools, the elements of metacommunity structure (EMS) and variance partitioning. Through these analyses local community composition and richness of 20 sites sampled in the Côte Nord region (Québec, Canada) in 2014 are compared and correlated to (i) quantitative descriptors of the landscape around each site (100-10,000 m; remote sensed data from the USGS), (ii) age and intensity of defoliation caused

by the SBW (aerial observations; QC gov), and (iii) spatial structure modeled as distance-based Moran's eigenvector maps (dbMEM). Our results will help us to identify tools for a forest management directed towards a biological control and regulation of SBW outbreaks.

Presenter: Marron, Bruce D

Title: Listening to the landscape

Authors: Bruce D Marron (Portland State University);

Session: Poster

Abstract: Planetary-scale trends demand sustainable agriculture but no one knows what 'sustainable agriculture' looks like at the landscape scale. The dynamics of agro-ecological landscapes are difficult to study because such landscapes involve coupled, complex adaptive systems that evolve in time and in space over multiple scales of both. A robust, flexible methodology is proposed for adequately differentiating agricultural practices with respect to their ecological impact. The methodology defines an n-dimensional vector of state variables that can be obtained from simulation experiments using a spatially explicit and spatially interactive forest landscape model (LANDIS-II). LANDIS-II is a useful model for evaluating agro-ecological landscapes because it is suspected that sustainable agriculture is a function of landscape disturbance. A feature extraction process (e.g., vector quantization) is applied to the output vectors in order to create a complete partitioning of the n-dimensional phase space into mutually exclusive and exhaustive subspaces. The unique prototype (reproduction) vector for each of these partitions can be considered as a landscape 'morph' and these in turn can be tagged with a simple, identification symbol. The dynamics and spatio-temporal behavior of the landscape is thus encoded as a sequence of symbols and the analytical tools from symbolic dynamics can be applied. In particular, statistical language models such as bigram models can be constructed from the symbolic time series data. Such models define the shift spaces of possible and "forbidden" sequences. It is anticipated that from such shift spaces the ecological sustainability of agricultural practices can be inferred and, ultimately, defined.

Presenter: Matthews, Stephen N

Title: Considering forest species vulnerability to climate change requires integration of current conditions and projection uncertainty

Authors: Stephen N Matthews (Ohio State University);Matthew P Peters (USDA Forest Service, NRS);Iverson R Iverson (USDA Forest Service, NRS);Anantha M Prasad (USDA Forest Service, NRS);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: The present extent of forests in the eastern United States is indelibly shaped by legacies of land use in the near term and emergent processes of much longer time horizons. Appreciating the temporal permanence of the extant communities we observe and manage provides a means to consider potential climate change impacts to forest biodiversity. It is in this context that we developed species distribution models (SDM) of 134 tree species across the eastern US using random Forest, which depends on key determinants of species present-day occurrences. These variables capture broad species associations to climate, elevational, and edaphic conditions. A key outcome of these efforts has been that such variables can be projected onto climate change scenarios to evaluate habitat change. Compiling and analyzing these responses are important ingredients when considering vulnerability and potential adaptation . Of course, there are many caveats that will limit the transferability of the results to ultimate outcomes so that we now aspire to develop further our ability to quantify the reliability of the individual species model performance. We focus first on quantifying the stability of model results and resulting contributions to model strength. Next we quantify the spatial confidence of model projections both under current and future conditions via evaluating the coefficient of variation across training data. Finally we show that such tools add to the capacity to properly consider the inference of the SDM results as well as provide opportunities for integration of our approach to the multiple other fruitful avenues towards modeling potential climate change impacts to forests.

Presenter: Mayer, Audrey L

Title: Bioenergy policies and production as prioritized by family forest owners in Upper Michigan

Authors: Audrey L Mayer (Michigan Technological University);Ashma Vaidya (Michigan Technological University);

Session: Dynamics in landscapes dominated by family forests

Abstract: Family forest owners (i.e., non-industrial private forests) pose a difficult regulatory problem for regional natural resource managers. Their large numbers and diverse land-use activities impact forests at multiple scales. Our previous work on voluntary incentive programs

for family forests demonstrated that the low enrollment in existing programs may be due to the poor fit of these programs with the values of these owners. The state of Michigan would like to advance forest-based bioenergy production, but family forest owners (who control ~30% of forests in the Upper Peninsula) are likely to be left out if programs do not address their values. We developed a community-driven regional assessment tool for forest-based bioenergy production in the upper Michigan (USA), with a diversity of stakeholders including family forest owners. Participants generated a preliminary list of criteria and indicators (C&Is) and narrowed the list using multiple criteria analysis (MCA) in a workshop. The final set of C&I consisted of 5 criteria and 31 indicators (in parentheses): Economic (6), Environmental (7), Social (8), Policy and Regulations (4) and Institutional Capacity (6). This participatory MCA method identified C&Is that were reflective of the regional context and the concerns of local stakeholders, and data for many of these C&I are readily available. Our work suggests that voluntary incentive programs which incentivize the conversion of abandoned agricultural land to bioenergy crops would be favored over the harvests of native forests, as these forests are highly valued for timber, wildlife, recreation, and cultural heritage.

Presenter: Mayrand, Paul

Title: Modelling the development of spatial genetic structure during range expansion: The case of the mountain pine beetle (Dendroctonus ponderosae)

Authors: Paul Mayrand (Université de Montréal);Élise Filotas (Télé-Université du Québec);Patrick MA James (Université de Montréal);

Session: Forest Pests

Abstract: Landscape genomics aims to identify putatively adaptive loci in non-model species by examining correlations between the allele frequencies and landscape heterogeneity. However, during range expansion neutral variation due to demographic processes can result in patterns that mimic adaptive genetic variation. This confounding effect can result in false positives in traditional outlier-detection methods. Although researchers are aware of this problem, we still do not know precisely under which conditions it becomes difficult to distinguish these sources of genetic variation. Using a spatially explicit genetic simulator (CDmetaPop), we investigate how dispersal, time since beginning of expansion, and strength of selection affects our ability to separate spatial patterns in neutral and adaptive genetic variation during range expansion. This model was parameterized to represent the spatial population dynamics and genetics of the mountain pine beetle, a native outbreaking forest insect pest of western North America that is currently extending its range northward and eastward. Results show that under conditions of weak dispersal and early sampling during range expansion, neutral loci are more likely to exhibit patterns similar with those generated by adaptive processes. In contrast, when dispersal

rates are high, and later in the expansion process, it is easier to distinguish adaptive from neutral loci. Therefore, landscape genomics methods are expected to produce a higher false positives rate during initial phases of range expansion and when dispersal is weak. Further development in statistical modelling is still required to separate these two sources of spatial genetic variation during range expansion.

Presenter: McCabe, Gregory J

Title: Variability in the start, end, and length of frost-free periods across the conterminous United States during the past century

Authors: Gregory J McCabe (US Geological Survey);Julio L Betancourt (U.S. Geological Survey);Song Feng (University of Arkansas);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: The timing of last spring frost dates (LSFDs), first fall frost dates (FFFDs), and frost-free period lengths (FFPLs) constrains freeze-thaw processes in hydrology, paces the annual life cycles of plants and animals, affects human food production, and influences land-atmosphere interactions, including the water and carbon cycles. Daily minimum temperature data for the conterminous United States (CONUS) from the Global Historical Climatology Network for the 1920 through 2012 period are used to determine LSFDs, FFFDs and FFPLs. Analyses of trends and variability in these growing season components indicate a trend towards earlier LSFDs, later FFFDs, and longer FFPLs for most locations in the CONUS. A general change to earlier LSFDs appears to have occurred after about 1983, whereas a change to later FFFDs is most noticeable after about 1993. Comparisons of time series of LSFDs and FFFDs with well-known climate indices indicate only weak correlations for most sites.

Presenter: McClure, Meredith L

Title: A connectivity data atlas for the Great Northern Landscape Conservation Cooperative: Making sense of diverse data to inform strategic connectivity conservation

Authors: Meredith L McClure (Center for Large Landscape Conservation);David M Theobald (Conservation Science Partners);Tabitha A Graves (USGS Northern Rocky Mountain Science Center);John Pierce (Washington Department of Fish and Wildlife);Bray J Beltran (Heart of the

Rockies Initiative);Carl Scheeler (Confederated Tribes of the Umatilla Indian Reservation);Ian Dyson (Alberty Environment and Sustainable Resource Development);Sean Finn (Great Northern Landscape Conservation Cooperative);Matt Heller (Great Northern Landscape Conservation Cooperative);Melly Reuling (Center for Large Landscape Conservation);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: The Great Northern Landscape Conservation Cooperative (GNLCC) is a voluntary network of partners that transcends boundaries and jurisdictions by sharing data, science, and capacity to address common landscape conservation goals. The GNLCC's Ecological Connectivity Project initiated to address the goal of conserving a permeable landscape with connectivity across aquatic and terrestrial ecosystems in the face of threats from conflicting land use and climate change. The project seeks to gather and disseminate available connectivity science and data; grow the diverse partnerships required for effective conservation; share successful on-the-ground actions; and generate recommendations for the GNLCC and its partners around short- and long-term connectivity conservation strategies. We present one component of this work, a connectivity data atlas, developed to support fulfillment of these objectives and to address a fundamental question: what do we know about connectivity in the GNLCC? The atlas compiles diverse spatial datasets identifying potentially important linkage zones throughout the GNLCC region in order to provide centralized, user-friendly connectivity data access; to support planning and decision-making by GNLCC partners, including land and wildlife managers and private lands conservation practitioners; and to ultimately help inform a GNLCC-wide connectivity conservation strategy. An overview of the state of our knowledge will be presented, including connectivity data richness, conservation status, and relative intensity of stressors across the GNLCC. An overview of the different types of information available across scales will be provided, and both opportunities and challenges for application of this information to on-the-ground connectivity management questions will be discussed through examples.

Presenter: McCluskey, Eric M

Title: Role of historical land use in the distribution of Eastern Massasauga rattlesnake habitat in northeastern Ohio

Authors: Eric M McCluskey (Ohio State University);Thomas E Hetherington (Ohio State University);

Session: Wildlife II

Abstract: Historical processes play an important role in the patterns of biodiversity we observe today. Of particular interest to conservation biologists and ecologists are the roles of prior land use and land cover change in influencing the present day distribution of rare species and ecosystems. I used object-based classification techniques to analyze historical aerial photographs (covering ~75 years) in order to quantify anthropogenic land use and successional transitions in land cover to gain a better understanding of how these processes have influenced the present day distribution of a threatened species, the Eastern Massasauga Rattlesnake (Sistrurus catenatus catenatus) in northeastern Ohio. I compared these patterns of land use with a habitat suitability map generated from a species distribution model based on current environmental conditions. I found that prior agricultural areas were associated with higher habitat suitability scores than forest or grassland areas. I also observed current massasauga populations residing in habitat patches that had previously been agricultural fields. These findings, coupled with observed increases in tree cover, which is detrimental to massasaugas, provide evidence for the role of agricultural land use as an important contributing factor to the distribution of massasaugas and their habitat in northeastern Ohio. In the absence of natural disturbance agents, agricultural fields that were allowed to go fallow represent an important source of early successional habitat vital to massasaugas in this part of their range.

Presenter: McEachron, Lucas G

Title: Assessing coral bleaching risk using sea bottom temperature

Authors: Lucas G McEachron (Florida Fish and Wildlife Research Institute);Katie Wirt (Florida Fish and Wildlife Research Institute);Renee Duffey (Florida Fish and Wildlife Research Institute);David Palandro (ExxonMobil Upstream);

Session: Coastal and Marine

Abstract: Satellite derived sea surface temperature is the most common product used to remotely monitor and assess coral bleaching risk. Increasing water temperature rapidly causes zooxanthellae, the source of 90% of a coral's energy, to leave the tissues of hermatypic corals. As zooxanthellae leave, corals turn pale, "bleach", and often die. Since 1979, six periods of mass coral bleaching have occurred with increasing severity. The goal of this study was to compare bleaching risk derived from sea surface temperature to a bleaching risk model derived from sea bottom temperature. Presumably, sea bottom temperature is a more accurate representation of bleaching risk because corals directly interact with bottom temperature. We generally assume sea bottom temperature is colder than surface temperature, but in some cases, sea bottom temperature can be warmer than surface temperature, leading to inaccurate bleaching risk assessments. While sea surface temperature is commonly used to assess bleaching because it is easily accessible, we demonstrate that sea bottom temperature can just as easily be

derived from surface temperature, while providing an alternative representation of bleaching risk.

Presenter: McElroy, Cara L

Title: Determining landscape connectivity through patterns of amphibian community composition across a land-use gradient

Authors: Cara L McElroy (University of Georgia, Joseph W Jones Ecological Research Center);Jeffrey Hepinstall-Cymerman (University of Georgia);Lora L Smith (Joseph W Jones Ecological Research Center);Travis C Glenn (University of Georgia);

Session: Amphibians in a changing landscape

Abstract: Amphibians in geographically isolated wetlands (GIWs) occur in wetland complexes embedded within an upland matrix that provides both juvenile and adult habitat. To better understand the effects of land conversion on amphibians, we compared species richness, evenness, and similarity of the amphibians in 36 GIWs within the Dougherty Plain region of southwestern Georgia. Study wetlands were chosen to allow comparison of amphibian species composition along a disturbance gradient, from wetlands embedded in intact longleaf pine (Pinus palustris) forests, to wetlands adjacent to remnant forest patches, and finally wetlands in extensive irrigated agriculture. Wetlands were sampled monthly with dipnetting and automated audio surveys to detect adult anurans and larval anurans and salamanders. We found that amphibian species richness was similar among reference and disturbed wetlands, but longleaf pine habitat specialists such as gopher frogs (Lithobates capito) and striped newts (Notophthalmus perstriatus) were not detected at wetlands without sufficient surrounding forest cover. In contrast, wetlands in agricultural fields were dominated by generalist species that fare well in disturbed landscapes. Greater landscape disturbance tended to lead to high densities of one or two generalist species, such as Lithobates sphenocephalus (southern leopard frog) or Hyla squirella (squirrel treefrog.) Our results suggest that to preserve amphibian diversity, landscape management should focus on the preservation of wetlands within intact forest or at least in close proximity to forest patches in an agricultural matrix. A companion study is using genetic relatedness of individuals within these wetland complexes to understand functional landscape connectivity.

Presenter: McGrath, Brian P

Title: An archaeology of the metacity

Authors: Brian P McGrath (Parsons School of Design);Steward TA Pickett (Cary Institute of Ecosystem Studies);

Session: Urbanization and Landscape Change: Socioeconomic Drivers and Ecological Consequences

Abstract: This presentation traces the origins of the present form of global urbanization termed the metacity to the creation of the first electronic stock market in 1971. By the 1980s, urban observers began to note some of the effects of digital globalization of finance had on cities. Joel Garreau's Edge City: Life on the New Frontier, and Neil Smith's The New Urban Frontier: Gentrification and the Revanchist City, both identified new forms of urbanism at both the center and the periphery of historical cities. Clearly former urban descriptions of city, metropolis, megacity, and megalopolis reinforced the image of larger and larger conurbations displacing farmland or wilderness, and the historical distinction between rural and urban, edge and center was no longer viable in describing current processes and patterns transforming both. A new urban theory must not only reflect on the simultaneous remaking of spatial frontiers both at the center and periphery of existing cities, but must also be situated at the frontiers of the urban disciplines of design and ecology. In 1981 the co-authors of this presentation found himself in the opposing frontiers as a designer in an gentrifying neighborhood of lower Manhattan and an ecologist amidst the sprawl of Garreau's edge cities in central New Jersey. The two of us, first separately in our own fields and frontiers, and then in collaboration at the nexus of both, redefined the intertwining the fields of urban design and ecology under the rubric of the metacity at the beginning of the twenty-first century.

Presenter: McGuire, Jenny L

Title: Last Glacial Maximum mammal fossils show strong mismatch with ecological niche model hindcasts: Ways to improve transferability to novel climates

Authors: Jenny L McGuire (Georgia Institute of Technology);Edward B Davis (University of Oregon);Michelle S Koo (University of California at Berkeley);

Session: Biogeography

Abstract: Studies have questioned the ability of ecological niche models (ENMs) to transfer knowledge about species distributions from one climate regime to another. This problem is important as the world struggles to predict biological responses to ongoing anthropogenic climate change. ENMs could be used to predict future ranges if results are transferable. We

addressed this problem by comparing ENMs trained using modern climate data to the Last Glacial Maximum (LGM, ~21 ka) fossil distributions of 40 extant species of mammals. Drawing from the FAUNMAP database, we selected species with well-sampled LGM ranges, which represent broad ecological and phylogenetic diversity. We used MAXENT to create ENMs using 19 standard bioclimatic variables derived from modern climate layers. We then hindcast those ENMs on a climate layer of the LGM created using the CCSM climate model. Our results show no systematic concordance between fossil data and ENM hindcasts. Using Huberty's one-tailed z-test, we find that only 13% of species have sensitivity greater than 0.6, meaning that hindcast distributions predict more than 60% fossil localities containing specimens of that species. In the end, the fossil specimens of half the species modeled fall nearly entirely outside of the hindcast range, suggesting a strong mismatch between their LGM and modern environmental occupation. To determine why this occurs, we are comparing each species' niche today and in the past and examining whether species with particular characteristics, such as dietary breadth or body size, would benefit from using different distributional modeling techniques.

Presenter: McHale, Melissa R

Title: Democratization of ecosystem services - A radically revised framework for assessing nature's benefits to communities

Authors: Melissa R McHale (North Carolina State University);Scott Beck (North Carolina State University);Dan Childers (Arizona State University);Steward TA Pickett (The Cary Institute for Ecosystem Studies);Wayne Twine (University of the Witwatersrand);Mary L Cadenasso (University of California, Davis);Liesel Ebersohn (University of Pretoria);Louie Rivers III (North Carolina State University);David N Bunn (University of the Witwatersrand);Louise Swemmer (South African National Parks);Ross Meentemeyer (North Carolina State University);

Session: Urbanization and Landscape Change: Socioeconomic Drivers and Ecological Consequences

Abstract: The concept of ecosystem services has emerged as a powerful tool for giving expression to the wide range of direct and indirect benefits that humans derive from nature. Despite the importance of the ecosystem services concept, its current applications have been challenged on a number of fronts. Due to the simplistic assumptions that emphasize the economic evaluation of ecosystem services and erroneous deductions that land use is an indicator of services provided to people, the ecosystem services framework has arguably failed to become an ideal instrument for linking human and natural systems in urban planning and land use change policy. Perhaps the most troubling issue to date is that many ecosystem services assessments do not account for the values, needs, and aspirations of many affected human communities. Thus, they are a result of an undemocratic process that reinforces power

asymmetries in society, often resulting in inequitable outcomes in their application at the local scale. We present a new framework for assessing ecosystem services that is inclusive of a broad range of stakeholders' values and results in actual quantification of social and ecological processes. Utilizing current maps of ecosystem service distribution in Bushbuckridge, South Africa we evaluate how a democratized process of assessing ecosystem services will produce a more nuanced representation of diverse values in society and capture heterogeneity in ecosystem structure and function. Finally, we demonstrate how this framework could be operationalized leading to a more sustainable and resilient future for communities in urbanizing areas.

Presenter: McKenzie, Donald

Title: Ecosystems as energy fields

Authors: Donald McKenzie (US Forest Service);Donald A Falk (University of Arizona);Donald McKenzie (US Forest Service);Tyson L Swetnam (University of Arizona);Carol Miller (US Forest Service);

Session: Implications and applications of thermodynamics in landscape ecology

Abstract: Ecosystems are widely interpreted as accumulations of mass (or more specifically, carbon), but an ecosystem can also be understood as a pool of embedded energy in the form of molecular bonds. We show how energy storage on a landscape can be estimated via a series of scalar transformations. Biomass / area (kg / ha) is multiplied by energy content of various biomass fractions (e.g. cellulose, hemicellulose, lignin) and their relative proportions (mols per ith molecular constituent / unit biomass [mol / kg). Net bond energy (joules / mol) is derived for each molecule type, and total energy context estimated as the sum of energy content across molecule types, in joules / ha. To calibrate the fundamental equation, xy LiDAR plots of biomass (z) are used with values segregated by biomass compartment. For each compartment, the molecular composition (e.g. % cellulose, hemicelluloses, lignin per unit mass) is estimated from existing allometries. Energy content of molecules as expressed here is the complete sum of energy content of all the bonds; a metric of more practical interest is the energy that would be released by oxidation of all molecules (e.g. breakdown of cellulose, etc into H2O and CO2 during combustion). As combustion approaches completeness, energy released approaches total energy stored in biomass, but combustion is always incomplete and influenced by weather and by fuel structure and condition. We illustrate these principles with estimates of changes in entropy from disturbances in dissipative (open) systems that are the domain of landscape ecology.

Presenter: McKerrow, Alexa J

Title: Normalized Burn Ratio fire-severity indices link ecosystem process with patterns of avian occurrence

Authors: Eli T Rose (NC Cooperative Fish and Wildlife Research Unit);Theodore R Simons (USGS NC Cooperative Fish and Wildlife Research Unit, Dept. of Applied Ecology, NCSU);Rob Klein (Great Smoky Mountains National Park, National Park Service);Alexa J McKerrow (USGS Core Science Analytics, Synthesis & Libraries);

Session: Wildland Fire II

Abstract: Remotely sensed Differenced Normalized Burn Ratios (DNBR) provides an index of fire severity across the footprint of a fire. We asked whether this index was useful for explaining patterns of bird occurrence within fire adapted xeric pine-oak forests of the southern Appalachian Mountains. We evaluated the use of DNBR indices for linking ecosystem process with patterns of bird occurrence. We compared field-based and remotely sensed fire severity indices and used each to develop occupancy models for six bird species to identify patterns of bird occurrence following fire. We identified and sampled 228 points within fires that recently burned within Great Smoky Mountains National Park. We performed avian point counts and field-assessed fire severity at each bird census point. We also used LandsatTM imagery acquired before and after each fire to quantify fire severity using DNBR. We used non-parametric methods to quantify agreement between fire severity indices, and evaluated single season occupancy models incorporating fire severity summarized at different spatial scales. Agreement between field-derived and remotely sensed measures of fire severity was influenced by vegetation type. Although occurrence models using field-derived indices of fire severity outperformed those using DNBR, summarizing DNBR at multiple spatial scales provided additional insights into patterns of occurrence associated with different sized patches of high severity fire. DNBR is useful for linking the effects of fire severity to patterns of bird occurrence, and informing how high severity fire shapes patterns of bird species occurrence on the landscape.

Presenter: McWilliams, Matthew R

Title: Participatory citizen science and historical logbooks: Co-creating tools for local management in a Newfoundland fishing community

Authors: Matthew R McWilliams (Memorial University);Yolanda Wiersma (Memorial University);Max Liboiron (Memorial University);

Session: Engaging People

Abstract: Over the course of the last year we have been working with a small fishing community on Fogo Island in Newfoundland, CA. The research uses participatory citizen science to engage and empower the local community. The project began with the construction of a GIS database detailing the historical fishing industry of Fogo Island from the 1960s to the 1990s. The creation of this database was requested by the fishermen and fisherwomen in hopes that it would be useful in arguing the location of their traditional fishing grounds. This historical database evolved into a Fogo Island database via the research project conducted the summer of 2015. The participatory citizen science project examined local temperatures throughout the fishing season. In this project, together with the fishermen and fisherwomen, we decided on the research question, created a methodology to collect the data required, and analyzed the results. After one season of data collection, there was no conclusive evidence that answered the research question that temperature fluctuations would drive the catch rates in 2015. However, we have learned the immense potential in conducting research together, with a local community. This presentation will briefly go over the historical GIS database as well as the participatory citizen science project. After briefly showing you what we have already completed, I will discuss why this project is important for Fogo Island and how it can contribute in managing a rapidly changing ocean landscape.

Presenter: Medvigy, David M

Title: Tropical dry forest phenology: Linkages to plant traits and sensitivity to climate

Authors: David M Medvigy (Princeton University);Xiangtao Xu (Princeton University);Jennifer Powers (University of Minnesota);Justin Becknell (Brown University);Kaiyu Guan (University of Illinois);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Over 40% of tropical forests are classified as “tropical dry forests” and are subject to substantial seasonal water stress. While this water stress is thought to prompt phenological responses, our understanding of the ecophysiological mechanisms underlying species’ responses to seasonal drought is still limited. Current drought-deciduous phenology models empirically represent plant water stress in terms of external factors like soil moisture. However, little consideration has been given to the role of plant functional traits in modeling ecosystem responses to water stress. The objectives of this study are to (i) mechanistically link differentiation in functional traits to different phenological dynamics; and (ii) understand the

implications of different phenological strategies for tree growth and ecosystem carbon accumulation. We developed new trait-based phenology and plant hydraulic modules, and integrated these modules into a dynamic vegetation model (ED2). We compared model simulations to field observations from a tropical dry forest site in Palo Verde, Costa Rica. We also evaluated simulated phenology against remotely-sensed phenology of Central America. In both simulations and observations, we find that there is a trade-off between hydraulic safety and hydraulic efficiency. Evergreen or leaf-exchanging behavior emerged from high-safety, low-efficiency traits, and deciduous behavior emerged from low-safety, high-efficiency traits. Our phenological scheme was able to closely match field observations of leaf expression, leaf litter fall, and interannual variations of tree growth, as well as the satellite-measured canopy seasonality over Central America. These results show that trait-based phenology is critical for explaining the seasonal and longer-term dynamics of tropical dry forests.

Presenter: Mehaffey, Megan H

Title: A spatially explicit tool combining climate change scenarios and ecosystem services

Authors: Megan H Mehaffey (US EPA);Anne Neale (USEPA);Brian Pickard (ORISE);Jeremy Baynes (Precisionhawk);

Session: Assessment II

Abstract: While discussions of global climate change tend to center on greenhouse gases and sea level rise,other factors, such as technological developments, land and energy use, economics, and population growth all play a critical role in understanding climate change. There is increasing urgency for methods to forecast how different sectors, in particular ecosystems and the goods and services they provide, may be altered as a result of climate change. However, due to their complexity, it is difficult to assess these ecosystem services at a single point in space or time, as they may be influenced by surrounding and distant patterns of land use and biophysical attributes in addition to climate change. In order to make meaningful conservation and adaptation choices, specific ecosystem components must be viewed in relation to future climate information. The US Environmental Protection Agency and its partners, have developed EnviroAtlas, a web-based geospatial tool that allows users to interact with climate change modeling information while simultaneously providing a range of information and data on different ecosystem goods and services. This can be a useful platform for inquiry about the supply, demand, or benefits provided by a specific ecosystem service, and to understand the potential impacts to that ecosystem service due to our changing climate. Housing a variety of data in one publicly available tool encourages users to think in new, trans-disciplinary ways that focus on the relationships between ecosystem services and climate change impacts. By combining many fields of research through this easy to use interface, the

result is a novel tool that is spatially and temporally explicit and enables better decision making across multiple sectors.

Presenter: Merritt, Danielle KM

Title: Invertebrate diversity on urban green roofs in Charlotte, NC

Authors: Danielle KM Merritt (University of North Carolina at Charlotte);Sara A Gagné (University of North Carolina at Charlotte);

Session: Poster

Abstract: As of 2015, more than 50% of the Earth's population lives in urban areas, and by 2050, the United Nations projects this proportion to increase to 67%. Urbanization causes land cover change in cities, resulting in degradation of ecosystems and habitats. In consequence, there is a general loss of biodiversity in urban areas, as many species are not able to thrive under the characteristically high-stress environments of cities. A trend toward green roofing is taking hold in many cities worldwide, but little attention has been given to their potential as habitat. The factors that affect the habitat potential of green roofs and their relative importance are not well understood, but may include vegetation amount and diversity, substrate type and depth, roof area, and irrigation and maintenance regimes. Our research objectives are to evaluate the effect of local environmental variables on invertebrate diversity and abundance on urban green roofs. We will focus on five green roofs in Charlotte, NC, using a grid pattern of sampling stations on each roof. We will record the quality of habitat by measuring temperature, humidity, vegetation density, and vegetation structure at each sampling location. We will sample invertebrates along the grid patterns on each roof using pan trapping, vacuum collection of ground dwelling specimens, and butterfly transects. We will identify individual specimens to the smallest identifiable taxonomic class. Our results will shed light on the effect of green roof design on the invertebrate community in a highly urban environment.

Presenter: Merschel, Andrew G

Title: The effect of landscape context on historical fire regimes across mixed-conifer ecotones

Authors: Andrew G Merschel (Oregon State University);Thomas A Spies (USDA Forest Service);Lisa M Ganio (Oregon State University);

Session: Wildland Fire I

Abstract: Managers and the public have strong interest in restoration of historical structure and composition of mixed-conifer forests that is consistent with the historical fire regime of central Oregon. However, the historical fire regime is poorly understood on relatively moist sites. In addition, the influence of surrounding topography and vegetation, hereafter landscape context, on dynamics at a local scale has not been effectively examined. The mixed-conifer forests of the region are distributed across a steep precipitation gradient overlaid on diverse topography including undulating slopes, prominent volcanic buttes, and pumice flats. Forest composition transitions from ponderosa pine (Pinus ponderosa) to grand fir (Abies grandis) dominance with increasing precipitation, while lodgepole pine (P. contorta) dominates flats due to coarse soil and cold air drainage. We characterized historical fire regimes, stand dynamics, and current conditions across a 10,000 ha landscape that spans an annual precipitation gradient of 25-45 inches. Historically large spreading fires were frequent CFI25=12.5, NFR=19), and fire intervals varied slightly with stand precipitation and composition (15-20 years in dry vs. moist stands). The spread of fire was historically limited by landscape context as mixed-conifer stands on buttes isolated by low elevation flats dominated by lodgepole pine often did not record large spreading fires, and burned in small isolated fire events. Mixed-conifer stands with an isolated landscape context had longer maximum fire free intervals (50 years) than non-isolated stands (30 years). Our results demonstrate that dry and moist mixed-conifer forests had similar fire regimes except where landscape context limited the spread of frequent fires.

Presenter: Mhatre, Snehal S

Title: Water for electricity: Impacts of habitat degradation and loss of connectivity on freshwater mussels

Authors: Snehal S Mhatre (Clemson University);Alan Johnson (Clemson University);

Session: Poster

Abstract: The use of water resources for electricity production and the associated impact on reservoir levels, streamflows, and thermal regimes is in conflict with the requirements of in-stream biota particularly freshwater mussels. Populations of unionid species have experienced significant declines and extirpations in the recent times due to habitat fragmentation, hydrologic alterations due to impoundments, changing thermal regimes and lack of connectivity. These long lived species reproduce by producing larval glochidia which are parasitic on fish gills, making availability of suitable host fish species crucial for dispersal. These freshwater mussel populations have potentially limited connectivity in situations where host fish are not available or their movements are restricted by dispersal barriers such as large

dams. We used metapopulation models to simulate the dynamics of spatially fragmented populations representing typical freshwater mussels. Habitat degradation had the most significant impact on metapopulation abundance and persistence of local populations. The loss of connectivity due to dams acting as dispersal barriers had much less immediate effect however may cause long term species decline. The development of such simulation models will aid in assessing the impact of water use on native freshwater bivalves and provide assistance in managing water resources for future energy use scenarios.

Presenter: Miller, Carol L

Title: Topographic features and fire weather conditions supporting fire refugia in temperate forests of western North America

Authors: Meg A Krawchuk (Simon Fraser University and Oregon State University);Sandra L Haire (Haire Laboratory for Landscape Ecology);Marc A Parisien (Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada);Carol L Miller (Aldo Leopold Wilderness Research Institute);Jonathan D Coop (Center for Environmental Sustainability, Western State Colorado University);Ellen Whitman (Universita of Alberta);Geneva W Chong (Northern Rocky Mountain Science Center, US Geological Survey);

Session: Wildland Fire I

Abstract: Fire interacts with underlying variability in physical and biotic characteristics, resulting in spatial heterogeneity that is an essential component of ecosystem function. Fire refugia--places retaining pre-fire ecological characteristics within the burn mosaic--are thought to be important for fire-sensitive species and legacy seed sources for recovery after fire. Numerous studies have characterized discerning features of remnant post-fire forest patches, but we lack a general framework for understanding how patterns of these refugia, their formation, and their persistence, vary with the environment. We propose a conceptual model that organizes the formation of fire refugia across gradients of two key environmental drivers: fire weather and topography. To provide a proof of concept of this model, we identified recurring landscape classes of relatively uniform fire environments for a set of case-study fires from western Canada, based on coarse-scale terrain complexity and an index of fire danger. Across the landscape classes, we compared patterns of fire refugia and their predictability in relation to fine-scale terrain. In regression models, catchment slope was the strongest predictor of refugia across all landscape classes, with high probability of refugia on gentle and steep slopes, but low probability on moderate slopes. Refugia were generally more predictable in environments with moderate terrain complexity and moderate fire weather, but areas that experienced more extreme fire weather also led to a moderate degree of predictability in some cases. This proof

of concept helps bracket the ecosystem conditions supporting fire refugia, a prerequisite for crafting strategies for promoting fire resilient landscapes.

Presenter: Mills, Richard T

Title: Scalable machine-learning approaches for analysis of large phenological datasets

Authors: Richard T Mills (Intel Corporation);Forrest M Hoffman (Oak Ridge National Laboratory);Jitendra Kumar (Oak Ridge National Laboratory);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: The increasing availability of high-resolution geospatiotemporal datasets from sources such as observatory networks, remote sensing platforms, and computational Earth system models has opened new possibilities for knowledge discovery and mining of ecological data sets fused from disparate sources. Traditional algorithms and computing platforms are impractical for the analysis and synthesis of data sets of this size; however, new algorithmic approaches that can effectively utilize the complex memory hierarchies and the extremely high levels of available parallelism in state-of-the-art high-performance computing platforms can enable such analysis. We describe some unsupervised knowledge discovery and anomaly detection approaches based on highly scalable parallel algorithms for k-means clustering and singular value decomposition, consider a few practical applications thereof to remotely-sensed vegetation phenology data sets, and speculate on some of the new possibilities that such scalable analysis methods may enable.

Presenter: Miniat, Chelcy F

Title: Downslope subsidies in topographically-complex forests affect forest carbon and water cycling

Authors: Chelcy F Miniat (USDA Forest Service, Southern Research Station);Sandra N Hawthorne (USDA Forest Service, Southern Research Station, Coweeta Hydrologic Lab);Kimberly A Novick (University of Indiana, School of Public and Environmental Affairs);Andrew C Oishi (USDA Forest Service, Southern Research Station, Coweeta Hydrologic Lab);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: Accelerating hydrologic variability, increasing intensity of both wet and dry extremes, is a critical aspect of global change. Topography may mitigate or intensify drought effects on vegetation through redistribution of soil moisture or atmospheric driving variables. Understanding the interaction of topography, soil moisture, microclimate and vegetation dynamics is important to identify vulnerable species and communities, and the resulting impacts on ecosystem services. Here we present long-term data collected in several studies at the Coweeta Hydrologic Lab, and examine the effects of topography on 1) soil moisture and transpiration in wet and dry years, and 2) cold-air drainage flows on forest carbon cycling. We show that trees are taller, have more sapwood area, and more leaf area supported for any unit sapwood area in downslope compared to upslope communities. While lower precipitation and higher D characterize relatively dry compared to relatively wet years, soil moisture is only significantly lower in upslope soils in dry years. As a result, transpiration is reduced in drier years in both landscape positions, but it's more pronounced in the upslope (58%) compared to downslope (23%) communities. Lastly, we show that cold air drainage downslope suppresses local temperature by several degrees C, leading to reductions in ecosystem respiration (~7.5%), and increases in net carbon uptake (12%). Downslope subsidies may mediate ecosystem responses to climate change, particularly for species-rich cove communities.

Presenter: Minor, Emily S

Title: Diversity and functional characteristics of flowering plants in an urban residential landscape

Authors: Emily S Minor (University of Illinois at Chicago);David M Lowenstein (University of Illinois at Chicago);

Session: Urban III

Abstract: Residential neighborhoods are the primary places where most people interact with nature. They are highly heterogeneous ecosystems whose physical structure and biodiversity is heavily influenced by the decisions that home owners and residents make about their yards and gardens. Variation in floral resources between neighborhoods has the potential to influence higher trophic levels and provision of ecosystem services, but little is known about the drivers of floral resources within cities. We recorded flowers in front-facing yards in 58 neighborhoods in Chicago, IL (USA) and examined patterns in community composition and species turnover between neighborhoods. We investigated how species richness and plant traits, including origin, cultivation intent, and life cycle, were affected by neighborhood socioeconomic factors.

Urban plant species tended to be perennial, ornamental, and non-native. Although we found 144 morpho-species across neighborhoods, most occurred infrequently. Species turnover was highest for ornamental species and lowest for weedy species, suggesting that intentional plantings are driving beta diversity across the landscape. We found the highest species richness in neighborhoods with intermediate numbers of Hispanic and white residents and with intermediate number of residential lots; neighborhoods with racially or ethnically homogenous populations had fewer plant species. These patterns have implications for pollinators and other animals that use floral resources, for urban agriculture, and for urban residents' aesthetic experiences.

Presenter: Mitchell, Jessica M

Title: An overview of lidar for characterizing shrub structure in the western US.

Authors: Jessica M Mitchell (Appalachian State University);Nancy F Glenn (Boise State University);Nayani Ilangakoon (Boise State University);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: The use of discrete return airborne lidar to characterize sparse, low height vegetation in dryland systems is limited by relatively few vegetation returns that are often close to ground returns in both space and time. A series of studies have evaluated the effectiveness of lidar in estimating sagebrush height, cover, and biomass in the western US. Canopy height is consistently underestimated on the order of 30 cm, which is roughly 30% of the height of an average shrub. Primary variables used to predict shrub cover were the interquartile range of height of all LiDAR vegetation returns, and the median absolute deviation from median height of all lidar vegetation returns. Prediction accuracy was improved when lidar was combined with hyperspectral variables (from r2 0.49 = to r2 = 0.58). A hierarchical shrub biomass scaling approach was developed across a watershed using crown delineation, volume calculations and canopy cover. Recent work examines the use of terrestrial laser scanning for leaf area index measurements, considers tradeoffs between combining lidar with hyperspectral or multispectral datasets, and processes full waveform lidar. Landscape applications include sage-grouse habitat mapping and monitoring rangeland health, restoration projects and responses to disturbances such fire, weed invasion and overgrazing.

Presenter: Monahan, William B

Title: Partnering to maximize landscape connectivity for climate change adaptation

Authors: William B Monahan (USDA Forest Service);Frank J Krist Jr. (USDA Forest Service);David M Theobald (Conservation Science Partners);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: A key adaptation strategy for responding to climate change is to increase landscape connectivity. Generally, species require large intact areas with broad environmental gradients and low climate change velocity if they are to adapt. Whether species will be able to adapt given these needs depends in part on the degree to which areas under various ownerships are part of coordinated conservation actions. Here, we model landscape connectivity for North American biomes projected through 2100, with and without conservation coordination across all lands. We first calculated the smallest extent at which landscape adaptation metrics were maximized (area, latitudinal range, elevational range, relief-weighted hydrologic area) or minimized (climate change velocity), thereby reducing partnership complexity and cost. We then combined these into a cost distance surface for use in least cost path models connecting current and future biomes. We repeated the analyses for a null model in which there was no conservation coordination among neighboring areas. The mean cost distance values associated with current biomes varied dramatically between the partnership and null models (23-36%), suggesting markedly different patterns of landscape connectivity in support of climate change adaptation. We quantify the differences in connectivity between the two models for all biomes and illustrate conservation applications for forests, including consideration of additional disturbances resulting from current and near-term wildland fires and insect and disease mortality. We conclude with discussion of how results could inform climate adaptation planning, with implications for strategic landscape level planning.

Presenter: Mondal, Indranil

Title: Connectivity conservation for tigers in a human dominated landscape

Authors: Indranil Mondal (Wildlife Institute of India);Bilal Habib (Wildlife Institute of India);Parag Nigam (Wildlife Institute of India);Gautam H Talukdar (Wildlife Institute of India);

Session: Wildlife I

Abstract: High density wildlife habitats in India are surrounded by high human use areas and such an interface is fraught with man- animal conflict. The same is true for tigers, especially when their dispersal routes, very often, pass through areas of high human activity, posing a

threat to humans and tigers alike. This study aims to investigate the use of areas outside protected forests and to characterize human-tiger conflict along potential movement corridors in the Eastern Vidarbha Landscape, in central India. We analyzed tiger presence and human-tiger conflict locations and regressed them against habitat variables to define the cost surface for connectivity analysis. We used Circuit Theory for corridor analysis. We mapped bottlenecks using centrality analysis and investigated the coincidence of conflict with occurrence of bottlenecks. Results show that tigers are using a much wider landscape than thought earlier. We found that there is high incidence of conflict in degraded stepping stone corridors and bottleneck areas. High number of conflict cases were reported from villages with high human and livestock population, and where agriculture and grazing was practiced adjacent to densely forested areas. Conflict occurrences also show significant difference across seasons and landuse classes. We recommend focused restoration of corridors and bottlenecks, and regulated grazing and agricultural activities near tiger corridors as the key to manage human-tiger conflict.

Presenter: Moorman, Christopher E

Title: An experimental approach to assess the effects of woody biomass harvests on wildlife habitat

Authors: Christopher E Moorman (North Carolina State University);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: Woody biomass is a renewable resource that may be chipped or packaged as pellets and burned to produce electricity. An increase in woody biomass harvesting has been predicted to meet legislative mandates for renewable energy in the United States and Europe. Yet, the environmental community has expressed substantial concerns about the effects of widespread and intensive woody biomass harvesting on wildlife habitat. Several states have implemented Biomass Harvesting Guidelines (BHGs) in response to concerns regarding the sustainability of woody biomass harvesting, but these BHGs are not informed by empirical data. We monitored reptile, amphibian, small mammal, bird, and invertebrate communities in 6 biomass harvesting treatments with varying volumes and spatial distributions of logging debris retained after harvests. The 6 treatments were replicated in each of 8 clearcuts located on industrial forest properties along the coastal plain of North Carolina and Georgia. We will provide a summary of the results from the 4-year multi-institutional, multi-state study and the sustainability implications for future woody biomass harvests.

Presenter: Mordecai, Rua S

Title: From planning to action: How people are using the South Atlantic Conservation Blueprint at multiple spatial scales

Authors: Rua S Mordecai (South Atlantic LCC);Hilary Morris (South Atlantic LCC);Louise Vaughn (South Atlantic LCC);Amy Keister (South Atlantic LCC);Brad Pickens (South Atlantic LCC);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: Individuals use conservation plans in different ways based on the scale of their decision. As a multi-state plan that has been used at the local, regional, and national level, the South Atlantic Conservation Blueprint provides an opportunity to evaluate how these uses differ across scales. The South Atlantic LCC is a partnership of federal, state, and local organizations committed to sustaining the region's natural and cultural resources for current and future generations. The Conservation Blueprint is a living spatial plan for the conservation actions needed to accomplish that goal—a shared vision of the future of the South Atlantic. Data-driven Blueprint Version 2.0, released in June 2015, uses indicators to identify priority conservation areas by measuring the integrity of terrestrial, freshwater, and marine ecosystems. So far, more than 400 individuals from over 100 organizations have actively participated in the development of the Blueprint. Partners have already used the Blueprint to attract national fire resilience funding to the region, compete for coastal wetlands protection and climate-smart wildlife management grants, provide landscape-scale context for public lands planning, and prioritize fish passage efforts. Through a transparent process, a science-based plan, and a user-friendly product, the Cooperative intends the Blueprint to eventually become a "gold standard" for guiding large landscape conservation decisions.

Presenter: Morrison, Lloyd W

Title: Inter-observer error in vegetation surveys: A case study with Lesquerella filiformis

Authors: Lloyd W Morrison (Missouri State University);Craig C Young (National Park Service);

Session: Conservation Biology II

Abstract: Vegetation surveys employing multiple observers are often conducted in many landscape studies. Such surveys are prone to varying degrees of inter-observer error. We quantified the inter-observer error associated with monitoring the rare winter annual Lesquerella filiformis Rollins (Missouri bladderpod) in a limestone glade of southwestern Missouri. A large population was monitored annually from 2006 - 2015. Abundances were

estimated using density classes for 963 5x5 m plots. Estimates were made by six observers with varying degrees of experience. In each year, after density class estimates were made, all plants were counted in a subsample of plots, to obtain true abundances. True abundances were compared to estimates to obtain the percentage of correct classification for plots that had been double sampled. The overall percentage of correct classification ranged widely by observer, from 40% to 68%. There was no significant association of percentage of correct classification with years of experience of the observer. Percentage of correct classification was significantly negatively associated with increasing plant abundance. All errors involved underestimates of true abundances. Lesquerella filiformis is diminutive (10 – 20 cm tall) and individuals may be easily overlooked, particularly as densities increase. A recent literature review found substantial inter-observer error to be common in most vegetation studies. Frequent evaluation of observers and documentation of such error is important. Because the inter-observer error reflected a systematic bias (i.e., underestimating true abundances), quantification allows for a population level correction. Screening and training of observers in each year, even experienced observers, may result in more accurate estimates.

Presenter: Morzillo, Anita T

Title: Stormwise: Promoting storm resistant trees and resilient power by integrating research, management, and outreach

Authors: Anita T Morzillo (University of Connecticut);Jason R Parent (University of Connecticut);Thomas E Worthley (University of Connecticut);Danielle P Kloster (University of Connecticut);Amanda M Bunce (University of Connecticut);John C Volin (University of Connecticut);Sean D. Redding (Eversource Energy);

Session: Urban I

Abstract: Stormwise is a forest vegetation management program with the goal of reducing the risk of tree-related storm damage to power lines. In Connecticut, more than 90% of power outages during storm events result from damage to utility infrastructure caused by fallen or damaged trees. Many of these trees are located on public or private lands along roadsides, which serve as an important connect between trees and people. Anticipating and adapting to future damage risk from storm events, while also promoting current and future benefits from trees, is an ongoing challenge. Addressing this challenge require cooperation among local officials, property owners, utility managers, forest and arboricultural practitioners, wood markets, and other stakeholders. Stormwise addresses this challenge using a blend of arboricultural and silvicultural practices that promote roadside forest conditions, increase storm resistance and resilience of trees, and provide aesthetic, wildlife, stormwater, and other benefits across the urban to rural landscape. Simultaneously, social science incorporates the

tree management needs of diverse stakeholders and public outreach to address those needs. These components are then tailored to a scale appropriate for and transferable to other communities, with the intent to make outcomes applicable, visible, and replicable by demonstrating application beyond traditional utility tree management boundaries.

Presenter: Muller, John A

Title: Landscape scale habitat associations of Sprague's Pipit (Anthus Spragueii) overwintering in the southern United States

Authors: John A Muller (Texas State University);Joseph A Veech (Texas State University);

Session: Avian II

Abstract: Sprague's Pipit (Anthus spragueii) is a North American endemic migratory grassland songbird that has experienced a substantial population decline over the last half-century. There has been very limited research done on Sprague's Pipits especially on their wintering grounds. There is no complete account of their historic wintering range as well as limited knowledge about the status of their current wintering range. On the breeding grounds, Sprague's Pipits seem very selective in their habitat use, while on the wintering grounds other reports indicate that there may be broader use of habitats. Our objective was to determine the habitat types that wintering Sprague's Pipits associate with at landscape scales. We used land cover data from the National Land Cover Database, USDA CropScape, and pipit locations retrieved from eBird. We examined landscape-scale (1, 2 and 5 km) habitat associations of Sprague's Pipit over wintering in areas of Arizona, New Mexico, Texas, and Louisiana. We then compared these habitat associations to those of random locations and to locations of the closely related American Pipit. We found that Sprague's Pipit locations had lower percentages of woody vegetation and certain agriculture land cover types. We also found that although Sprague's Pipit is known to be negatively affected by non-native and anthropogenic grasslands at fine spatial scales, these grassland types may be suitable for the species at larger landscape scales. The results of our study could potentially be used in landscape-level planning for the conservation of the species on its wintering grounds.

Presenter: Nair, Shadananan K

Title: Climate change and land use changes: Impacts on the forest landscapes in the western Ghats Mountain

Authors: Shadananan K Nair (Nansen Environmental Research Centre);

Session: Landscape Dynamics I

Abstract: Fast rising human and livestock populations, poverty in forest-dependent communities, development of hill tourism and the changing climate lead to the depletion and degradation of forests in the Western Ghats Mountain of India, affecting water security and national economy. The forests that include patches of tropical rainforest are rich in biodiversity with rare species of wildlife, medicinal herbs and precious trees. Agricultural expansion, plantation agriculture, hydroelectric projects and poaching have destroyed extensive forest areas. Climate change adds to this. Increasing seasonality and intensity of rainfall cause erosion of the degraded land. Floods and landslides have become common. Increasing frequency and intensity of tropical storms destroy large trees. Associated with deep convection and lightning, forest fire is becoming common. Protection of the forests is vital in maintaining biodiversity and water availability, alleviation of poverty, improvement of national economy and minimising man-animal conflicts. Though India has invested heavily on afforestation and forest protection and has developed a strong forest policy, they could not fulfil the objectives because of various social, political, and administrative reasons. Present study assesses the anthropogenic and climate change impacts on the forests and analyses the current policies, strategies and conservation programmes to suggest an appropriate forest policy.

Presenter: Naujokaitis-Lewis, Ilona R

Title: Addressing timing of conservations actions to maintain climate refugia for threatened species

Authors: Ilona R Naujokaitis-Lewis (Environment and Climate Change Canada);Lars Y Pomara (Forest Service);Benjamin R Zuckerberg (University of Wisconsin-Madison);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: In situ habitat management is one adaptation strategy aimed at conserving species threatened by climate change. To efficiently achieve conservation targets for threatened species, consideration of when to implement management actions at the landscape-scale remains an outstanding question faced by decision-makers. While these questions are further complicated by the uncertainty of future risks associated with climate change, delaying actions can result in elevated threats to population-level and even global extinction. We address the question of when to implement management actions to maintain climate refugia in the face of uncertainty by identifying landscapes of risk and opportunities. The conservation objective was

to maximise the number of populations occupied for a priority species, the Eastern Massasauga Rattlesnake, which is threatened by habitat loss from climate and land-use changes. We parameterised a range-wide stage matrix population dynamics model, whereby demographic sensitivities were related to drought events and human-modified landcover, and projected extinction risks associated with future climate change. Using Monte Carlo simulations we evaluated trade-offs associated with delaying management actions and the duration of interventions, simulated by increasing survival rates due to improved habitat quality. In general, acting quickly influenced the rate of recovery and the number of occupied sites; however this result was sensitive to uncertainty in long-term extinction risk and the duration of management interventions. These results suggest that management actions can buffer the effects of future climate change on range-wide persistence, however, the utility of designing effective conservation plans requires the consideration of when and how long to manage for.

Presenter: Neale, Anne C

Title: The EnviroAtlas: Connecting ecosystems, people, and well-being

Authors: Anne C Neale (US EPA);

Session: Assessment III

Abstract: The EnviroAtlas is a web-based application containing a collection of geospatial data, analysis tools, and interpretive information focused on ecosystem goods and services. Ecosystem goods and services are essentially defined as the benefits that humans receive from nature and encompass the critical elements that underpin almost every aspect of our well-being: our food and water, our security, our physical and mental health, and our economy. EnviroAtlas provides comprehensive metrics on ecosystem services, the built environment, demographics, and drivers of change for the conterminous United States. EnviroAtlas also contains high resolution data for selected towns and cities across the country. EnviroAtlas is a multi-organization collaborative effort with a growing list of partners. Anne Neale, Lead for the EnviroAtlas effort, will discuss the foundational principals of EnviroAtlas's development, the data and tools contained within, and how EnviroAtlas relates to current efforts on sustaining Environmental capital.

Presenter: Negri, Maria C

Title: A resource recovering landscape for sustainable bioenergy

Authors: M. Cristina - Negri (Argonne National Laboratory);Herbert Ssesane* (Argonne National Laboratory);John B Graham (University of Michigan);Joan I Nassauer (University of Michigan);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: Agricultural landscapes face tremendous challenges, magnified by climate change and population growth, to maintain productivity while improving their sustainability. Optimizing the provisioning of energy, food and conservation is a complex system problem that needs to be addressed at multiple scales. At the system scale, nutrient losses from commodity agriculture need to be considered as resources that are recoverable in-situ. Because of their high cost and high energy intensity, these resources must and can be reutilized rather than dispersed in the environment, both airborne and water-borne. At the landscape level, designing bioenergy and agricultural system for resource management and recovery will be a necessary step in improving agricultural sustainability. This presentation will discuss the case of a small agricultural watershed in the US agricultural Corn Belt, and the potential effects of a strategically integrated landscape including commodity and bioenergy crops on several environmental and ecological indicators. We will examine how design strategies help us identify target areas at the subfield level for maximized resource recovery and water quality benefits, which is a priority environmental challenge facing this system. We will also discuss how this alternative landscape optimized for productivity and water quality can also provide synergistic ecological services in terms of improved pollinator habitat, and environmental services in terms of contributions to carbon sequestration. Finally, this presentation will discuss the economic implications of a distributed bioenergy cropping system and the concerns and interests of stakeholders related to the adoption of the developed landscape.

Presenter: Nejadhashemi, A Pouyan

Title: Optimization of bioenergy crop selection and placement based on a stream health indicator

Authors: A Pouyan Nejadhashemi (Michigan State University);Matthew R Herman (Michigan State University);Fariborz Daneshvar (Michigan State University);Mohammad Abouali (Michigan State University);Dennis M Ross (Michigan State University);Sean A Woznicki (Michigan State University);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: The emission of greenhouse gases continues to amplify the impacts of global climate change. This has led to the increased focus on using renewable energy sources, such as

biofuels, due to their lower impact on the environment. However, the production of biofuels can still have negative impacts on water resources. This study introduces a new strategy to optimize bioenergy landscapes while improving stream health for the region. To accomplish this, several hydrological models including the Soil and Water Assessment Tool, Hydrologic Integrity Tool, and Adaptive Neruro Fuzzy Inference System, were linked to develop stream health predictor models. These models are capable of estimating stream health scores based on the Index of Biological Integrity. The coupling of the aforementioned models was used to guide a genetic algorithm to design watershed-scale bioenergy landscapes. Thirteen bioenergy managements were considered based on the high probability of adaptation by farmers in the study area. Results from two thousand runs identified an optimum bioenergy crops placement that maximized the stream health for the Flint River Watershed in Michigan.

Presenter: Nettles, Jami E

Title: Sustainable bioenergy intercropping in pine plantations - results from research to operational-scale trials

Authors: Jami E Nettles (Weyerhaeuser Company);Peter Birks (Weyerhaeuser Company);Eric Sucre (Weyerhaeuser Company);Robert Bilby (Weyerhaeuser Company);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: In 2008, Catchlight Energy was formed as a joint venture of Chevron Corporation and Weyerhaeuser Company to explore production of cellulosic biomass within intensively managed forests and conversion to liquid transportation fuel. Weyerhaeuser's land base and Chevron's refining and distribution infrastructure provided a platform to explore a potentially win-win idea: intercropping switchgrass, a dedicated energy crop, in pine plantations. Switchgrass is a native grass, protects soil from erosion, and is water efficient. The joint venture established research programs in environmental sustainability (water, biodiversity, soil and carbon), biomass production operations (scaling up efficient planting, growing and harvesting) and conversion technology. The joint venture formally ended in 2014, but sustainability research continued to be funded and is yielding valuable results, applicable not only to intercropping but to other intensive silvicultural practices. This presentation will provide an overview of the Catchlight Energy experience from the perspective of the research program. Three major operational barriers to successful forest-based intercropping are presented as examples - site preparation for high germination rates, effect of shading on interplanted crop, and inefficiencies in forest-based operations. The challenge of addressing these production barriers while meeting project goals for environmental, sustainability and economic return presented a serious technical challenge. Results of ongoing and published research, interviews

with operational team members and outcomes from previously proprietary trials will be discussed. This project clearly demonstrated that decisions made in large-scale sustainable bioenergy planning require balancing local environmental effects, global sustainability concerns, and economic feasibility.

Presenter: Newcomb, Douglas J

Title: Landscape level analysis of QL2 LiDAR data by species for avian nesting habitat in eastern North Carolina

Authors: Douglas J Newcomb (USFWS);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: Avian habitat preferences are strongly associated with vegetation type and structure. The collection of of USGS QL2 standard (0.7 m posting distance) LiDAR data for all of Eastern North Carolina offers the opportunity to empirically analyze forest structure metrics such as for a large contiguous landscape at a variety of resolutions for relationships with species specific habitat preferences. LiDAR point LAS tiles for more than 30 counties in Eastern North Carolina (4-10 billion points per county) were analyzed by binning at cell sizes of 60ft(18.288m) and 20ft(6.096m) for Z range (canopy height) of LiDAR Z values, variance of LiDAR Z values, skewness of LiDAR Z values, horizontal slicing, and canopy closure using GRASS GIS version 7.1. The raster data sets were then compared to avian nest locations buffered to 82.021 ft (25m) for avian species of interest with varied habitat requirements in Eastern North Carolina including Red-cockaded woodpecker (Picoides Borealis).

Presenter: Newman, Erica A

Title: Macroecology meets disturbance ecology: connecting species diversity patterns to disturbance ecology through information entropy statistics

Authors: Erica A Newman (University of California, Berkeley);John Harte (University of California, Berkeley);

Session: Implications and applications of thermodynamics in landscape ecology

Abstract: Disturbance has a fundamental role in structuring ecological communities, and the study of these processes and extension to novel ecological disruptions is of increasing importance due to global change. Previous attempts to unite disturbance ecology with macroecological theory have been hindered by macroecology's reliance on equilibrium mathematics. In contrast, the recently advanced Maximum Entropy Theory of Ecology (METE) uses the same information-entropy statistics as are used in thermodynamics to describe the current state of a system, and requires no assumptions of equilibria to make highly accurate predictions of plot-scale to ecosystem-scale metrics. These predictions, which have been extensively tested in near-steady-state systems, include species-area relationships, abundance of individuals within species, spatial clustering of individuals, and energetics metrics. I apply METE to three novel datasets collected from highly disrupted and disturbed ecosystems in order to test the usefulness of this theory for ecosystems in transition. I find that certain metrics, such as predicted number of rare species, seem robust to ecological disruption. This application leads to a method for cross-system comparisons of community structure for ecosystems in transition. A related study with one of these datasets also yields the first meaningful predictions of plot-scale body-size distributions and opportunities to unite disturbance ecology with metabolic theory.

Presenter: Niu, Jianming

Title: Landscape sustainability in changing Eurasian grasslands: Linking ecosystem services with grassland degradation and restoration

Authors: Jianming Niu (Inner Mongolia University);Xuefeng Zhang (Inner Mongolia University);

Session: Climate change and landscape sustainability of global drylands

Abstract: In China, grassland covers 41.7% of land area, and nearly 80% of it distributes in arid and semiarid regions. Grassland changes have been being paid more attention during past decades. Understanding impacts of grassland changes on ESs have become increasingly essential for maintaining ecological and social securities of Northern China. Our objective was to explore ESs with grassland degradation and restoration in the Xilin River Basin, Inner Mongolia, China. We evaluated grassland changes by Grassland Degradation Index (GDI) in 1983, 1989, 2000, and 2011. Aboveground biomass (AGB), soil conservation (SC) and water retention (WR) were also estimated. Results showed that (1) GDI increased during 1983-2000 while decreased during 2000-2011, indicating that grassland had being in restoration period since 2000 after severe degradation. (2) GDI was significantly negatively correlated with AGB and SC. WR and SC declined in 1983-2000 and increased in recent ten years. SC, however, increased slowly than WR, demonstrating the time lag of soil restoration. (3) Less AGB was observed in degraded grassland. But, the significant relationship between AGB and

precipitation was not changed regardless of grassland conditions. (4) A clear trade-off existed between AGB and SC while synergy existed between AGB and WR. In conclusion, great changes occurred in grassland ecosystems of the Xilin River Basin over past three decades. Grassland degradation affected ESs deeply. Improving AGB was not the end of grassland restoration. Other ESs, such as SC and WR, should be taken into account in the future.

Presenter: Noh, Jin K

Title: Effects of habitat fragmentation on richness of vascular plants in south-central of Chile

Authors: Jin K Noh (University of Concepción);Cristian M Echeverría (University of Concepción);Aníbal Pauchard (University of Concepción);

Session: Fragmentation

Abstract: Habitat fragmentation has become major research themes because of negative influences on plant species declines and extinctions. However, local extinction of species can occur with a substantial delay following habitat fragmentation, and such delay is called extinction debt. Many studies about extinction debt rely on community equilibrium from relationships between species richness and habitat variables. We assumed that the distribution of many vascular plant species in the Coastal Range of south-central Chile is not in equilibrium with the present habitat distribution. The aim of this research was to detect extinction debt from relationships between current richness of different assemblage of vascular plant species (considering longevity and habitat specialization) and both of past and current habitat variables. Results show that native forests have been reduced by 53% in the study area between 1979 and 2011. Current richness of plant species was mostly explained by past area and connectivity. Richness of long-lived specialist plants was best explained by past habitat variables, while past and current area and connectivity mostly had a negative relationship on species richness of short-lived plants. Our analyses provide the first evidence of future loss of plant species in South American hotspot. Consequently, an unknown proportion of the plants in the study area would be extinct, if there are no targeted restoration and conservation actions in the near future.

Presenter: Norman, Steven P

Title: Forest structural complexity of the Southern Appalachians revealed by above ground LiDAR classification

Authors: Steven P Norman (US Forest Service);Jitendra Kumar (Oak Ridge National Lab);William W Hargove (US Forest Service);Forrest Hoffman (Oak Ridge National Lab);Douglas Newcomb (US Fish and Wildlife Service);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: Traditional vegetation maps emphasize the prominent or commercially important species present, yet structural attributes are also critical for understanding habitat and vegetation dynamics. When available, structural information is usually limited to coarse inferences about successional canopy height, or separate maps that show the absence-presence of understory evergreen shrub cover as inferred from leaf-off canopy conditions. This compositionally-heavy approach to mapping and classifying vegetation has continued despite public investments in LiDAR technology. Above-ground LiDAR return data often goes underutilized because the large volume of point return data is computationally intensive with unwieldy data volumes that can challenge projects over large landscapes. Here we describe a regional effort to classify vertical structure across western North Carolina at 20m resolution using non-hierarchical k-means clustering. We quantify vertical structural diversity within compositionally-based vegetation polygons used by land managers for practical insights into successional dynamics, then address cross-scale neighborhood patterns of diversity and how they relate to topography and land use history without consideration of composition. This reveals the scale of structures within established vegetation types and the topographic setting more generally, with implications for vegetation genesis and behavior.

Presenter: Nunez-Mir, Gabriela C

Title: Understanding the influence of beta diversity on native-exotic diversity patterns

Authors: Gabriela C Nunez-Mir (Purdue University);Songlin Fei (Purdue University);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: Understanding and predicting emerging patterns from the relationship between native and exotic species diversity has been a long-standing goal in invasion ecology. Several landscape characteristics (e.g., soil heterogeneity, disturbance, and topography) have been invoked as the underlying drivers of these patterns. However, the contradictory results of previous studies prompt us to explore other factors that may better explain the patterns observed in the relationship between native and exotic diversity. Although abiotic environmental heterogeneity has been extensively explored as a driver of these patterns, little is known about the role of biotic heterogeneity, or beta diversity. Here, we seek to understand

how characteristics of community composition, namely turnover, nestedness and variation in local richness (i.e. different measures of beta diversity), influence the observed relationship between native and exotic species richness. To explore the role of these characteristics, we obtained native and exotic richness data from the USGS nonindigenous aquatic species database. We took advantage of nested properties of this database (HUC levels) to incorporate the influence of scale in these relationships. If turnover, nestedness and/or the variation in local richness drive the patterns observed, we expect to see a relationship between these factors of biotic heterogeneity and the slope of the relationship between native and exotic species diversity. Ultimately, we seek to contribute to the understanding of the relationship between native and exotic diversity in order to better determine the vulnerability of communities to invasion.

Presenter: Nuse, Bryan L

Title: Predicting spatial structure in gopher tortoise (Gopherus polyphemus) populations in Georgia, USA

Authors: Bryan L Nuse (Georgia Cooperative Fish and Wildlife Research Unit, Warnell School of Forestry and Natural Resources, University of Georgia);Clinton T Moore (USGS and Georgia Cooperative Fish & Wildlife Research Unit, Warnell School of Forestry & Natural Resources, Univ. of Georgia);Jeffrey Hepinstall-Cymerman (Warnell School of Forestry and Natural Resources, University of Georgia);Matt J Eilliott (Nongame Section, Georgia Department of Natural Resources);

Session: Conservation Biology II

Abstract: The gopher tortoise (GT) is a burrowing keystone species of Coastal Plain pine forests in the southeastern US. Because it is widespread within its range, but also a candidate for listing under the Endangered Species Act, there is much interest in GT conservation. The state of Georgia is beginning to acquire lands to serve as tortoise reserves, but the arrangement of such reserves in the landscape will depend upon the degree of functional connectivity among nearby parcels. Although their movements are primarily local, GTs are long-lived; and long-distance dispersal has occasionally been observed. As part of a larger project to develop optimal reserve design strategies for GT conservation in Georgia, we developed a demographic model of discrete, bounded gopher tortoise populations based on line transect surveys that have been carried out at more than 70 sites. We then used a statewide habitat suitability model to estimate landscape resistance, and identified likely movement corridors among known populations. We find circumstantial evidence that GT dispersal is a normal process, because populations with few pathways for emigration tend to have higher densities. A counterintuitive result of our survey-constrained demographic model is that populations that are better

connected could have lower survival in some age classes, though they should be more resilient to perturbation because they can receive immigrants. Those charged with conserving the tortoise may consider prioritizing for protection those areas predicted to be used frequently for dispersal, as many upland land uses are barriers to GT movement.

Presenter: Orejola, Nadine A

Title: Investigating differences between modeled historical and station calculated drought

Authors: Nadine A Orejola (US EPA/ORISE);Maliha S Nash (US EPA);Megan H Mehaffey (US EPA);Anne Neale (US EPA);

Session: Forests, Weather and Climate

Abstract: With growing concern over increased frequency and intensity of extreme climate events, there is an imperative need to investigate drought under different future scenarios for the contiguous U.S. To assess future drought relative to a historical baseline, drought occurrence (number of events) and mean monthly drought duration can be calculated from a climatic water balance drought index such as the Standardized Precipitation-Evapotranspiration Index or SPEI at different time scales (6- and 12-month accumulations). However, in order to proceed with future drought interpretations, it is necessary to investigate the limitations of the modeled data by recognizing its differences with that calculated from station data. Thus, we calculated the two drought variables for 6- and 12-month SPEI from 1960-2005 for two datasets, the historical downscaled data NEX-DCP30 (modeled) and selected stations from U.S. Drought Risk Atlas (station). The differences between station and modeled drought showed that modeled compared reasonably well with station drought based on the minimal outliers (approx. 1-3.9% of 2,237 stations). The statistically significant clusterings of regions where modeled drought over/under predicted station calculated drought suggests similarities in spatial processes driving the differences across the contiguous U.S. Continuing research will investigate drought frequency and magnitude under different climate scenarios and the likely implications increased drought-related stress will have on vegetation, ecosystem services and human health.

Presenter: Oswalt, Christopher M

Title: Southern invasive plant inventory data, tools, and discoveries

Authors: Christopher M Oswalt (USDA Forest Service);Songlin Fei (Purdue University);Thoedore R Ridley (USDA Forest Service);Sonja N Oswalt (USDA Forest Service);Basil V Ionnone III (Purdue University);Kevin M Potter (North Carolina State University);Qinfeng Guo (USDA Forest Service);Brian Pijanowski (Purdue University);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: The Southern Research Station (SRS) Forest Inventory and Analysis (FIA) program began monitoring invasive plant (IP) species in 2001 in response to a growing desire to track potential forest health threats on United States (US) forestland. Invasive plants are threats to US forests through the displacement of native species, the alteration of soil physical and chemical properties, and the disruption of successional pathways among other potential impacts. Because of the environmental and ecological burdens posed by these species, IP inventory and monitoring is considered a priority in many parts of the US. The SRS-FIA IP program has produced significant results and contributed considerably to the understanding of the distribution and spread of IP in the southern U.S. No other program in the United States provides a mechanism for monitoring the spread of common invasive plant species across both public and private lands on a regularly updated basis. The survey of invasive plant species was added to the traditional timber resource surveys that have been underway since the 1930's. Over the past 3 years, the SRS FIA inventory program has developed new data access tools as part of a push for National consistency in data collection allthewhile providing for significant research discoveries being afforded by compilations of regional data.

Presenter: Padonou, Elie A

Title: Bowalization: its impact on soil, biodiversity, and human livelihoods in West Africa

Authors: Elie A Padonou (Faculty of Agronomic Sciences, University of Abomey-Calavi, Cotonou, Benin);Anne M Lykke (Department of Bioscience, Aarhus University, Silkeborg, Denmark);Yvonne Bachmann (Institute of Ecology, Evolution and Diversity, J. W. Goethe University, Frankfurt am Main, Germany);Brice Sinsin (Faculty of Agronomic Sciences, University of Abomey-Calavi, Cotonou, Benin);

Session: Arid Landscapes

Abstract: Bowal (plural bowé) is a particular form of degraded land on hardened ferruginous soils (ferricrete) found in tropical regions with unimodal precipitation. It is characterized by ferricrete exposure due to soil surface erosion. The drivers for bowé establishment are deforestation, intensive monocrop production and/or climatic dryness. Bowé are characterized by reduced water retention capacity and electrical conductivity, low organic matter, nitrogen,

silt and extractable phosphorus but high amounts of exchangeable potassium and increased soil temperature. Bowalization leads to loss of biodiversity and changes in vegetation structure. The vegetation on bowé is characterized by annual herbaceous plants and trees with impeded roots growth and structural adaptions (e.g Combretum nigricans develops more stems, more branches and larger crown diameter on bowal compared to surrounding soils). Bowalization has negative consequences for crop production. Farmers in West Africa have adopted methods for growing cowpea and groundnut on bowé using a hoe for manual tillage and weed control. Livestock herders exploit the short season with annual grasses and practice transhumance or use food supplies during the dry season. Bowalization is predicted to persist and increase in extent in the future.

Presenter: Parish, Esther S

Title: Effects of wood-based pellet production on forest conditions in two fuelsheds in the southeastern United States

Authors: Esther S Parish (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Virginia H Dale (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Keith L Kline (Oak Ridge National Laboratory, Center for Bioenergy Sustainability);Emma Tobin (University of Tennessee);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: The use of woody biomass for energy from forestry operations in the Southeastern United States (SE US) has grown rapidly within the past decade, with wood pellet exports to Europe more than doubling from 2012 to 2014. Data collected under USDA's Forest Inventory Analysis (FIA) were used to characterize changes in timberland, timber harvest, plantations, naturally regenerating forest areas and associated carbon for periods before and after the increase in pellet production in the SE US. The study focused on supply areas surrounding pellet mills that support wood-based pellet exports from the ports of Chesapeake, Virginia, and Savannah, Georgia as case studies. No major changes in forest condition were found to be attributable to pellets based on the FIA data. The FIA data indicate that net carbon in both fuelsheds has continued to increase, reflecting harvest rates and removals below the rate of regrowth in the fuelsheds surrounding pellet mills.

Presenter: Parisien, Marc

Title: The spatially varying influence of humans on fire activity in North America

Authors: Marc Parisien (Canadian Forest Service);Sean A Parks (US Forest Service);Evan DeLancey (US Forest Service);

Session: Disturbance

Abstract: Humans often have conflicting impacts on fire regimes, providing ignition sources in some cases, suppressing wildfires in others, and altering natural vegetation in ways that may either promote or limit fire. In North America, reported effects of people on fire activity vary widely; however, studies have been conducted over different spatio-temporal frames and used different data, thereby making continent-wide comparisons difficult. We circumvent these challenges by investigating the broad-scale impact of humans on fire activity using parallel statistical models of wildfire activity from 1984-2012 as a function of climate, enduring features (topography and percent nonfuel), lightning, and three indices of human activity (population density, human footprint index, roadless volume) across equally spaced regions of the U.S. and Canada. Through a statistical control approach whereby we account for the effect of other explanatory variables, we found evidence of non-negligible human-wildfire association across the entire continent, even in the most sparsely populated areas. A surprisingly coherent negative relationship between fire activity and people was observed across the U.S. and Canada: fire activity by and large diminishes as a function of human influence. An intriguing exception to this relationship is some the continent's most untouched parts, where fewer humans equate to less fire. These areas, however, also often have lower lightning densities, leading us to believe they may be ignition limited at the spatiotemporal scale of the study. Our results suggest that there are few purely natural fire regimes left in North America, and that these should be diligently preserved.

Presenter: Parks, Sean A

Title: Identifying potential migration routes under a changing climate

Authors: Sean A. Parks (Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station);Solomon Z. Dobrowski (College of Forestry and Conservation, University of Montana);

Session: Fragmentation

Abstract: Climate change velocity describes the direction and rate at which organisms must move to maintain a given climate. Estimates of velocity are often based on the Euclidean distance (ED) between any given pixel in time period one and the nearest analog climate in time

period 2. However, ED may oversimplify estimates of velocity because organisms are more likely to favor trajectories (or paths) that minimize their exposure to dissimilar climate as opposed to those that minimize distance traveled. In this study, we evaluated climate change velocity for North America over the interval 1995 to 2085. We used least-cost modelling to identify the locations of future climate analogs based on resistance surfaces that penalized dissimilar climate. We then built trajectories between any given pixel and its future climate analog and calculated climatic dissimilarity along each trajectory in °C. The length of these trajectories suggests that ED-based approaches often underestimate climate change velocity. More interestingly, however, is that the trajectories in some regions (flat areas) exhibiting high velocity have little-to-no exposure to dissimilar climate. Conversely, trajectories in some mountainous regions suggest low velocity (i.e. short trajectories), but exposure to dissimilar climate along these trajectories is high. The trajectories we delineated provide valuable dataset that can be used to manage for adequate connectivity in the coming century as species migrate in response to a warming climate.

Presenter: Parks, Sean A

Title: How will climate change affect wildland fire severity in the western US?

Authors: Sean A Parks (Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station);Carol Miller (Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station);John Abatzoglou (University of Idaho);Lisa Holsinger (Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station);Marc Parisien (Canadian Forest Service);Solomon Dobrowski (University of Montana);

Session: Wildland Fire I

Abstract: Fire regimes are expected to change over the next several decades as a result of climate change. Although some fire regime characteristics (e.g., area burned and fire season length) are relatively well-studied in the context of a changing climate, fire severity has received less attention. In this study, we used empirical data in the western United States (US) to build a statistical model of fire severity as a function of climate. We then applied this model to several (n=20) climate change projections representing mid-century (2040-2069) conditions under the RCP 8.5 scenario. Model predictions suggest widespread reduction in fire severity for large portions of the western US. However, our model implicitly incorporates climate-induced changes in vegetation type, fuel load, and fire frequency. As such, our predictions are best interpreted as a potential reduction in fire severity, a potential that may not be realized due to natural and human-induced disequilibrium between plant communities and climate. Consequently, to realize the reductions in fire severity predicted in this study, land managers should consider facilitating the transition of plant communities towards a state of equilibrium

with the emerging climate through means such as active restoration treatments and passive restoration strategies like managed natural fire (under suitable weather conditions). Resisting changes in vegetation composition and fuel load via activities such as aggressive fire suppression will only amplify disequilibrium and will likely result in increased fire severity in future decades because fuel load will remain static (or increase) as climate warms and fire danger becomes more extreme.

Presenter: Pearlstine, Leonard G

Title: Near-term operations forecasting for ecological decision support

Authors: Leonard G Pearlstine (National Park Service);James M Beerens (U.S. Geological Survey);Gregg A Reynolds (National Park Service);Kevin J Suir (U.S. Geological Survey);James M McKelvy (U.S. Geological Survey);

Session: Assessment III

Abstract: Water management is the principal tool available for conservation of ecological communities in the Florida Greater Everglades. Ecological modeling for resource management in the Everglades has concentrated on restoration scenarios projected to occur over the next decade and longer, however, water operations decisions are regularly being made in the immediate short-term. Thanks to a wealth of Everglades research activity, there is often a good understanding of species and community responses to water management. However, quantitative forecasts for near-term operations, including landscape spatial distributions and temporal change, have been mostly absent. For near real-time evaluation of Everglades water operations and ecological responses, we have developed a spatially-continuous analysis to create daily Monte Carlo simulations of near-term futures for water stage and depth over a period of up to a year beyond current conditions. Operation of regional water management systems is spatially modeled with SFWMD Regional Simulation Model hydrologic scenarios. Best fit near-future conditions are constrained by National Oceanic and Atmospheric Administration precipitation forecasts, North American Multi-Model Ensemble precipitation data as well as Everglades Depth Estimation Network past water stage variances and rates of change. We developed an objective, quantitative, and spatially-explicit framework that ranks species and landscape responses to forecast range of water operations simulations and compares the outcomes among the responses. Recommendations can be made to meet target water depths for species and landscapes most likely to benefit from the range of probable future environments.

Presenter: Pederson, Neil A

Title: The potential masking of eastern US forest vulnerability during the Anthropocene due to 20th century climate

Authors: Neil A Pederson (Harvard Forest);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: There is a wide range of forecasts on how eastern US forests will respond to 21st Century climate. Because they provide ecosystem services for 58% percent of the US population and are an important carbon sink, an understanding how these diverse forests change is crucial. Perhaps the most common model forecast is of rapid change at regional to subcontinental scales during this century. The dominant disturbance regimes observed in these forests, however, are generally asynchronous and often occur at small spatial scales. From this model of forest dynamics, it is not clear how eastern US forests could change in a rapid fashion at large spatial scales. Based upon this model of forest dynamics and ideas that these forests are rather insensitive to climate, there is a substantial set of forecast suggesting these forests will be resistant to climatic change. The disparity in the response of these forests to climate does not provide guidance on how to manage these systems as we move deeper into the 21st Century. Combining results from a: 1) reconstruction forest canopy disturbance history back to the late 1600s and 2) reconstruction of drought back to the 1500s, I will lay out evidence for the hypothesis that climate of the late-20th Century may have lulled Us into a false sense of security in the stability of eastern US forests.

Presenter: Perera, Ajith H

Title: Assessing spatio-temporal patterns of extensive forest disturbances in northern Ontario, Canada

Authors: Ajith H Perera (Ontario Forest Research Institute);Tarmo K Remmel (York University);Marc R Ouellette (Ontario Forest Research Institute);

Session: Monitoring and assessment of landscape change

Abstract: The vast boreal forest landscape in northern Ontario exceeds 110 million ha. This area consists of a shifting spatial mosaic of composition and age structure, historically driven by recurring natural disturbances: wildfires, insect defoliations, and changes in water table. Extensive forest harvest activities have also become common in over 1/3rdof this region during

the last 75 years. Assessing the immediate and cumulative effects of these disturbances requires an accurate measurement and quantification of their spatio-temporal patterns. Multiple data sources (e.g., aerial photographs, Landsat MSS and Landsat TM) are useful in detecting historical disturbance footprints; but spatial and temporal discontinuity in their coverage poses a challenge to data merger, in addition to their differences in sensors and resolution. Furthermore, the inherent complexity and fuzziness of disturbance footprints demand innovative spatial analytical methods in delineating their boundaries. Estimation of associated errors and their propagation through the steps of assessments is also a considerable challenge in this unique real-world application; such obstacles are rarely encountered in typical instances of smaller case studies of detection and analysis of landscape patterns. In this presentation, I detail the challenges involved in detecting and assessing historical patterns of disturbances and subsequent dynamics of forest composition, and discuss potential solutions.

Presenter: Peters, Matthew P

Title: Analyzing drought in eastern US forests from 1961–2099: Potential changes in resiliency

Authors: Matthew P Peters (US Forest Service, Northern Research Station, Delaware, Ohio);Louis R Iverson (US Forest Service, Northern Research Station, Delaware, Ohio);Steve N Matthews (School of Environment and Natural Resources, The Ohio State University, Columbus, Ohio);Anantha M Prasad (US Forest Service, Northern Research Station, Delaware, Ohio);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: Droughts can directly influence forest composition by limiting water and indirectly by intensifying other stressors that affect establishment, growth, and mortality. Forests of the eastern United States have experienced varying degrees of drought frequency and intensity over the last five decades and given the uncertainty of future droughts, it's important to examine potential future conditions based on downscaled climate projections. Using three general circulation models (GCM) and two representative concentration pathways (RCP) from CMIP5 we calculated a gridded self-calibrated Palmer Drought Severity Index (PDSI) to: 1) examine drought frequencies and intensities during the periods 1961–2014 and 2020–2099, and 2) compare spatio-temporal patterns of drought to modeled suitable habitat for many eastern US tree species. Tree species were assigned, via literature, to one of three drought-tolerant or -intolerant classes and used in combination to determine whether the overall forest composition within a 10×10 km grid tended towards tolerance or intolerance to drought. Future conditions provide a range of potential possibilities representing a 2.3–6.3 °C increase in mean annual temperature and a 62.5–186 mm increase in precipitation, averaged across the eastern US by the end of the century. Much of the eastern US has experienced near normal

conditions during 1961–2014 (56 % mean area per period) and future projections show similar trends (45–64% mean area per period). Analyzing past and future drought conditions relative to current and future potential suitable habitat provides information that can aid in management planning to promote forest compositions that add resilience to future droughts.

Presenter: Petras, Vaclav

Title: Efficient processing of dense point clouds in GRASS GIS

Authors: Vaclav Petras (NCSU Department of Marine, Earth and Atmospheric Sciences);Douglas J Newcomb (U.S. Fish and Wildlife Service);Helena Mitasova (NCSU Department of Marine, Earth and Atmospheric Sciences);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: GRASS GIS offers a plethora of analysis for terrain and remote sensing processing. In this talk we will present new tools in GRASS GIS for processing dense point clouds obtained by LiDAR surveys or through structure from motion (SfM) processing of UAV imagery. With quality and efficiency in mind, we will look in detail at techniques for deriving raster topographic products ranging from micro-topography to the regional scale. We will apply GRASS GIS 2D and 3D raster capabilities to multiple return LiDAR data to derive vegetation height and density maps. We will also explore tools in GRASS GIS for terrain visualization and analysis such as sky-view factor and local relief model, which can help us to detect subtle terrain features and evaluate the quality of generated surfaces. Finally, we will see how GRASS GIS can work together with PDAL, a new and powerful point cloud processing package.

Presenter: Phifer, Colin C

Title: Bird community responses to afforested eucalyptus plantations in Argentina

Authors: Colin C Phifer (Michigan Technological University);Jessie L Knowlton (Michigan Technological University);Christopher R Webster (Michigan Technological University);David J Flaspohler (Michigan Technological University);Julian A Licata (Instituto Nacional de Tecnología Agropecuaria);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: As part of an interdisciplinary study of the effects of bioenergy development, we examined how changes in land use influences bird communities in Entre Ríos, Argentina, which is developing eucalyptus as a biomass export. We investigated how this novel agricultural land use influences avian communities by examining large-scale eucalyptus plantations along with two other common land uses (pasture/annual crops and smaller mixed-use farms with citrus and blueberry) and remnant native espinal savannas. In this patchwork landscape, we completed point counts to assess how avian diversity and communities changes between land uses. We also tested for an edge effect produced by large-scale eucalyptus plantations by recording bird diversity along 1 km transects centered on the boundary between plantations and ungrazed grasslands. Distinct bird community assemblages were strongly associated with each land use type. Species richness and abundance of birds also varied, with eucalyptus plantations containing a mean of 8.9 (SE ± 1.2) species compared to 22.8 (± 2.6) and 20.5 (± 2.6) for pasture/annual crops and mixed-use farms, respectively, and 36.4 (± 3.3) species in the espinal savanna. Bird abundance trends followed the same pattern, with low overall abundance in the plantations, intermediate levels for pasture/annual crops, and highest abundance in the espinal. Birds can be useful indicators for biodiversity as a whole, and the depopulated and depauperate avian community within the eucalyptus plantations will likely lead to reduced provision of many biodiversity-dependent ecosystem services in this region if the spatial extent of plantations continues to expand.

Presenter: Pickard, Brian R

Title: A novel approach for examining future US domestic water demand

Authors: Brian R Pickard (US Environmental Protection Agency);Maliha Nash (US Environmental Protection Agency);Jeremy Baynes (Precision Hawk);Megan Mehaffey (US Environmental Protection Agency);

Session: Watersheds and Hydrology

Abstract: Costs of repairing and expanding aging infrastructure and competing demands for water from other sectors such as industry and agriculture are stretching policy makers' abilities to meet essential domestic drinking water needs for future generations. Using Bayesian statistical modeling on past and present water use we project future domestic water demand in the context of four climate scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) as part of their Special Report on Emissions Scenarios (SRES). We then compare 2010 demand to the projected estimates of domestic water demand for the years 2030, 2060 and 2090 for the four SRES scenarios. We found that the number of counties exceeding 50% or more demand over 2010 levels increased through 2090 for two of the scenarios and plateau in 2050 for the other two. The counties experiencing these large increases in water demand were

concentrated in the states of California, Texas, and isolated portions of the Mid-West, South East, and Mid-Atlantic. Closer examination of the spatial distribution of these high demand counties showed that they are typically found around or adjacent to metropolitan centers, potentially putting greater stress on already taxed systems. Identifying counties within the United States that may be vulnerable to significant increases in domestic water demand allows for adaptive management policies to be considered and priority areas to be identified and planned for by local decision makers.

Presenter: Pickell, Paul D

Title: Anthropogenic landscape pattern changes of the Canadian boreal forest from 1985 to 2010

Authors: Paul D Pickell (University of British Columbia);Nicholas C Coops (University of British Columbia);Sarah E Gergel (University of British Columbia);David W Andison (University of British Columbia);Peter L Marshall (University of British Columbia);

Session: Assessment II

Abstract: Humans derive a wide range of ecosystem goods and services from boreal forests, which also account for approximately one-third of global forest cover. The boreal forest of Canada represents an excellent continental-scale case study for investigating anthropogenic landscape pattern changes due to human appropriation of natural resources. Moreover, the historical satellite record allows us look back in time on landscape pattern change in long term and unprecedented ways. We used annual Landsat time series to examine trends of forest cover patterns across the Canadian boreal forest between 1985 and 2010. We demonstrate the use of the Vegetation Change Tracker to monitor forest cover trends in the boreal forest and develop a dynamic vegetation recovery model to spectrally monitor trends in forest recovery following disturbance. Landscapes were characterized by net declines in forest cover and this was associated with declining largest forest patch size, declining core forest cover, and increasing forest edge density. The highest magnitude changes were observed for forests managed for wood production. A multi-scalar analysis indicated that the pattern indices were robust across a range of landscape extents and ecological zones. The results significantly advance our understanding of the development of landscape patterns in the Canadian boreal forest. The integration of forest disturbance and recovery detection extends our tools of pattern analysis in novel ways for managed landscapes. The remote sensing procedure can improve forest land management by supporting the information needs of organizations and land management agencies tasked with monitoring the impacts of cumulative forest land uses.

Presenter: Pickett, Steward TA

Title: The Continuum of Urbanity: A new approach for integrating social-ecological processes in and among complex urban regions

Authors: Steward TA Pickett (Cary Institute of Ecosystem Studies);Christopher G Boone (Arizona State University);Karen Seto (Yale University);Weiqi Zhou (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Daniel L Childers (Arizona State University);

Session: Urbanization and Landscape Change: Socioeconomic Drivers and Ecological Consequences

Abstract: The continuum of urbanity recognizes that urban processes extend well beyond the borders of cities, or even metropolitan areas. Contemporary urban regions are complex spatial mosaics integrated by key social-ecological interactions. The continuum of urbanity is a conceptual tool to 1) work with the entanglement of city, suburban, exurban, rural, and wild lands and cultures, 2) identify the broad kinds of integrating phenomena, 2) acknowledge the multiple spatial and temporal scales of interaction and integration. Under this framework, all areas are considered to be hybrids of characteristics and dynamics that have traditionally been separated into urban and rural poles. In particular, the continuum of urbanity proposes that four features describe the different degrees of urban-rural hybridity: Livelihood, which describes how people support themselves in both informal and formal economies; Lifestyle, which describes how people identify and the consequent locational and consumption choices they make as individuals or institutions; Connectivity, which describes the material, informational, and migration within and between urbanized regions; and Place, which evaluates the nature of built, social, biological, and physical systems of particular areas. Narrative examples of the continuum will be presented, documenting the regional, continental, and global scope of the continuum. A final example will be the use of the continuum in a region undergoing rapid shifts between rural and urbanized tourist-based livelihood and lifestyles, based on enhanced physical and media connections.

Presenter: Pillay, Rajeev

Title: Decoding songbird vocalizations reveals the hidden impact of logging

Authors: Rajeev Pillay (University of Florida);Robert J Fletcher (University of Florida);

Session: Avian I

Abstract: Selective logging is arguably the most widespread and pernicious driver of landscape change in the tropics. The effects of logging on biodiversity have been widely evaluated with population and community metrics. The behavioral responses of taxa, however, have received lesser attention. Birdsong is a fundamental behavioral trait in mate choice, pairing success and in the establishment and defense of territories. We contrasted two behavioral traits important for pairing success in oscines, the rate of male song production and duetting rates of paired songbirds, against the widely-used population metrics of occupancy and abundance. We asked the questions: (i) do vocalization behaviors provide insights into impacts of logging that comparisons of population metrics may mask? and, (ii) can habitat variables and species life-history traits predict population and behavioral responses to logging? We leveraged a large-scale, bioacoustic sampling design to estimate the state variables of occupancy and abundance for 35 species of oscines in old growth and logged forests in Sabah, Malaysian Borneo. We then estimated per-capita singing rates for each species and duetting rates for a subset of eight species (Family Timaliidae – old world babblers). Our results indicate significant declines in per-capita singing and duetting rates in logged forests for forest specialists but increases for generalists. Species traits, such as foraging stratum and foraging habit interact with habitat variables such as understory cover, canopy cover and canopy height to influence vocalization behaviors. Altered singing behaviour may indicate declining avian reproductive success in logged forests, a major conservation concern that warrants further research.

Presenter: Plante, Judith

Title: Why did it cross the road ?: Landscape and road features influencing roadkill locations

Authors: Judith Plante (Concordia University);Jochen AG Jaeger (Concordia University);Andre Desrochers (Laval University);

Session: Wildlife II

Abstract: Roads are now widely considered as a major source of disturbance to wildlife. Mitigation measures such as wildlife passages have been developed to attempt to reduce road mortality, mostly for large mammals. However, little work has been done to reduce collisions with smaller fauna, even though road mortality could also endanger their populations. During the widening of Quebec's road 175, 33 wildlife passages designed specifically for small and medium fauna were added under the road. Small fauna fences were also built for 100 meters on each side of every passage to direct animals to the passage entrance. Our study examines the effectiveness of those passages to reduce road mortality of small and medium mammals while considering the potential confounding effects of landscape variables. To do so, we analyze the spatial distribution of road mortalities along road 175. Daily mortality surveys were

conducted by car during summers 2012 to 2015. During those four years, 895 mortalities were found comprising 14 different species or taxonomic groups. We examined the relationship between roadkill locations and distance to various landscape and road features such as forest cover, water bodies, and road sinuosity. Detection probability was also considered during statistical analysis. Mortalities were the highest at the ends of the fenced sections. Mortalities were lower within the fenced sections than the unfenced sections. The results may indicate a displacement of roadkills to the end of the fences. To resolve this issue, the fence design should be revised to prevent animals from going around them.

Presenter: Plunkett, Ethan B

Title: Incorporating landscape change into conservation design

Authors: Ethan B Plunkett (Department of Environmental Conservation, University of Massachusetts, Amherst);Kevin McGarigal (Department of Environmental Conservation, University of Massachusetts, Amherst);Bradley W Compton (Department of Environmental Conservation, University of Massachusetts, Amherst);William V DeLuca (Northeast Climate Science Center, Department of Environmental Conservation, University of Massachusetts, Amherst);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: The Designing Sustainable Landscapes project for the North Atlantic Landscape Conservation Cooperative used assessment of ecological integrity and landscape capability for a suite of representative species as the basis for creating a Landscape Conservation Design (LCD) consisting of two tiers of conservation core areas and a set of connections between them. We used future projections to incorporate climate change, sea level rise, and urban growth into the LCD, and into additional spatial data layers that can be used separately by conservation planners. At the ecosystem level climate stress and sea level rise were explicitly modeled as metrics and incorporated into our Index of Ecological Integrity; this essentially pushes cores towards locations where the ecological systems are less stressed. Urban growth was used to weigh ecological systems such that those that were most at risk of development would have more representation in the cores. Species landscape capability was assessed both in the present condition and in a future scenario where each species distribution was shifted to track its climate niche. Incorporating landscape and climate change into landscape design creates reserve networks that are better suited to our changing world.

Presenter: Polo-Akpisso, Aniko

Title: Ecological characteristics of natural habitat within the complex of protected areas Oti-Keran-Mandouri in Togo

Authors: Aniko Polo-Akpisso (West African Science Service Center for Climate Change and Adapted Land Use , Université Félix Houphoet Boigny, Abidjan, IC);Kpérkouma Wala (Laboratoire de Botanique et Ecologie Végétale, Faculté des Sciences, Université de Lomé, Lomé, TG);Soulemane Ouattara (Laboratoire de Zoologie et Biologie Animale, UFR Biosciences, Université Félix Houphoet Boigny, Abidjan, IC);Mamadou Coulibaly (Department of Geography and Urban Planning, 800 Algoma Boulevard, Oshkosh WI 54901-8642, USA);Yao Tano (Laboratoire de Zoologie et Biologie Animale, UFR Biosciences, Université Félix Houphoet Boigny, Abidjan, IC);

Session: Conservation Biology I

Abstract: The complex of protected areas Oti-Keran-Mandouri is a key biodiversity area in Togo. It is listed as Ramsar site, as International Bird Area and considered as conservation corridor for the African savanna elephant. However, its habitat are under increasing anthropogenic pressure. Therefore, the directions and magnitude of changes in land use/land cover and the different landscapes processes were assessed using moderate resolution Landsat images from different missions spanning the time steps 1987, 2000 and 2013. The current state of habitats was described through vegetation sampling. A model of elephant habitat suitability was performed using a multicriteria evaluation. The socio-ecological system including perceptions of climate change was also assessed among resident communities through a social survey. From 1987 to 2013, natural habitats regressed to the profit of croplands with wetlands being the main contributor. Three main habitat change processes leading to landscape anthropization were identified. These are attrition in forests and savannas, dissection in wetlands and creation in croplands. Two ecological gradients influencing the distribution of plant species and seven plant communities were identified. There are still patches of suitable habitats but resident communities expressed no interest in the conservation of this area and suggested its release for them to increase their agricultural land. Population growth, former and current management inadequacy and climate change are the main drivers of habitat fragmentation and biodiversity loss in this region. The restauration of this complex of protected areas will be only successful if resident communities are put at the heart of the conservation system.

Presenter: Pomara, Lars Y

Title: Roles for integrative landscape resilience measures in conservation planning

Authors: Lars Y Pomara (US Forest Service);Danny C Lee (US Forest Service);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: Environmental decision-making at multiple scales is aided by evaluating the dimensions and trajectories of landscape change, the likely impacts of change on systems of conservation interest, system resiliencies or adaptive capacities, and uncertainties in each of these. For example, the provisioning of various kinds of ecosystem services may be sensitive to the distributional dynamics of ecosystem capacities, stressors, uses, and management interventions. Remotely sensed data sets have become sufficiently rich in temporal and spatial dimensions to provide the raw materials for assessing landscape change and resilience, but a challenge has been to develop robust theory linking these data to ecological process and pattern. We illustrate the potential for a suite of information theoretic metrics applied to satellite-derived (MODIS) vegetation greenness data to integrate landscape-level pattern and process. We explore the utility of these measures for assessing landscape resilience and ecosystem service sustainability, through comparison to ancillary environmental data sets, using the Appalachian Landscape Conservation Cooperative (LCC) as a case study. We suggest that regional prioritizations undertaken for conservation planning can be complemented by and linked to evaluations of landscape condition with measures of resilience derived from remotely sensed data.

Presenter: Ponisio, Lauren C

Title: Curbing biotic homogenization through restoration

Authors: Lauren C Ponisio (University of California Berkeley);Claire Kremen (University of California Berkeley);

Session: The Landscape Ecology of Pollination Mutualisms

Abstract: Through habitat restoration, ecologists seek to reassemble communities to reestablish the fundamental patterns that support species diversity, such as spatial heterogeneity in community composition (beta-diversity). Currently, agriculture is associated with eroding beta-diversity. Using a long-term pollinator dataset, comprising 9,800 specimens collected from the intensively managed agricultural landscape of the Central Valley of California, we show that on- farm habitat restoration in the form of native plant 'hedgerows', when replicated across a landscape, can boost beta-diversity by approximately 14% relative to unrestored field margins, to levels similar to some natural communities. Hedgerows restore beta-diversity by promoting the assembly of phenotypically diverse communities. Intensively managed agriculture imposes a strong ecological filter that negatively affects several important

dimensions of community trait diversity, distribution, and uniqueness. However, by helping to restore phenotypically diverse pollinator communities, small-scale restorations such as hedgerows provide a valuable tool for conserving biodiversity and promoting ecosystem services. In addition, globally, there is mixed evidence about the effectiveness of small-scale habitat enhancements as a pollinator biodiversity conservation strategy in agricultural areas. We are also synthesizing pollinator survey data from approximately 50 studies across the world and hundreds of thousands of pollinator observations to ask whether attempts to restore environmental heterogeneity are generally effective at re-establishing beta-diversity.

Presenter: Portugal, Marina P

Title: Effects of grain size on the identification of Jaguar (Panthera onca) priority conservation areas in Cerrado, Brazil

Authors: Marina P Portugal (Programa de Pós Graduação ECMVS- UFMG- Brazil);Ronaldo Morato (Centro Nacional de Pesquisa e Conservação de Mamíferos Carnívoros -ICMBIO- MMA- Brazil);Katia MPM Ferraz (Departamento de Ciências Florestais- ESALQ/USP, Brazil);Flávio Henrique G Rodrigues (Departamento de Biologia Geral- UFMG- Brazil);Claudia Jacobi (Departamento de Biologia Geral- UFMG- Brazil);

Session: Wildlife I

Abstract: The choice of resolution is an important factor in Species Distribution Modelling (SDM) that can change predictions and management actions. We aimed to assess the effect of grain size on the identification of jaguar priority conservation areas (JCA) in the Cerrado biome using SDM, comparing JCA in a regional scale, in the north of Minas Gerais state. We used 126 jaguar occurrence points and 15 environmental layers (250m and 1km resolution), identifying variables with correlations ≥0.65 and excluding spatial-climate correlated points. We ran 24 models with a combination of less-correlated layers (250m) in Maxent v3.3. We calculated true skill statistics (TSS) for three thresholds at the fine grain, evaluating AUC and omission values for models with TSS>0.4. The best model was ran with 1km resolution. We considered JCA areas with suitability higher than 0.595, with native vegetation cover and area ≥10km². SDMs were significant for the fine (AUC=0.80±0.04, omission=0.28, TSS=0.55) and coarse grain (AUC=0.76±0.05, omission=0.28, TSS=0.40), both with a higher influence of mean annual rain. Jaguar suitability total area in the Cerrado was greater in the coarse grain (706 118km²), covering 255 350km² more than the fine-grained model. The fine-grained model identified 21 JCA, up to 157km², while the coarse-grain model identified 37 JCA, up to 92km². JCA identified with different grain sizes did not differ in the total area, but they had some differences in spatial configuration. The fine-grained model appears to be the best choice with better TSS values, bigger JCA and JCA located in different areas.

Presenter: Potter, Kevin M

Title: How – and where – do nonnative trees alter the biodiversity of eastern U.S. forests?

Authors: Kevin M Potter (North Carolina State University);Christopher M Oswalt (USDA Forest Service, Southern Research Station);Songlin Fei (Purdue University);Basil V Iannone (Purdue University);Qinfeng Guo (USDA Forest Service, Southern Research Station);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: Biodiversity is expected to convey numerous functional benefits to forested ecosystems, including increased productivity and resilience. When assessing biodiversity, however, statistics that account for evolutionary relationships among species may be more ecologically meaningful than traditional measures such as species richness. Using evolutionary diversity statistics calculated from more than 40,000 Forest Inventory and Analysis (FIA) plots across the Eastern United States, we assess the degree to which the introduction of nonnative tree species has altered the biodiversity of native forests. We use two sets of evolutionary diversity metrics: (1) phylogenetic diversity statistics, which weight species based on their evolutionary distinctiveness, unlike traditional measures of biodiversity which weight species equally, and (2) phylogenetic community structure statistics, which quantify the degree to which co-occurring species are clustered on the phylogenetic tree of life. These metrics quantify different aspects of biodiversity, and as such are indicators of the potential functional diversity of forested ecosystems. In most regions of the Eastern United States, we detected little significant evolutionary diversity impact resulting from the presence of nonnative trees, but exceptions included the Gulf Coast and parts of the Midwest. In some places, nonnative trees appear to be reducing forest evolutionary diversity, and thus negatively impacting ecological functionality. In others, nonnative trees appear to be increasing evolutionary diversity and ecological functionality. Such analyses of the evolutionary relationships among co-occurring tree species offer new insights into the ecological organization of forest communities across broad regions.

Presenter: Povak, Nicholas A

Title: Power-laws, complexity, and entropy in wildfire systems

Authors: Nicholas A Povak (USFS PSW Research);Paul F Hessburg (USFS PNW Research);Brion Salter (USFS PNW Research);

Session: Implications and applications of thermodynamics in landscape ecology

Abstract: Wildfires are a keystone process that shape the structure and functioning of ecosystems and regulate other important ecosystem processes. Identifying how fire-prone systems are structured and how they respond to and recover from recurrent wildfire disturbances will help shed light on future system stability and resilience. Studies from the complex system sciences suggest that observed power-law distributions in wildfire event sizes are indicative of self-regulation through the interactions of past and future wildfire patterns (i.e., self-organized criticality). Other studies question the simplicity of this model and suggest wildfires and their influence on ecosystem patterns and processes are controlled by multi-scaled endogenous and exogenous processes, and that influences such as climate change may alter ecosystem resilience. More recently, the application of thermodynamics to landscape ecology, particularly the study of entropy, has offered insight into quantifying pattern-process interactions to identify broad-scale spatiotemporal structure in ecosystems. To this end, we sought to identify linkages between entropy, complexity theory, and system-level resilience using empirical evidence from wildfire event sizes across 16 ecoregions within California, USA. We combine power-law analyses, neutral landscape models, and fractal time-series analyses to identify key top-down and bottom-up drivers of fire size distributions. Our results suggest that order in fire-prone systems may be driven by feedbacks between fractal topographic patterns, past fire patterns, and climatic variability. Furthermore, the level of bottom-up and top-down control on fire regimes varies across biophysical provinces and across fire sizes. We attempt to relate these findings to system-level thermodynamic properties.

Presenter: Prasad, Anantha M

Title: Combining integrated ecological modelling with genetic analysis to manage eastern hemlock populations

Authors: Anantha M Prasad (Northern Research Station, USDA Forest Service);Kevin M Potter (North Carolina State University);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: Eastern hemlock (Tsuga canadensis) occupies a large swath of eastern North America with many populations afflicted with the hemlock woolly adelgid (HWA). In this study we differentiate genetic clusters based on within-species evolutionary lineages derived from

nuclear micro-satellite molecular markers from 58 populations of the species in the eastern United States. We sub-divide these clusters into four groups to differentiate the north-central (NC), north-eastern (NE) and south-eastern (SE) lineages. We use demographic data (relative abundance, mortality and seedling regeneration) from the Forest Inventory Analysis (FIA) plots to differentiate and model relevant environmental gradients that may have caused divergence of populations among these four groups. We also compare environmental niches and genetic indices among these clusters for significant differences. Differences in abundance based suitable habitats are modelled locally (cluster-based) and globally (entire hemlock distribution in the eastern US) under current and future climatic conditions. Future expected migration of this species is simulated to examine possible corridors of colonization that could assist in the conservation of genetically differentiated populations. Preliminary results show that within-cluster responses to environmental correlates are different among cluster groups, which in turn are quite different from the global response. Mapping of future migration corridors allows targeting populations deemed important by our analysis for future climatic conditions.

Presenter: Prebyl, Thomas J

Title: Characterizing fragmented stream networks and prioritizing restoration in the Southeastern US

Authors: Thomas J Prebyl (University of Georgia);

Session: Watersheds and Hydrology

Abstract: Stream habitat connectivity is a common conservation concern as many fish species must make short or long distance movements to access different habitats as part of their life histories. Fragmentation is of particular concern in the southeastern United States as there are hundreds of thousands of dams and road crossings that may act as barriers to fish movement. In this research we characterized stream connectivity at two spatial scales. At a broad scale we assessed the current level of stream connectivity across the South Atlantic Landscape Conservation Cooperative region, taking into account all known potential barriers to fish movement. At a local scale we simulated the removal (or restoration) of potential barriers on select watersheds, constructing prioritization schemes that account for the needs of fishes with varying life histories. Our results indicate that the level of connectivity varies considerably across the landscape and that stream fragmentation is higher in the inland piedmont ecoregion compared to the coastal plain. Secondly, our results suggest that priorities for barrier removal or restoration vary depending on species-specific life histories and whether or not smaller structures such as culverts are considered in analyses. Identifying optimal prioritization schemes presented both spatial and computational challenges and thus, we also present

approaches for integrating GIS, graph theory, and optimization techniques to address these challenges.

Presenter: Preslicka, Amanda

Title: Spatially explicit modeling of several landscape features for the health of managed bees

Authors: Amanda Preslicka (Miami University);Eric Lonsdorf (Franklin and Marshall);David Mushet (USGS);Emily Kirkpatrick (Miami University);Amelie Y Davis (Miami University);

Session: Poster

Abstract: Research is ongoing as to the causes of honeybee mortality but the potential threat to our varied food supply is well established. While parasitic mites and viruses seem to be partially to blame for the observed losses, landscape elements play a role as well. Indeed, the quality of forage varies within and across natural and agricultural landscapes. Forage quality is also closely linked to agricultural land management practices such as diversity of crops, availability of native habitat (both as remnant and as edges), herbicide/pesticide applications, and so forth, but also inter-annual weather variations. We modified the pollination module of InVEST so that it a) can be applied to managed bees, b) integrates diversity of high quality habitat, and c) modulates floral quality using Normalized Difference Vegetation Index (NDVI). The output of the model is representative of the quality of the landscape for a honeybee. Using a linear mixed effect model to account for repeat sampling of apiaries over multiple years, we investigate whether this landscape quality index affects honey production in the Prairie Pothole region from 2008 to 2012. We find a positive relationship between honey production and the landscape quality index. The relationship is strengthened by the addition of the NDVI component to the spatially explicit model. The models thus indicate that inter-annual weather variations are important for honey production. The implications for honey bee health under various climate change scenarios are discussed.

Presenter: Puric-Mladenovic, Danijela Dr.

Title: Defining a composite index of vegetation quality

Authors: Danijela Dr. Puric-Mladenovic (OMNRF, Science and Research Branch, Natural Heritage Information Centre);

Session: Assessment II

Abstract: Across Ontario ' settled landscapes already altered natural settled landscapes n is exposed to numerous pressures such as increased urbanization, invasive species impacts and climate change. Consequently, there is a growing need to preserve and improve the state of natural vegetation and restore it where is underrepresented. However, to ensure strategic conservation and restoration of vegetation, biodiversity and manage it for a steady flow of ecological goods and services, vegetation needs to be integrated into landscape planning, conservation and adaptive management actions. The success of these efforts, depends on the amount, health and quality of the existing vegetation, and a timely detection of changes in vegetation amount, structure and composition. To respond to all of these needs, multipurpose integrative and landscape scale vegetation monitoring approach is established in the Lake Simcoe Watershed. The monitoring, based on a set of strategically placed plots, enables capturing base field measurements from which a composite index of vegetation quality is derived. This composite index is based on several individual and independent quality indicators derived from information on structural, functional, and compositional vegetation characteristics. The site level monitoring and reporting composite quality index and individual criteria can be extrapolated across landscapes, and used for informing adaptive management actions.

Presenter: Quinn, John E

Title: Application of scenario planning to improve biodiversity conservation in a rapidly urbanizing ecoregion

Authors: John E Quinn (Furman University);Dainee M Gibson (Furman University);

Session: Conservation Biology I

Abstract: Projected simplification of human and natural systems as a function of expected change necessitates integration of data and perspectives in regional planning to prepare for future outcomes. Outcomes though of land use and land cover change are difficult to suggest based on past transformations alone. For example, while temperate forests of southeast United States were replaced by agriculture during the 20th century; today reforested areas are being lost to rapid urbanization. Our research focuses on identifying unexplored conservation challenges in these managed ecosystems while improving sustainably of local human systems. In this presentation we summarize outcomes from a synthesis of data using InVEST software from the Natural Capital Project to develop and test informed scenarios for future development in Greenville Co., SC. Scenarios prioritized forest conservation and restoration, retention of agriculture, and stormwater control in light of expected rapid urbanization. These scenarios

present opportunities for conservation of forest species but highlight the challenge of protecting shrubland and pine specialists. For example, while countywide restoration of forest had the greatest net increase of habitat quality for forest interior species, scenarios that that emphasized urban infill also had similar, though not as large gains in habitat quality. Habitat quality for pine species increased slightly for all restoration or conservation scenarios while only the scenario that prioritized agricultural lands maintained habitat quality shrubland birds. Individually these data are valuable; however, their worth is increased when coupled across systems and scales while identifying alternative futures that enhance regional conservation and planning efforts.

Presenter: Rakoto Ratsimba, Harifidy

Title: Madagascar, a country of change: Understanding forest landscape dynamics

Authors: Harifidy Rakoto Ratsimba (University of Antananarivo);Felana Ramalason (University of Antananarivo);Herijaniaina Rakotoarisoa (University of Antananarivo);Ihoby Henintsoa Randriamalala (University of Antananarivo);Pierrot Ramanamandimby (University of Antananarivo);Ando Jocelyn Radonarison (University of Antananarivo);Percy Yvon Rakoto (University of Antananarivo);Fetra Mihajamanana Rabenilalana (University of Antananarivo);Arimino Aina Navale Ratovoson (University of Antananarivo);Jan Bogaert (University of Liège);

Session: Landscape Change and Sustainable Development: The Case of Madagascar

Abstract: Madagascar, the fourth largest island in the world, has long been known for its unique biodiversity. However, the country is also facing a continuous increase in natural resources threats at all levels especially on species and on the natural habitats. At a global scale, it has been qualified that the country has been passing from a “green” to a “red” island linked to the degradation of the landscapes. At local scale, the observed changes are more characterized by a fragmentation of natural landscapes and seascapes especially forest but also other specific habitats like wetlands, coral reefs and natural open lands. This study is focused on the impacts of natural process variability and anthropogenic factors on forest landscape dynamics. Remote sensing digital image analysis is applied between 2000 and 2015 (Landsat images) to monitor the behaviors of forests from in four specific sites from the North to the south including humid forest, transition forest and dry forest. The vegetation reacts in relation with rainfall variability, fire frequencies and forest openings have been analysed using vegetation indices as NDVI (Normalized Difference Vegetation Index). Results indicate that the response of forest ecosystem are different depending on its type and on landscape structure showing a different scale of resilience. Natural process variability and anthropogenic factors have significant

correlation with landscape dynamics and most of observed changes are the combination of these two factors which leads most of the time to a definitive change of the landscape matrix.

Presenter: Raposa, Kenneth B

Title: Assessing tidal marsh resilience to sea-level rise at broad geographic scales with multi-metric indices

Authors: Kenneth B Raposa (Narragansett Bay NERR);Kerstin Wasson (Elkhorn Slough NERR);Scott B Lerberg (Chesapeake Bay Virginia NERR);Erik M Smith (North Inlet-Winyah Bay NERR);

Session: Coastal and Marine

Abstract: Tidal marsh resilience to sea-level rise (SLR) can vary across multiple spatial scales. Resource managers need to understand how vulnerable their marshes are to identify priority sites in need of intervention actions. However, comparing resilience among marshes is hindered by a lack of simple, effective analysis tools. Here, we develop and test tidal marsh resilience to sea-level rise (MARS) indices that incorporate multiple categorical metrics that contribute to overall marsh resilience to SLR. Metrics include elevation distributions, marsh elevation change and accretion, sediment availability, and tidal range. Scores can be calculated for each individual metric and across metrics for each site using multiple complementary indices. We applied MARS indices to tidal marshes at 17 National Estuarine Research Reserves (NERRS) that span five different biogeographic regions to explore relative marsh resilience across the conterminous US. Results indicate that resilience varies markedly among marshes within the same estuary and across different estuaries and regions. Atlantic Coast marshes were generally more vulnerable to SLR than Pacific Coast marshes, and the least resilient marshes were consistently found in southern New England, which is currently a hot spot for accelerating SLR. The MARS indices leverage the robust estuarine monitoring datasets that are unique to the NERRS System-wide Monitoring and Sentinel Sites Programs. However, the data needed to apply the MARS indices to any tidal marsh are easily collected, thereby facilitating their application across additional marshes to broaden our understanding of spatial patterns in marsh vulnerability to SLR.

Presenter: Ratovoson, Arimino Aina Navale A

Title: Landscape change in the north western mangrove of Madagascar: the role of sustainable fisheries for local communities' livelihoods

Authors: Arimino Aina Navale Ratovoson (Département des Eaux et Forêts, ESSA);Harifidy Rakoto Ratsimba (Département des Eaux et Forêts, ESSA);Ramiandrisoa (Ministère des Ressources Halieutiques et de la Pêche);Samuel Razanaka (Centre National de Recherche sur l'Environnement);Jan Bogaert (Unité Biodiversité et Paysage, Gembloux Agro-Bio Tech);

Session: Landscape Change and Sustainable Development: The Case of Madagascar

Abstract: Mangrove ecosystems show higher social, economic and ecological values among forest ecosystems due to its localization in the coast. However, ecologic, economic, human factors and global change involved simultaneously have serious impact in this kind of ecosystem while direct contributions assessment are still less investigated. In addition, lack of study demonstrated integration of ecosystem services value to natural resources dynamic. In this sense, this research is focused on mangrove change and crab market importance as drivers of change in two observed bays (Bombetoka and Mahajamba). The study include crab stock estimation, local livelihoods involvement and landscape analysis. Landscape analysis includes mangrove landscape mapping from remotely sensed data especially Landsat data while classification has been implemented and compared (2005, 2010 and 2015). The results emphasize the importance of degradation between the two observed bays. Mahajamba bay shows a weak degradation while Bombetoka bay show an advanced degradation and deforestation. Since 2010, the integration of crab market have changed mangrove landscape trend. The emergence of crab market have significantly reduced mangrove deforestation and degradation in the Bombetoka bay and prevented deforestation in Mahajamba bay. Importantly, the study highlights contributions of natural resources economic value to local livelihoods system which affect landscape change prevention. In order to model mangrove dynamic integrating ecosystem services value, an upscale of the study at national scale should be conducted including other parameters.

Presenter: Raya Rey, Andrea N

Title: A telecoupling analysis for the Patagonian Shelf seascape: A suggested template on how to study the wider seabirds-fisheries interactions worldwide for sustainability

Authors: Andrea N Raya Rey (CADIC-CONICET);Falk Huettmann (EWHALE lab, Inst of Arctic Biology, Biology & Wildlife Dept. University of Alaska Fairbanks);

Session: Landscape networks as telecoupled human and natural systems

Abstract: The Southwest Atlantic Ocean and the extended Patagonian shelf in particular, is a highly productive seascape. It is a very complex ecosystem of global relevance and maintains a great diversity and abundance of seabirds and marine mammals, too. Fisheries have been identified as a main stressor for the marine ecosystems and as the main cause of seabird population declines. Using the framework of telecoupling - the sophisticated natural and socioeconomic interactions over wider distances - we present a fresh look at the dynamic fisheries and (endangered) seabird interactions for the Patagonian Shelf seascape. We found that these waters are affected by many nations and players, inside and outside. Here we show how the input, output and spill-over of the Patagonian shelf ecosystem are distributed almost globally. In addition, we also show 'losers' (=nations that are left out entirely from this global resource and its governance). Our findings are based on best available public trade and harvest analysis for this region, linked with predictive modeling (machine learning and some open source geographic information systems GIS) for nine seabird species. We extend this analysis with a perspective from the financial sector and ethical banking policy that support the Patagonian fisheries as international investment projects. As increasingly recognized elsewhere, we believe that telecoupling can serve as a new but rather sophisticated study template for an improved more holistic conservation research on oceans and global sustainability questions.

Presenter: Raya Rey, Andrea N

Title: Prediction of ten seabird species of the Patagonian Shelf: Digital baseline with open access machine learning for a more effective seascape management

Authors: Andrea N Raya Rey (CADIC-CONICET);Falk Huettmann (EWHALE lab, Inst of Arctic Biology, Biology & Wildlife Dept. University of Alaska Fairbanks);

Session: Machine Learning and Data Mining Applications in Land- and Seascape Ecology: What it is, Why it matters, and Where the Progress Still Sits

Abstract: Quantitative knowledge about the spatial distribution of seabirds at sea is relevant for conservation. The Southwest Atlantic Ocean and the extended Patagonian shelf in particular, is a highly productive seascape. It is a very complex ecosystem of global relevance (i.e. fisheries, climate regulation) and maintains a great diversity and abundance of marine life. Direct and indirect discharge of chemical pollutants, industrial and expanded cities pollution, by-catch, entanglement, climate change and alien species pose severe threats for seabird populations in the Patagonian shelf. Nevertheless seabird at sea distribution is missing for most species and even less open access efforts. Based on the data mining and machine learning TreeNet (boosting) algorithm, and 10 environmental publicly available Open Source Geographic Information Systems (GIS) layers, we built for the first time 10 predictive seabird models for the Patagonian shelf based on public open access data archives such as the Global Biodiversity

Information Facility (GBIF), and Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations database (OBIS-Seamap). Top five explanatory variables for seabird distribution were distances to shelf break, to subantarctic front, to coast, to ports, as well as bathymetry. Our models are the first of its kind for the seascape and have a good accuracy according to two assessment metrics (Receiver Operating Characteristics (ROC-AUC) curves, and alternative field data). Seabird distribution maps for the Patagonian shelf and especially when publicly available for transparency are essential for best practices, marine conservation planning, assessment of conflict with human activities, and forecasting regarding climate change impacts.

Presenter: Reilly, Matthew J

Title: Biogeography of contemporary wildfires in the Pacific Northwest: Cumulative effects on landscape structure, regional forest change, and biodiversity

Authors: Matthew J Reilly (Oregon State University);Thomas A Spies (USDA Forest Sevice PNW Research Station);

Session: Disturbance

Abstract: Disturbance is a major driver of landscape change and regional forest dynamics. Increases in the frequency and extent of wildfires have received a great deal of attention, but most studies focus on broad patterns of severity. Relatively little is known regarding the cumulative effects of these disturbances on landscape structure, regional forest change, and biodiversity. We integrate a regional atlas of fire severity along with imputed maps of forest structure and compare changes in the abundance and spatial patterns of forests in early and late seral stages among biogeographic provinces in Oregon, Washington, and northern California from 1984 to 2010. Gains in the abundance of diverse, early seral forests and losses of late seral forests associated with high severity fire were limited to landscape scales (<10,000 ha) in the North Cascades, Klamath, East Cascades, and Blue Mountains provinces. High severity fire created large patches (≥100 ha) of diverse early successional forests, but affected a small proportion of most biogeographic provinces and these structural conditions remained relatively rare compared to later seral forests. The effects of wildfires appear to have increased variability in landscape composition and structure among biogeographic provinces primarily through the creation of diverse early seral forests and increased heterogeneity associated with low and moderate severity fire. Knowledge of how recent dynamics vary across regional scales can help inform discussions of management and conservation around balancing the trade-offs of losses of late seral forests with gains in diverse early, seral forests.

Presenter: Remmel, Tarmo K

Title: Classifying boreal wildfires by clustering ShrinkShape2 spectra of internal unburned vegetation patches

Authors: Tarmo K Remmel (Department of Geography, York University);

Session: Monitoring and assessment of landscape change

Abstract: Naturally occurring boreal wildfires consume large areas of forest in Ontario annually, forming burned area footprints ranging in area from hundreds to tens-of-thousands of hectares. Heterogeneities in species cover, moisture regimes, local topography, and weather create uneven consumption and thus island stands of unburned forest cover remain after these disturbance events. These patches of residual vegetation can range from about 3 to over 20% of the footprint area and form important ecological refuges for flora and fauna alike. Patterns and spatial characteristics of these residual vegetation patches are hypothesized to be indicative of burning conditions and should be usable in aggregate as markers of burning conditions. This study implements the ShrinkShape algorithm to measure shape spectra that are subsequently scaled and grouped by k-means clustering to assess whether similar residual patches form such that they cluster according to their shape in space and by event (in time). If trends are detected in the space-time clustering of residual patch shapes, these clusters will be interpreted as being influenced by (1) the pre-fire landscape conditions or (2) the burning conditions. Assessments can be made as to whether pre-fire landscape conditions differ among identified shape clusters, and if they do not, the burning conditions are deemed responsible for the clusters of similar residual patch shapes.

Presenter: Riitters, Kurt H

Title: Modeling North America tree cover disturbance at multiple scales

Authors: Kurt H Riitters (USDA Forest Service);Jennifer K Costanza (North Carolina State University);Brian J Buma (University of Alaska);

Session: Monitoring and assessment of landscape change

Abstract: Disturbances happen in particular places, but landscape-level impacts may depend on disturbance patterns across broader spatial extents. We modeled the spatial patterns of disturbance in North American forest biomes using a 30-meter resolution map showing tree cover loss from 2000 to 2012 (Hansen et al. 2013). Each location was described by the amount

(Pd) and contagion (Pdd) of tree cover loss in its neighborhood, for eight neighborhood sizes from 6 ha to 180 km^2. A systematic 10% sample of locations (n = 1.1x10^9) were then grouped (via k-means clustering) into 14 “disturbance profiles” based on the similarity of Pd and Pdd values across neighborhood sizes. Each disturbance profile thus represents a typical multi-scale trajectory in a two-dimensional {Pd, Pdd} pattern space. To interpret the results in geographic space, the frequencies of the 14 profiles were evaluated for each of 64 forest ecoregions to identify (1) ecoregions containing unusually large concentrations of a given profile, and (2) spatially-contiguous groups of ecoregions having similar concentrations of the 14 profiles. The identity of those ecoregions and groups was determined in part by ecoregional differences in the original tree cover patterns which constrain the patterns of disturbances that can occur.

Presenter: Ripplinger, Julie

Title: The role of residential areas in socio-ecological dynamics of urban ecosystems: A conceptual framework

Authors: Julie Ripplinger (Arizona State University);Emily S Minor (University of Illinois at Chicago);Anita T Morzillo (University of Connecticut);

Session: Urban II

Abstract: Traditionally, research on urban systems has largely been single-city focused, with less attention to understanding socio-ecological characteristics, patterns, and processes among cities. Residential areas are where the majority of human-environment interactions occur in cities, providing opportunities to expand conservation efforts and ecosystem service provisioning in neighborhoods and yards. In residential areas, people directly carry out local-scale management through activities on their own yards. As a result, larger-scale emergent patterns vary among neighborhoods due to income, lifestyle, and other factors. These larger-scale patterns may ultimately determine urban biodiversity and provisioning of ecosystem services. Using a cross-city approach, we developed a conceptual framework to study how household preferences scale up to neighborhood patterns by integrating socioeconomic and psychological variables with yard characteristics. For case study cities, we developed a typology of neighborhoods based neighborhood characteristics such as yard size, tree canopy cover, turf grass, and percent impervious surface. Future work will include examination of cultural and other ecosystem services experienced by residents for the different neighborhood types in the typology. Our multiscale, cross-city approach integrates landscape ecology with urban planning and cognitive psychology to understand key feedbacks among neighborhood characteristics and ecosystem services, and how these vary from one city to another.

Presenter: Robbins, Tessia O

Title: Spatial patterns of Canada lynx habitat connectivity under a changing climate

Authors: Tessia O Robbins (University of Washington);Donald McKenzie (University of Washington);

Session: Avian II

Abstract: As a species threatened in the contiguous United States and dependent on climate-sensitive landscape conditions, Canada lynx (Lynx canadensis) are vulnerable to climate change at southern range peripheries. For lynx in Washington State, we will estimate and compare current and future connectivity with network modeling applied to both current landscapes and those projected under climate change. The model will be informed by geospatial analysis, habitat suitability modeling, and literature review. We will apply connectivity metrics to output from the network modeling to assess the impact of climate change on pattern and extent of connected habitat and use sensitivity analyses to identify key knowledge gaps. Results will inform management strategies that seek to facilitate Canada lynx resilience and response under a changing climate.

Presenter: Rojas, Isabel M

Title: Contribution of riparian forest to structural corridors of Chile

Authors: Isabel M Rojas (1 SILVIS Lab, Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, USA);Sebastian Martinuzzi (1 SILVIS Lab, Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, USA);Anna M Pidgeon (1 SILVIS Lab, Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, USA);Volker C Radeloff (1 SILVIS Lab, Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, USA);

Session: Poster

Abstract: Despite that there is increasing evidence that individual riparian corridors facilitate movement of several species, we lack an understanding of how often and where riparian forests actually form corridors. Our goal was to a) map the structural forested corridors of Chile, and b) assess the extent to which riparian forest may provide corridors. We focus on rivers because vegetation next to rivers is frequently protected by law, and because riparian areas are linear and potentially connected over long distances. We defined forest as areas with more than 10% of tree cover in dry ecosystems, and above 25% elsewhere, and analyzed our

forest map using image morphology to differentiate corridors from other forest classes (e.g., core, edge, islet or branch). After mapping corridors throughout Chile, we measured for each of the 34 largest watersheds the contribution of rivers to corridors by quantifying the proportion of corridors with a 60 m buffer along rivers. We found that 33 of 34 watersheds have some corridors, and that corridors cover as much as 543 km2 of a watershed. Of these, riparian corridors are rare on average (6%), but relative importance varied greatly (0 - 14 %). Riparian forests were most important for corridors in watersheds dominated by pasture, shrubs, grassland or agriculture. Overall riparian areas are highly fragmented, and are mostly covered by open land or isolated patches of forest. Our results suggest that restoration is necessary to improve the corridor function of riparian forest.

Presenter: Russell, Marc J

Title: Landscape scale assessment of ecosystem goods and services and the extent, location, and magnitude of urban-suburban expansion

Authors: Marc J Russell (US EPA);Aarin Teague (San Antonio River Authority);James Harvey (US EPA);Darrin Dantin (US EPA);Katherine Murphy (US EPA);

Session: Planning

Abstract: Human development adjoining coastal cities is the prevalent force changing the Anthropocene landscape. The extent, location, and magnitude of urban-suburban expansion can drastically modify how important features of ecosystems are effected. These effects are best summarized using ecosystem goods and services concepts since they present results in relatable and comparable terms to landscape managers. There are, however, few real world landscape scale demonstrations of assessments that have allowed the consideration of tradeoffs between development scenarios and the continued supply of valuable ecosystem goods and services. Ecosystem goods and services assessment tools can get quickly complicated when one begins to consider multiple ecosystems, multiple goods and services and their relative value to human beneficiaries. Many existing tools also don’t allow users to receive quick feedback from user-generated landscape change alternative scenarios. Therefore, we developed a landscape scale ecosystem goods and services assessment tool (EPA H2O) that generates metrics of four different ecosystem goods and services and their values. These include carbon sequestration into biomass as a metric of the maintenance of a more stable climate, denitrification as a metric of the production of usable water, atmospheric pollution removal as a metric of usable air, and water retention by soils as a metric of flood protection. With this tool we summarize tradeoffs related to several alternative futures in the Tampa Bay, USA watershed system as a demonstration of how the extent, location, and magnitude of

urban-suburban expansion can affect the value of ecosystem goods and services production at the landscape scale.

Presenter: Salzer, Johanna

Title: Introduction: landscape change and infectious disease ecology: Applications to public health

Authors: Johanna S Salzer (National Center for Emerging and Zoonotic Infectious Diseases, Centers for Disease Control and Prevention);

Session: Landscape Change and Infectious Disease Ecology: Applications to Public Health

Abstract: Landscape plays a significant role as a barrier or a conduit of disease amplification and spread in human, domestic animal, and wildlife populations. Disease ecology is a rapidly evolving field focused on understanding how hosts, pathogens, vectors, and their environment evolve, respond, and interact with one another in ways that influence disease dynamics. Landscape can influence disease risk directly, for example through habitat availability for vector and zoonotic reservoir populations. Or alternatively, impacts may be more indirect; by shifting the biodiversity of an ecosystem in ways that limit or propagate pathogen spread within the reservoir community. Understanding the ecological conditions that affect the life cycles and interactions of vectors and reservoirs may provide valuable information for identifying critical control points for improved public health. In addition, cultural, social, and political forces shape these human-animal-environment interactions and understanding these human dimensions of landscape change is vital for limiting infectious disease spread. In this introduction, we will define key terms and provide historical examples of the contribution of ecological research to the field of public health.

Presenter: Sampson, Christie L

Title: Human-elephant conflict in Myanmar

Authors: Christie L Sampson (Clemson University);David W Tonkyn (Clemson University);Melissa Songer (Smithsonian Conservation Biology Institute);Peter Leimgruber (Smithsonian Conservation Biology Institute);

Session: Poster

Abstract: Myanmar has experienced dramatic declines of its wild elephant population, from as many as 10,000 elephants in the 1940s to as few as 2,000 today. This is attributed to 1) live-captures of wild elephant for use as labor; 2) habitat loss and ensuing human-elephant conflict (HEC); and 3) Illegal trade in live elephants. Our project explores HEC and a newly discovered threat from poaching to the elephant population in the Southern Bago Yoma landscape. Our combined projects in this region, including an analysis of elephant movement data from 10 satellite-GPS collared wild elephants, a fecal DNA study to identify individual conflict elephants, an interview survey to assess risk tolerance and conservation attitudes of local communities, and working with village based conflict response teams to record conflict, will provide systematic data that our collaborators in the Myanmar government will use to better inform elephant management policy. Results from the interview surveys show that 38% of farmers are losing 50% or more of their crop annually, however nearly 90% of interviewees support continued conservation of elephants in Myanmar. Using tracking data from the GPS-collars and a landscape-wide HEC reporting effort, we have identified several hotspots of HEC and are working with local communities to erect seasonal electric fencing at these sites to decrease conflict. Future studies will expand the fecal DNA collection beyond conflict elephants to include the greater elephant population within the Southern Bago Yoma landscape, and the implementation and assessment of current and new HEC mitigation strategies including educational outreach.

Presenter: Sawatzky, Margaret E

Title: Protecting wetlands in agricultural landscapes: Buffer zones vs. broad-scale forest preservation

Authors: Margaret E Sawatzky (Carleton University);Lenore Fahrig (Carleton University);

Session: Poster

Abstract: Two common goals when managing aquatic systems are water quality protection and conservation of at-risk species groups such as amphibians. One often-recommended way to achieve these goals is to maintain a strip of undisturbed land (a “buffer zone”) between water bodies and human land uses such as crop fields or residential areas. However, the large buffer zones believed to provide necessary amphibian habitat may be challenging to implement in agricultural landscapes. As an alternative, landscape ecology studies suggest that preserving a percentage of natural land cover such as forest in the surrounding landscape can facilitate both water quality protection and amphibian conservation. However, the relative conservation impacts of buffers and landscape-scale forest preservation are unknown. Our study addresses two main questions: (1) To what extent do buffer size and landscape-scale forest amount affect

concentrations of contaminants such as atrazine and neonicotinoids in water bodies; and (2) To what extent do buffer size and landscape-scale forest amount affect frog and toad species richness and abundance? We conducted this research in 38 farmland ponds and small wetlands in eastern Ontario over a five-month period. Preliminary results suggest that maintaining forest cover in the surrounding landscape is more important than maintaining buffer zones adjacent to water bodies for wetland conservation goals.

Presenter: Sayler, Kristi L

Title: Improvements in modeling land use and land cover using the FORE-SCE model

Authors: Kristi L Sayler (USGS);Terry L Sohl (USGS);Jordan M Dornbierer (SGT, Inc.);Steve P Wika (SGT, Inc.);

Session: Assessment I

Abstract: Climate change, precipitation variability, and LULC change are pervasive influences on hydrologic cycles, biodiversity, carbon and greenhouse gas fluxes, and many other ecological processes. Scientists examining potential future changes in these processes require spatially explicit, LULC projections that include impacts of climate and precipitation variability. Similarly, planners, policy-makers, and other decision-makers require LULC projections to understand the impacts and feedbacks of climate and land-use change. USGS EROS has applied the FORE-SCE model to produce unprecedented national-scale projected and “backcast” LULC data at annual time steps from 1938 through 2100, with four IPCC projections for the future. . However, the spatial, temporal, and thematic characteristics of these data may not meet the needs of many stakeholders. In addition, users of projected LULC data also often need unique, customized scenarios. Thus, improvements to the FORE-SCE model were made to allow more flexibility for scenario demand input, increased image resolution, dynamic climate data input, and the use of ownership boundaries to facilitate the modeling of customized, high-resolution LULC projections. Recent applications using these model improvements include impacts of increased demand for biofuel crops in the northern Great Plains, hydrology impacts of potential agricultural land-cover change in the upper Mississippi river basin, and impacts on ecological processes due to changes in climate, precipitation variability and LULC change in the South Central U.S.

Presenter: Scaife, Charles I

Title: Landscape patterns and variation of spatial soil moisture from plot to catchment scales at the Coweeta Hydrologic Laboratory

Authors: Charles I Scaife (Dept of Geography, UNC-CH);Charlotte M Hopson (Dept of Geography, UNC-CH);Lawrence E Band (Institute for the Environment, UNC-CH);

Session: Watersheds and Hydrology

Abstract: Understanding landscape patterns of spatial soil moisture over time is a major component for characterizing feedbacks between ecology and hydrology, but the nature of soil moisture is spatially and temporally complex and highly dependent on scale making mapping across the landscape particularly challenging. There are several factors that influence soil moisture including climate, soils, vegetation, and most importantly topography. The degree to which topography explains landscape variation in soil moisture patterns changes seasonally with climate and vegetation switching from local controls (e.g. soils and vegetation) to non-local controls (e.g. climate and topography). To examine these changing landscape patterns, our study utilizes point-based measurements of surface soil moisture in humid temperate forests of Coweeta Hydrologic Laboratory located in SW North Carolina. Synoptic sampling was conducted using a portable soil moisture probe during two field campaigns: (1) 08/2011-11/2012 and (2) 08/2015-present, comprising over 5000 measurements. Measurements were focused along a hillslope in a low elevation control catchment, watershed 14 (WS14), but recently expanded to include WS5 and WS18, which have plots that extend the length of the catchment. Our preliminary results show that landscape patterns of soil moisture vary with mean wetness. As observed in previous studies, the standard deviation of spatial soil moisture exhibited a concave down trend peaking at mid-wetness levels. We also found that soil moisture linearly decreased with increasing distance to stream and that this gradient varied from wet to dry conditions. Future analyses will examine similar landscape patterns in WS18 and WS5 focusing on differences between catchments.

Presenter: Schaffer-Smith, Danica J

Title: Shorebird response to flood dynamics in the Sacramento Valley during migration

Authors: Danica J Schaffer-Smith (Nicholas School of the Environment, Duke University);Jennifer J Swenson (Nicholas School of the Environment, Duke University);Matthew E Reiter (Point Blue Conservation Science);

Session: Avian II

Abstract: To better manage migratory shorebird populations under climate change, we need a better understanding of how these species respond to changes in habitat availability over broad spatial and temporal scales. For the Sacramento Valley, an important inland stopover for shorebirds, we mapped flood extent from 30 years of spring satellite imagery with an accuracy of 90-99% for the flooded class. We assessed the area and configuration of flooding within various buffers around wetlands in the Sacramento National Wildlife Refuge Complex. We then used regressions to analyze the strength and spatial scaling of the effect of valley-wide flooding—mostly on private agricultural lands—on shorebird use in refuge wetlands from 1999 - 2014. The maximum flood extent detected occurred on February 19th, 2004 when ~241,400 ha (20% of the study area) were inundated. Federal and state-managed lands provide the most reliable habitat during spring migration, but flood extent in these areas decreases in early March, before the peak of migration. Flood-irrigated agriculture provides the largest potential habitat area, but management practices typically reduce the amount of habitat during the peak of migration in late March and early April. The maximum average flooding of agricultural areas occurs at the end of May (~154,700 ha inundated), whereas only ~15,500 ha (9% of the maximum average) is flooded during the peak of migration. Water allocation decisions and the timing of flooding and drawdown of agricultural wetlands can strongly influence shorebird use in the refuge.

Presenter: Schaffer-Smith, Danica

Title: Applying the telecoupling framework through the lens of landscape ecology

Authors: Dorothy Y Maguire (USDA-ARS, European Biological Control Laboratory);Danica Schaffer-Smith (Nicholas School of the Environment, Duke University);Stephanie A Tomscha (Forest and Conservation Sciences, Faculty of Forestry, University of British Columbia);Michael L Treglia (University of Tulsa, Department of Biological Science);Jianguo Liu (Center for Systems Integration and Sustainability, Michigan State University);

Session: Landscape networks as telecoupled human and natural systems

Abstract: Interactions among humans and natural ecosystems are complex, occurring not just locally, but across various spatial scales. The telecoupling framework is useful for characterizing these connections, both within and across social-ecological systems. Understanding these relationships is critical for long-term management in our globalized society, particularly with potential for changing commodities with climate change. However, empirical work on quantifying coupled human and natural systems, let alone telecoupled systems, is in its relative infancy, as these relationships can be overwhelmingly complex. We suggest that Landscape Ecologists are well-suited for addressing this issue, given their expertise in considering humans and natural resources, and spatio-temporal dynamics, across multiple scales to understand

relationships between emergent patterns and underlying processes. Thus, we present a suite of techniques from landscape ecology, and illustrate, conceptually, how they can be applied in understanding relationships among agents in the global soy market, with an emphasis on Brazil and China. We highlight how available datasets may be used with specific analytical methods towards understanding this complex system, and explain how the results can feed into understanding other linkages, ultimately yielding a fairly complete representation of the system.

Presenter: Scheller, Robert M

Title: Alternative policy scenarios under a changing climate: tradeoffs among ecosystem services in the Oregon Coast Range

Authors: Robert M Scheller (Portland State University);Megan K Creutzburg (Portland State University);Melissa S Lucash (Portland State University);Stephen D LeDuc (EPA);Mark G Johnson (EPA);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: Balancing economic, ecological and social values has long been a challenge in the forests of the Pacific Northwest, where conflict over timber harvest and old-growth habitat on public lands has been contentious for the past several decades. The Northwest Forest Plan, adopted two decades ago to guide management on federal lands, is currently being revised, as the region searches for a balance between sustainable timber yields and habitat for sensitive species. In addition, climate change imposes a high degree of uncertainty on future forest productivity, sustainability of timber harvest, wildfire risk, and species habitat. Our objectives were to evaluate the trade-offs among timber yield, carbon storage, and old-forest habitat given projected climate change and existing and potential shifts in landscape-scale forest management policy. We used a simulation modeling approach to project the long-term effects of climate change, wildfire and timber harvest across 2.1 million hectares of forests in the Oregon Coast Range, a region with a complex spatial configuration of management practices. The Coast Range is comprised of a mosaic of public and private land ownership managed for a wide range of goals, with highly varied management practices and stand conditions. We explored multiple future scenarios, including policy scenarios designed with input from a group of stakeholders in the region, and climate change projections encompassing much of the likely range of future climatic conditions. Projections highlight the divergence of land management across private and public lands under business-as-usual, where private industrial forests are heavily harvested and many public (especially federal) lands accumulate carbon and old forest habitat but provide little timber. Two alternative scenarios suggest ways to increase timber

harvest and native early-seral conditions, currently rare in the region; while illustrating tradeoffs of reduced old forest and carbon storage. Our results suggest that climate change is likely to increase forest productivity and carbon storage over the next century as warmer winter temperatures allow greater conifer production in cooler months. The gains in carbon storage are unlikely to be offset by increased risk of wildfire. Our scenarios of future conditions can inform policy makers, land managers, and the public about the potential effects of climate change, land management alternatives, and the tradeoffs that are inherent to management in this region.

Presenter: Schleeweis, Karen G

Title: National U.S. maps of forest disturbance processes

Authors: Karen G Schleeweis (USFS RMRS);Gretchen Moisen (USFS RMRS);Chris Toney (USFS RMRS);Todd Schroeder (USGS);

Session: Landscape Dynamics II

Abstract: A lack of historical observations limits the ability to characterize the processes that have shaped forest canopy patterns. Yet, consistent assessments across space and time are necessary for meaningful interpretations of dynamic landscape trends. What are the suitable spatial and temporal scales to characterize forest disturbance regimes? What can resources such as the Landsat satellite record (1985-2010) add to the story? As part of the North American Forest Dynamics (NAFD) Project we have developed empirical models, using the Landsat record and forest history metrics from multiple disturbance algorithms, to map the location and timing of harvest, fire, stress, wind, and conversion events on forest land cover between 1985 and 2010. The 30m annual resolution of the maps provides a novel perspective for monitoring and quantifying these processes. We will present map results and their trends across multiple scales.

Presenter: Schumaker, Nathan H

Title: Impacts of a human disturbance on greater prairie chickens: Insights from a spatial IBM

Authors: Nathan H Schumaker (US Environmental Protection Agency);Andrew J Gregory (Bowling Green State University);Breanna F Powers (University of Auckland);Brenda Groskinsky (US Environmental Protection Agency);

Session: Avian I

Abstract: The Flint Hills of Kansas are home to the largest remaining tallgrass prairie ecosystem in North America. The Flint Hills are currently managed under an early season burn-intensive stocking regime, whereby ranchers will ignite the majority of pasture land each year to increase rangeland productivity for cattle, and then stock pastures at high densities for brief periods of time. The Greater Prairie-Chicken (Tympanuchus Cupido) is a regional grassland obligate of conservation concern that both benefits from, and can be harmed by frequent field burning. Greater Prairie-Chicken (GPC) habitat is compromised by shrub encroachment due to lack of fire. Conversely, GPC's rely on having abundant tall native grass and forbs to hide in during nesting, but if grass becomes too thick it inhibits movement. Thus, the species' ability to both forage and avoid predators varies with time since the last disturbance, and may be optimal when native prairie communities are subjected to 3-6 year burning rotations. Regional stakeholders are interested in how the pattern, frequency, and extent of field burning might be adjusted to balance the resultant economic, ecological, and human health trade-offs, such as prairie conservation, the degradation of air quality, and fires' direct impacts on native plants and animals. Here we describe the development of a spatial IBM for the GPC, and our application of this model to explore this species' response to a proposed shift in fire management away from intensive early season burning towards a patch-burning regime comprised of spatially-distributed multi-year rotations.

Presenter: Schwantes, Amanda M

Title: Drivers of drought-induced tree mortality across Texas

Authors: Amanda M Schwantes (Duke University);Jennifer J Swenson (Duke University);Mariano González-Roglich (Duke University);Daniel M Johnson (University of Idaho);Jean-Christophe Domec (Duke University and Bordeaux Sciences Agro);Robert B Jackson (Stanford University);

Session: Forests, Weather and Climate

Abstract: In 2011, Texas experienced its most severe drought since record-keeping began, which caused widespread tree mortality. Increased drought-induced tree mortality is expected with climate change, which could in turn impact biophysics, carbon cycling, and species compositions. Using remotely sensed imagery from before and after the drought, we quantified canopy cover loss across the state. Our method was capable of detecting mortality across the diverse natural regions of Texas, ranging from closed canopy pine & hardwood forests in the east to open canopy shrub lands in the west. First, we classified ~200 orthophotos (1-m) to create fine-scale tree mortality maps, which were highly correlated (R2 = 0.82) with ground

estimates of canopy loss. Then, these fine-scale mortality maps were used to calibrate and validate Landsat. Using a zero-inflated beta regression model we calculated percent cover loss within each pixel of Landsat, to create continuous wall-to-wall mortality maps across the state. Canopy loss occurred across all major natural systems of Texas, with the Edwards Plateau and Trans Pecos areas most affected, each with ~9% and ~14% canopy loss, respectively. We also identified climatic and edaphic factors that controlled the spatial distribution of tree mortality across Texas. Although climate contributed to these canopy loss patterns, there were many localized hotspots of mortality, suggesting other factors related to soil, topography, management, and stand density also played a role. Identifying drivers controlling patterns of drought-induced tree mortality could improve tree mortality modeling and aid in our ability to predict future tree mortality given climate change.

Presenter: Scott, Andy

Title: Balancing bioenergy benefits on the landscape with sustainable productivity challenges on sites

Authors: Andy Scott (USDA Forest Service, Southern Research Station);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: The woody biomass and bioenergy market offers opportunities to both improve or degrade the capacity of forests to provide a range of ecosystem services, and a key to understanding these is understanding existing conditions. The link between biomass energy markets and landscapes interacts at the stand level through changing forest management within stands (intrinsic margins) or by changing forest area (extrinsic margins). Increasing management intensity increases opportunities for reduced wildfire risk, reduced pest outbreaks and potentially improved wildlife habitats, while changing forest area can improve soil protection, carbon storage, and water quality. Changing intrinsic margins can also lead to losses in soil porosity, organic matter and possibly site productivity and can negatively affect wildlife habitat and other services, depending on reference conditions. Because biomass feedstock harvesting impacts on site productivity have been studied in depth for many years, it will be used as a case study for the importance of understanding existing condition on various ecosystem services. One of the largest-scale studies on forest management ever conducted examined how management intensification affects long-term site productivity across landscapes ranging from the southern pine forest to northern hardwoods, mixed conifers throughout the western U.S., and a number of boreal landscapes. After 25 years, this study has found that forests across the U.S. and Canada are remarkably resistant to degradations in site productivity caused by harvest intensification, but at stand-level, impacts are closely tied to the existing condition.

Presenter: Seagle, Steven W

Title: Monitoring and predicting emergence pathways of lyme disease in northwest North Carolina

Authors: Steven W Seagle (Appalachian State University);Austin J Harner (Appalachian State University);

Session: Connectivity

Abstract: Lyme disease is caused by the bacterium Borrelia burgdorferi and vectored to humans by the Black-legged tick (Ixodes scapularis). Though more common in the northeastern and mid-Atlantic United States, human Lyme disease cases have advanced southward over the last decade, with the largest cluster in southwest Virginia. Field sampling in October and November 2015 found large populations of I. scapularis in Claytor Lake State Park which is central to the human case cluster in southwest Virginia. Sampling in northwest North Carolina yielded a broad range of I. scapularis occurrence, from absence (Elk Knob and Mt. Jefferson State Parks) to modest (Stone Mountain, Pilot Mountain and Hanging Rock State Parks) to large (New River State Park) populations. Collected ticks are currently being tested for B. burgdorferi. This abundance pattern suggests that emergence of Lyme disease in northwest North Carolina has begun, but is not yet characterized by clusters of high human incidence. Land use, landscape fragmentation, and climate variables were mapped at 1 km resolution across southwest Virginia and northwest North Carolina. Pixels surrounding Claytor Lake State Park were assumed to represent “known habitat”; similarity was then calculated between known habitat and all other pixels. This similarity map was used in an initial effort to predict spatial pathways of emergence for Lyme disease in North Carolina. Predicted pathways correspond generally to North Carolina populations of I. scapularis. These probable pathways of emergence will be used to design a monitoring program for both tick populations and tick infection with B. burgdorferi.

Presenter: Shevade, Varada S

Title: Forest loss and conversion to plantations in Malaysian tiger habitat

Authors: Varada S Shevade (University of Maryland);Peter Potapov (University of Maryland);Nancy Harris (World Resources Institute);Dmitry Aksenov (Transparent World);Tatiana V Loboda (University of Maryland);

Session: Poster

Abstract: Habitat loss and fragmentation is one of the major threats for biodiversity. Expanding agriculture is one of the primary causes of tropical forest loss and is expected to continue with increasing demands of the growing population and an increasingly interconnected world. Southeast Asia has some of the highest deforestation rates globally and peninsular Malaysia has a long history of land cover and land use change. Malayan tiger (Panthera tigris jacksoni) is endemic to peninsular Malaysia and is listed by IUCN as a 'critically endangered' species. Malayan tigers are greatly threatened by habitat loss and fragmentation and their population has been declining in the recent past. Long-term viability of populations in the landscape will depend on maintaining habitat and the connectivity between forest complexes. We map primary forest extent for year 1988 and primary forest cover loss in Malayan tiger habitat from 1988 - 2000 using the Landsat data archive. We aggregated our forest cover loss data with Hansen et al. 2013 global product to get a consistent forest loss dataset from 1988 - 2012. We further use mapped plantations in peninsular Malaysia to distinguish between the loss of primary forests from conversion to plantations and other primary forest loss within the region. We report our findings on contribution of plantations towards forest loss in the region. Understanding the drivers of tiger habitat loss will be essential in developing natural resource management and biodiversity conservation policy.

Presenter: Shoemaker, Douglas A

Title: Structural equation analysis of the role of urban pattern in generating ecosystem services

Authors: Douglas A Shoemaker (NCSU Center for Geospatial Ana);Melissa McHale (NCSU);Ross K Meentemeyer (NCSU Center for Geospatial Ana);

Session: Ecosystem Services II

Abstract: Development pattern, such as urban sprawl, has been widely implicated in driving environmental degradation and compromising ecosystem resilience. However, a lack of concise theory regarding urban pattern and process, and the paucity of representative case study, has left the role of spatial structure in modulating ecosystem function largely unexplored. To investigate effects associated with pattern, we first translated a conceptual model of urban impact into a testable structural equation model (SEM). Data to parameterize the model was generated using a novel coupling of urban growth simulation and ecosystem services modeling for 37 subwatersheds in the rapidly developing Charlotte (NC) region. Coupling allowed us to project change in water purification and carbon storage related to scenarios of plausible urban expansion by 2030, measured as a suite of landscape metrics representing composition,

configuration, and connectivity. We statistically evaluated correspondence between latent and measured variables, and iteratively arrived at a model (r2adj = 0.79) that found heterogeneity in composition most influential (βstd = - 0.58) in the generation of nutrient non-point source pollution (NPSP), followed by connectivity (βstd = 0.28) and heterogeneity of form (βstd = - 0.15). Land use intensity, a measure of local change, had insignificant direct effect, but moderated all other effects. Purification function varied with the configuration of new development, evidence that ecosystem resilience was spatially conditioned. To reduce NPSP regionally, planners are advised to manage amplifying effects of greenfield conversions by maintaining land cover diversity, and limit the connectivity of developed land covers along hydrological gradients.

Presenter: Shoffner, Alexandra V

Title: The relative impacts of habitat amount, habitat configuration, and urbanization on forest breeding birds

Authors: Alexandra V Shoffner (University of North Carolina at Charlotte);Andrew M Wilson (Gettysburg College);Sara A Gagne (University of North Carolina at Charlotte);Wenwu V Tang (University of North Carolina at Charlotte);

Session: Urban II

Abstract: It is clear that urbanization causes changes in landscape structure that adversely affect biodiversity. However, the relative impacts of different components of landscape structure remain unclear. Using the 2006 National Land Cover Database and 2010 U.S. Census data, we quantified forest amount, forest configuration, and urbanization intensity in landscapes spanning the state of Pennsylvania in order to distinguish the independent impacts of these three aspects of landscape structure on avian biodiversity in remnant forest. We estimated abundances of individual forest bird species corrected for detection bias and forest bird species richness from a large and spatially-extensive dataset of point counts collected during the 2nd Pennsylvania Breeding Bird Atlas conducted 2004-2008. Landscape structure variables were quantified in concentric landscapes of 10 different radii (ranging from 0.2km to 16km) centered on point count locations within forest. Forest amount and forest configuration metrics were calculated using ArcGIS v10.3 and FRAGSTATS v3.3, and urbanization intensity was quantified using a principal components analysis of multiple land cover and Census-derived variables. We will present the results of analyses that test for the relative effects of the three landscape variables of interest on avian biodiversity. The outcome of our research will inform urban policy and planning to promote the conservation of avian biodiversity where people live and work.

Presenter: Shu, Shijie

Title: Synthesis of satellite NDVI products and vegetation dynamics in Earth system models using a data mining approach

Authors: Shijie Shu (University of Illinois at Urbana Champaign);Forrest M Hoffman (Oak Ridge National Laboratory);William W Hargrove (USDA Forest Service);Jitendra Kumar (Oak Ridge National Laboratory);Atul Jain (University of Illinois at Urbana Champaign);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Uncertainties and complexities of data retrieved from remote sensor present challenges to using such observational products to constrain and evaluate Earth system models (ESMs). Robust data mining methods, like unsupervised clustering analysis, offer powerful tools for summarizing model-data differences in the spatial and temporal patterns of ecological characteristics. In this study we focus on examine ESMs' vegetation dynamics. We compare modeled land surface phenology with MODIS 16-day composited Normalized Difference Vegetation Index (NDVI) (MOD13C1) and Global Inventory Modeling and Mapping Studies (GIMMS) NDVI3g products spanning years 2001 to 2012 under a data mining framework. We separate the work into four stages: 1) Annual traces of NDVI from two ESMs (CESM-CLM and ISAM) were calculated from the output of historical simulations. 2) Multivariate Spatio-Temporal Clustering (MSTC) was applied to annual traces of both satellite NDVI products to create phenological regions (phenoregions) and analyzed using Mapcurves, a tool designed for comparing categorical maps, to check the consistency of the spatial patterns of observations. 3) To evaluate modeled phenology, MSTC was applied to obtain representative centroids of NDVI annual trace from both ESMs and satellite respectively, then modeled NDVI were projected onto the centroids defining phenoregions of observed NDVI, and observed NDVI were projected onto the centroids of modeled NDVI. 4) Mapcurves was then applied to compare the spatial patterns of these classifications. Results showed a general agreement in the spatial pattern of phenoregions from models to satellite observations, except in high-latitude regions and agricultural land. However, Mapcurves results detected relatively low goodness of fit score for modeled phenology projected onto observations. Study demonstrates the ability of a data mining approach for cross-validation of observations and evaluation of model performance and benchmarking.

Presenter: Singleton, Peter H

Title: Habitat overlap with barred owls influences multi-season site occupancy by northern spotted owls

Authors: Peter H Singleton (USFS PNW Research Station);John F Lehmkuhl (USFS PNW Research Station);Martin G Raphael (USFS PNW Research Station);

Session: Avian I

Abstract: Competition with barred owls is an important factor contributing to the decline of the threatened northern spotted population. We evaluated habitat for both species in the eastern Cascade Range, Washington. We quantified habitat overlap around spotted owl pair sites included in demographic monitoring from 1989 to 2011, and used those measures to evaluate effects of overlap on site colonization and extinction rates with multi-year occupancy models. Barred owl sites tended to be located in gentle lower slope or valley bottom settings more than spotted owl sites, and barred owls used a broader range of forest structure and tree species than spotted owls. Annual spotted owl site probability of colonization declined during the study, but was higher at sites where habitat characteristics used more than available by spotted owls overlapped with characteristics used less than available by barred owls. Annual site probability of extinction increased over the monitoring period and was higher at sites where barred owls were detected during spotted owl surveys, regardless of habitat overlap. We hypothesize that this pattern of high site colonization rates in areas of least habitat overlap coupled with high site extinction rates could reflect displacement of spotted owl pairs into marginal habitat. Areas of least habitat overlap between spotted owls and barred owls appear to contribute to short-term persistence of spotted owl pairs in the eastern Cascade Mountains of Washington, but these areas do not appear to provide long-term refugia from competitive interactions with barred owls.

Presenter: Smart, Lindsey S

Title: A Bayesian approach to inform urban growth models with choice experiment data on tradeoffs facing landowners in rapidly urbanizing regions

Authors: Lindsey S Smart (Department of Forestry and Environmental Resources, Center for Geospatial Analytics, NC State University);Monica A Dorning (US Geological Survey, Denver, CO);Jordan W Smith (Department of Environment and Society, Utah State University);Brian R Pickard (Department of Forestry and Environmental Resources, Center for Geospatial Analytics, NC State University);Lauren N Dupey (Department of Environment and Society, Utah State University);

Session: Urban IV

Abstract: Urban growth influences the productivity of natural systems as well as the health of human populations. Urbanization results in the loss of productive agricultural lands, the fragmentation of habitat and decreases in critical ecosystem services. Despite abundant research on agent-based models of land-use change, incorporating empirically-based landowner decision-making processes remains a research challenge. Very little attention has focused on the heterogeneous processes that aggregate to influence broader-scale patterns of urbanization. We examine the land-use tradeoffs faced by individual landowners' in one of the United States' most rapidly urbanizing regions – the urban area surrounding Charlotte, North Carolina. We focus on the land use decisions of non-industrial forest owners located across the region's development gradient. A discrete choice experiment is used to determine the critical factors influencing individual forest owners' intent to sell their undeveloped properties across a series of experimentally varied scenarios of urban growth. Data are analyzed using a hierarchical Bayesian approach, which incorporates estimated parameters informed by prior knowledge about the system. The distributions derived from the survey data are used to modify a spatially-explicit trend-based urban development potential model, derived from time series of remotely-sensed imagery and observed changes in the region's socioeconomic and infrastructural characteristics. This modeling approach combines the theoretical underpinnings of behavioral economics with spatial-temporal data describing a region's historical development patterns. By integrating empirical social preference data into spatially-explicit urban growth models, we begin to more realistically capture processes as well as patterns that drive the location, magnitude and rates of urban growth.

Presenter: Smith, Jordan W

Title: Using immersive virtual environments to quantify stakeholder perceptions of, and behavioral responses to, landscape change

Authors: Jordan W Smith (Utah State University);

Session: Modeling with Stakeholders

Abstract: Quantifying stakeholder perceptions of, and behavioral responses to, landscape change is a difficult task for social scientists. Surveys and expert elicitation methods are commonly used to determine how different types of stakeholders are most likely to respond to local landscape change. However, the validity of these methods are commonly questioned by biophysical scientists who place a high value on experimental designs capable of testing causal relationships. At best, most survey research is only capable of testing for significant correlations between different magnitudes of landscape change and concordant shifts in perceptions and

behavioral responses. This presentation details how social scientists can use immersive virtual environment technology to “immerse” stakeholders in alternative landscapes emerging from biophysical processes (e.g., the spread of an invasive insect that alters the aesthetic characteristics of a landscape) or management interventions (e.g., the culling of trees to suppress fire risks). Immersive virtual environment technology enables investigators to collect, manipulate and present 360-degree photorealistic imagery to research participants via a head-mounted display within a controlled environment; the technology is an emerging method for simulating alternative landscapes with a high level of psychological and mundane realism to rigorously quantify contingent perceptions of, and behavioral responses to, landscape change. Two experiments are reviewed that examine individuals’ preferences for, and behavioral responses to, landscapes with varied levels of cultural, provisioning and regulating ecosystem service production. The presentation also describes how immersive virtual environment technology can be used to integrate stakeholders’ contingent behavioral responses into landscape-scale simulation models.

Presenter: Sohl, Terry L

Title: Improving regional land cover modeling for ecological applications

Authors: Terry L Sohl (US Geological Survey);

Session: Machine Learning and Data Mining Applications in Land- and Seascape Ecology: What it is, Why it matters, and Where the Progress Still Sits

Abstract: An understanding of land-use and land-cover (LULC) change is vital in helping scientists, decision-makers, and other stakeholders to understand the impacts of LULC change on societal and ecological issues. Projections of future LULC enable land managers to visualize future landscapes and optimize landscape planning to account for those impacts. A number of regional- to national-scale LULC projections have been produced for the conterminous United States, with a variety of spatial, thematic, and temporal characteristics. Assessment these modeling results reveals weaknesses in both the LULC models themselves and underlying modeling paradigms. Modeling results indicate that choice of model likely has a much greater impact on results than does choice of scenario or any other modeling component. Comparing modeling applications that purportedly assess the “same” IPCC scenario reveals issues with land change theory in general, with vast differences between models (and modeling teams) in determining how well-defined driving forces will impact future LULC change. A comparison of both aggregate and spatially explicit modeling results brings into question the credibility of LULC models, with projected changes that are likely unrealistic compared to both historical LULC change or with overall land use capacities. To better inform ecological applications, future LULC projections should 1) use a multi-model/ensemble modeling approach to account for

model uncertainty, 2) increase investment in quantifying specific driving force impacts on LULC change to avoid inconsistencies between modeling applications, and 3) use an increased use of historical information to inform future projections, to ensure credibility and realism of future scenarios.

Presenter: Spangler, Mark A

Title: Environmental DNA sampling as a means to investigate wood frog (Rana sylvatica) range extent in northern Alaska

Authors: Mark A Spangler (University of Alaska Fairbanks);Juan A Lopez (University of Alaska Fairbanks);Falk Huettmann (University of Alaska Fairbanks);

Session: Amphibians in a changing landscape

Abstract: The distribution of the wood frog (Rana [Lithobates] sylvatica) in northern Alaska is not well understood. Although historically believed to be absent from the North Slope, recent observations suggest otherwise. The objective of this study is to develop a method that will non-intrusively test for wood frog presence through the use of environmental DNA (eDNA) sampling. Once established and validated with traditional techniques, this method will provide a cost-effective, labor-reducing, and time-saving technique to monitor wood frogs on a wide scale. The method will then be employed in field surveys along the Dalton Highway in Alaska in order to determine how far north this species can be detected along the north-south gradient. Furthermore, the results of these field surveys will be combined with previously existing records in order to create a cumulative account that builds on past knowledge of wood frog distribution in Alaska. This account will consist of models which not only predict the current distribution of the species, but also forecast how its distribution may shift in response to climate change. The availability and interpretation of such models will become increasingly important as this and other species adapt to a changing landscape.

Presenter: Spear, Stephen F

Title: Using environmental DNA to monitor hellbenders and its potential for understanding the effect of landscape alteration on populations

Authors: Stephen F Spear (The Orianne Society);Lori A Williams (North Carolina Wildlife Resources Commission);Chloe E Moore (University of Georgia);Michael J Freake (Lee University);John D Groves (North Carolina Zoo);

Session: Amphibians in a changing landscape

Abstract: Environmental DNA (eDNA) has provided a non-invasive method to detect species presence and has the potential to provide information on population size and response to landscape change. As a result, there has been great interest in incorporating this technique into inventory and monitoring programs for threatened aquatic species. We developed an eDNA test to complement survey effort for Eastern hellbenders (Cryptobranchus alleganiensis alleganiensis) across North Carolina and Tennessee, and we have demonstrated both its suitability for presence/absence as well as an increase in eDNA concentration during the breeding season. Presence/absence data follow similar trends as seen in snorkel surveys, with the highest number of occupied sites across national forest land in the southern Appalachians and notable absences across much of middle Tennessee. We did not see a significant association with eDNA concentration and snorkel survey numbers, although this may be related to variation in snorkel survey abundances. Finally, we conducted a study to test the association of eDNA presence with surrounding land use at a fine scale in the Little Tennessee River watershed. Contrary to expectations, we detected a positive trend of eDNA detection with impervious surfaces, a relationship that may represent a lag in hellbender population response to land use, and casts doubt as to how many of our sampled sites represent currently viable populations. Overall, we demonstrate the ability of eDNA to successfully monitor hellbender presence, and present a framework for asking additional questions about hellbender population status.

Presenter: Spies, Thomas A

Title: Working with stakeholders from forest collaborative projects to model fire and forest restoration at landscape scales

Authors: Thomas A Spies (PNW Research Station);Eric M White (PNW Research Station);Emily Jane Davis (College of Forestry, Oregon State University);Andrew G Merschel (College of Forestry, Oregon State University);

Session: Modeling with Stakeholders

Abstract: Collaborative Forest Landscape Restoration Projects (CFLRPs) are efforts by diverse groups of stakeholders and forest managers to work together to use “science-based ecosystem restoration of forested landscapes” to lower the potential for uncharacteristic wildfire and

reduce wildfire costs. We are developing science, tools and approaches to assist two CFLRPs in Oregon in using landscape concepts and taking landscape approaches to restoration. Our work has involved two activities: 1) developing landscape-level spatial models of fire history that can inform collaboratively-developed restoration plans; and 2) using a landscape simulation model of wildfire and forest management to evaluate landscape conditions and ecosystem services production under alternative forest restoration scenarios. Both activities have been useful to CFLRPs and forest managers in designing landscape restoration projects and in understanding landscape-scale factors that influence the effectiveness of restoration efforts. A key component of the success has been early and continual engagement of scientists and stakeholders in the research and modeling process through workshops and field trips. Given the complexity of the models and the need for scientists to develop and run them, participation of stakeholders in the process is limited to informing the research questions and assumptions of the models, providing feedback on preliminary results and model prototypes, and suggesting scenarios to run. We see a need to develop fundamental literacy in landscape ecology within the CFLRPs as a precursor to more effectively using landscape knowledge in forest restoration. We are still evolving how to engage with stakeholders in using the simulation models to advance collaborative restoration goals.

Presenter: Spruce, Joseph P

Title: Use of MODIS NDVI phenology data in monitoring regional vegetation disturbances from abiotic weather events

Authors: Joseph P Spruce (Self Represented);William W Hargrove (USDA Forest Service);Steve P Norman (USDA Forest Service);William M Christie (USDA Forest Service);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Abiotic vegetation disturbances from weather events can negatively affect individual vegetative plants, patches of similar vegetation, and even vegetation patch mosaics across broad regions. Such disturbances can vary in location, severity, and extent. Humanity and wildlife depend on forests, range, agriculture, wetland, and other land cover with healthy vegetation. Land resource managers need to monitor regionally evident vegetation disturbance. Previous studies have shown that vegetation disturbances at the landscape scale can cause observable impacts to vegetation greenness phenology. MODIS satellite data collected in many places twice daily offers a means to monitor regional vegetation phenology status and disturbance impacts, including disturbances due to abiotic causes. This presentation discusses use of temporally processed MODIS phenology products from the ForWarn forest change recognition and tracking system to view and assess regional abiotic disturbance impacts

to U.S. forests and other vegetation. Regional abiotic vegetation disturbances from drought, wind, hail, flood, fire, and frost weather events will be discussed with ForWarn MODIS results compared to reference data. All discussed MODIS phenology products from the ForWarn system are accessible through the on-line U.S. Forest Change Assessment Viewer. For cloud and snow free conditions, ForWarn's NDVI change and profiling products can provide useful geospatial information on regional abiotic disturbance relative location, extent, and severity. Regionally extensive abiotic disturbances from weather events can reduce land surface NDVI and disrupt the timing of an expected NDVI, relative to normal, non-disturbed patterns of seasonal growth and senescence. More work is needed to classify disturbance patches according to causal agent.

Presenter: Starr, Scott M

Title: Using remotely sensed imagery to document how land use drives turbidity of playa waters in Texas

Authors: Scott M Starr (Department of Biological Sciences, Texas Tech University);Lucas J Heintzman (Department of Biological Sciences, Texas Tech University);Lucia S Barbato (Center for Geospatial Technology, Department of Geosciences, Texas Tech University);Kevin R Mulligan (Center for Geospatial Technology, Department of Geosciences, Texas Tech University);Nancy E McIntyre (Department of Biological Sciences, Texas Tech University);

Session: Assessment III

Abstract: Sedimentation (primarily from human land use) is a major threat to runoff-fed wetlands of the Great Plains of North America (playas), but it is unknown how many playas are turbid, how prevalence of turbidity has changed over time, and how turbidity is related to surrounding land use. We used remotely sensed imagery to assess sedimentation in the waters of over 7700 playa basins in Texas on four dates during a 29-year span: 25 July 1986 (a regionally wet time), 3 May 2014 (during drought), 4 June 2014 (after the drought was broken), and 25 July 2015 (one year post-drought). Even on the wettest date examined, 64.0% of playa basins did not hold water. Turbidity varied over time, was already present in over half of the basins examined in 1986, and prevalence of turbidity was not simply proportional to overall wet playa abundance. There was an increase in total and irrigated cropland in our focal region and a statistically significant association between sedimentation and land use within 100 m of a playa: clear playas were associated with more urban development and pasture/grassland, and turbid playas were surrounded mostly by cropland.

Presenter: Stegall, Christie M

Title: Social vulnerability and ebola virus disease in rural Libera

Authors: John A Stanturf (USDA Forest Service);Scott L Goodrick (USDA Forest Service-Southern Research Station);Melvin L Warren (USDA Forest Service);Susan Charnley (USDA Forest Service);Christie M Stegall (USDA Forest Service);

Session: Poster

Abstract: The 2014-2015 Ebola virus disease (EVD) epidemic in West Africa was typical in terms of symptoms, transmissibility, and mortality rate, however, was unprecedented in that EVD was previously unknown in this area and larger than prior outbreaks. Now that EVD is established in West Africa, future outbreaks can be anticipated. Using census indicators mapped at the district scale, we developed a Social Vulnerability Classification for Liberia. Using this Classification, we estimated that districts having the highest social vulnerability lie in the north and west of Liberia in Lofa, Bong, Grand Cape Mount, and Bomi counties. Three of these counties together with the capital Monrovia and surrounding Montserrado and Margibi counties experienced the highest levels of EVD infections in Liberia. Vulnerability has multiple dimensions and a classification developed from multiple variables provides a more holistic view of vulnerability than single indicators such as food insecurity or scarcity of health care facilities. Few rural Liberians are food secure and many cannot reach a medical clinic in less than 80 minutes. Our results illustrate how census and household survey data, when displayed spatially at a sub-county level, may help highlight the location of the most vulnerable households and populations. Our results can be used to identify vulnerability hotspots where development strategies and allocation of resources to address the underlying causes of vulnerability in Liberia may be warranted. We demonstrate how social vulnerability index approaches can be applied in the context of disease outbreaks, and our methods are relevant elsewhere.

Presenter: Stewart, Andrea N

Title: The sensitivity of catchment models to the spatial distribution of forests of different physiologic types

Authors: Andrea N Stewart (UNC Chapel Hill);Lawrence E Band (UNC Chapel Hill);

Session: Watersheds and Hydrology

Abstract: Forests with species compositions that comprise different physiologic characteristics, such as stomatal conductance and xylem anatomy, use different amounts of water and respond

differently to drought. In general, isohydric plants with diffuse-porous xylem anatomy are more susceptible to drought, while anisohydric plants with ring-porous xylem are less susceptible to drought and use less water. The spatial distribution of these forests in the landscape may impact annual and seasonal watershed yield and water balance. However, few studies have used species-level ecophysiological information to improve catchment models or predict future watershed behavior. In this study, we used a spatially-distributed hydro-ecological model, the Regional Hydro-Ecological Simulation System (RHESSys), to simulate two small catchments in Durham and Chapel Hill, NC. We estimated leaf area index for common forest types and manipulated the spatial distribution and ecophysiological parameters of forests with different physiological characteristics to quantify model improvements, future watershed yield, and future water balance. Initial results suggest that modeled watershed yield is impacted by the spatial distribution of forests of different physiologic types and the inclusion of species-level ecophysiological parameters, particularly with respect to the major types of xylem (ring-porous, diffuse-porous, and tracheid). Results will aid modelling efforts of future local and regional water supply and help us understand the hydrologic impacts of changing forest landscapes at the species level.

Presenter: Strassman, Andrew C

Title: Mapping the Appalachian Trail Corridor: Turning continuous vegetation into a map

Authors: Andrew C Strassman (USGS);

Session: Assessment I

Abstract: The Appalachian Trail provides a near-continuous corridor of vegetation stretching from Springer Mountain, GA to Katahdin, ME. The US Geological Survey (USGS) Upper Midwest Environmental Sciences Center (UMESC) mapped this corridor as part of the National Park Services (NPS) Vegetation Mapping Inventory (VMI) Program. But how do you turn 2,200 miles of continuous vegetation into a compartmentalized map linked to the US National Vegetation Classification (USNVC)? We will review the steps needed to turn aerial imagery into a reliable and detailed vegetation map for such a varied stretch of terrain including field reconnaissance methodology, active consultation and in-field cooperation with ecologists, creation of realistic and reliable map classes, and in-field verification of draft mapping.

Presenter: Strong, Courtenay

Title: Influence of climate on irruption of North American boreal seed eating birds

Authors: Courtenay Strong (University of Utah);Zuckerberg Benjamin (University of Wisconsin);Julio L Betancourt (USGS);Walter D Koenig (Cornell);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Climate-driven variations in the timing and magnitude of seed production in the boreal forest can trigger migration of seed eating birds such as Pine Siskin. Two principal modes of Pine Siskin migration are identified and linked to climate variability. The first mode is a rare but dramatic north-south “irruption” pattern where Siskins appear in large numbers over the eastern US far south of the boreal forest. This mode is triggered by climate conditions conducive to a strong boreal-forest seed crop that boosts bird populations in one year followed by poor seed production in the irruption year. The second mode is an east-west migration across the boreal forest associated with oppositely-signed climate anomalies, and hence contrasting seed crop outcomes, over the eastern versus western boreal forest. Long term variations in these climate drivers of irruption are examined, and implications for avian ecosystem health are discussed.

Presenter: Stupak, Inge

Title: Creating trust and credibility in sustainability governance of bioenergy supply chains

Authors: Inge Stupak (University of Copenhagen);C. Tat Smith (University of Toronto);Maha Mansoor (York University);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: Trust and transparency are becoming equally important to corporate reputation and success of public policies as quality of products and services. This is pronounced in large-scale bioenergy deployment, where public and private governance initiatives have been developed to ensure compliance with sustainability standards along supply chains. We outline a framework for analyzing the ability of such initiatives to create trust and credibility, which builds on elements from rhetoric and legitimacy theory. We apply the framework to two groups of governance systems, which address wood-pellet supply chains ending in Europe and straw-based supply chains in Europe. Trust developed in forest certification systems through wide stakeholder involvement, built over two decades, lends a sense of credibility to the first group of systems; and national EU Member State sustainability criteria lend these systems democratic legitimacy. Other strengths include comprehensive, transparent standards, and third-party

audits as control systems. However, performance and progress as measured in auditing should be communicated more transparently in order for credibility to rely less on mere trust in the brand and the actors recommending it. Another challenge for this first group is demonstrating the effectiveness of risk-based auditing for supply chains originating from sustainably managed but non-certified forests as compared to certified forests. The second group of systems that we analyze includes the European Union's Cross Compliance rules. They are linked to rigorous governmental control systems, but control reports are not publicly available. We conclude with an overview of how system design and implementation is critical in building trust and credibility.

Presenter: Sturtevant, Brian R

Title: Long-distance dispersal of spruce budworm in the northeastern boreal forest – Model validation and application

Authors: Brian R Sturtevant (USDA Forest Service, Northern Research Station);Barry J Cooke (Natural Resources Canada, Northern Forestry Centre);Jacques Régnière (Natural Resources Canada, Laurentian Forestry Centre);Gary L Achtemeier (USDA Forest Service, Southern Research Station);Joseph J Charney (USDA Forest Service, Northern Research Station);R Saint-Amant (Natural Reources Canada, Laurentian Forestry Centre);Eric J Gustafson* (Non-Author Presenter; USDA Forest Service);

Session: Forest Pests

Abstract: Long-distance dispersal is thought to play an important role in synchronizing disparate populations of forest insect defoliators, but its importance relative to other factors remains unclear due to the difficulty of quantifying dispersal. The spruce budworm atmospheric transport model (SBW-ATM) is an agent-based model developed to project flight and deposition patterns of SBW based on aerobiological principles. Our team integrated the SBW-ATM with a phenological model (BioSIM) to produce a near-operational model that identifies the phenological timing of potential mass-exodus events and generates the probabilistic deposition maps representing likely deposition patterns given the atmospheric conditions at the time of the event. We applied the model to several dates in eastern Canada where an emerging outbreak resulted in multiple instances of presumed immigration events – identified by trap captures of moths outside of their expected flight window based on local phenology. In general we found the immigration events consistent with projected deposition patterns from a large source population on the north shore of the St. Laurence River. However, model projections were also sensitive to the resolution of modeled meteorological conditions that may affect our ability to operationalize the model. We discuss the implications of SBW

deposition patterns in the context of an experimental early intervention strategy currently deployed in New Brunswick, Canada.

Presenter: Sun, Ge

Title: Coupling Water-Carbon and Water Supply-Demand using the WaSSI Watershed Ecosystem Model

Authors: Ge Sun (USDA Forest Service);Peter V Caldwell (USDA Forest Service);Steve G McNulty (USDA Forest Service);

Session: Watersheds and Hydrology

Abstract: Water supply and carbon sequestration are the two fundamental ecosystem services that a forested watershed provides. Ongoing climate change and land use change have already caused serious damages to ecosystem services worldwide. However, there are few practical methods that can accurately quantify water and carbon balances and predict their responses to future environmental changes. The US Forest Service Southern Research Station has developed an online computer simulation model, Water Supply Stress Index (WaSSI), that has the capacity to model seasonal dynamics of watershed hydrology and ecosystem carbon balances, and estimate water supply stress (Water Demand/Water Supply) at a large basin scale (8-digit, and 12 Digit Hydrologic Unit Code) for the lower 48 states. The model was designed to capture the broad patterns of water yield and ecosystem productivity, and water supply stress at the regional to continental scale.

Presenter: Sunde, Michael G

Title: Using multi-scenario CMIP5 data coupled with a physically-based watershed model to estimate potential hydrologic changes in an urbanizing Midwestern watershed

Authors: Michael G Sunde (University of Missouri);Hong S He (University of Missouri);Jason A Hubbart (University of Missouri);Craig Scroggins (Missouri Department of Conservation);

Session: Watersheds and Hydrology

Abstract: Hinkson Creek Watershed (HCW) is an urbanizing watershed in central Missouri comprising a 232 km2 area. Approximately 59% of Columbia, a city of 113,225 residents, is

situated within HCW. While previous studies have examined how land cover changes could affect the hydrologic regime in HCW, none have focused on the potential impacts of changing climate in the watershed. Moreover, few studies have yet coupled climate model projections from the Coupled Model Intercomparison Project Phase 5 (CMIP5) used in the most recent IPCC assessment report with watershed models to estimate the hydrologic impacts of climate change on watersheds in the Midwestern United States. This study uses multiple CMIP5 climate model projections to identify the possible hydrologic impacts of climate changes in HCW. In order to bracket a wide range of potential future conditions, two models and two scenarios (RCP2.6, RCP8.5) from the CMIP5 were selected to represent the least and most conservative climate change projections for the study area, respectively. Climate projections were then coupled with a physically-based hydrologic model, the Soil Water Assessment Tool (SWAT), to quantify potential hydrologic changes in the study watershed. Results from this climate change impact study will provide quantitative estimates of possible changes to processes such as surface runoff, groundwater flow, and evapotranspiration in HCW for the remainder of the current century. Since changes to the timing and amount of surface water can have water quality implications, such information can be particularly useful to land managers and decision makers.

Presenter: Sutherland, Ron W

Title: Landscape conservation at regional and continental scales: the Wildlands Network perspective

Authors: Ron W Sutherland (Wildlands Network);Maggie M Ernest (Wildlands Network);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: Wildlands Network was one of the first conservation nonprofit organizations to advocate for landscape conservation at truly large scales. Our strong emphasis on habitat connectivity led to the collaborative completion of a number of Wildlands Network Designs, regional conservation plans that lay out a framework for core areas, buffers, and corridors. At the continental-scale, Wildlands Network has worked to secure Wildways, which are envisioned as braided streams of habitat corridors running across the wilder trajectories of North America. More recently, we have worked with a number of partners to conduct cutting edge scientific analysis of habitat corridor and wildlife road crossing needs in the southeastern region of the USA. We will summarize both the historic and current connectivity conservation approaches taken by Wildlands Network, identifying tie-ins and points of future collaboration with the landscape ecology community as we celebrate our 25th year of rewilding North America.

Presenter: Swaminathan, Divya R

Title: Land use change and indigenous communities: A case study from protected forest areas in Southern India

Authors: Divya R Swaminathan (Center for Development Research, University of Bonn, Germany);

Session: Poster

Abstract: In India the rural indigenous communities represent some of the most marginalized and poorest people in the country. However, their socio-economic and cultural livelihood conditions are subject to rapid change. Indigenous communities living in forest use forest as a source for resources for their sustenance and livelihood. They apply a combination of multiple land-use systems such as agriculture, agro-forestry, forestry, and pasture. However, many indigenous communities are at the lower end of the social and economic order in India and do not have political decision-making power nor control over the land they use, particularly the forested areas. Most forests are under control of local governments and the lack of secure and proper land tenure rights makes it difficult for indigenous communities to adapt sustainable land management and livelihood systems. The research focuses on “how agricultural transformation and designation of Protected Areas impact on the land uses and livelihoods of the Soliga communities living in and around forests in Southern India?”Qualitative participatory appraisals have been used to derive narratives of the past and existing situations using semi-structured interviews, oral histories and participant observations apart from a literature review and GIS mapping of land use resources in the study area. The main outcome of the research has been to understand the agricultural transformation processes and the drivers of land use changes of the indigenous Soliga communities and to recommend for more sustainable land use policies and implementation that better reflects the needs and concerns of the Soliga communities.

Presenter: Tarr, Nathan M

Title: Modeling the effects of biomass production on landscapes and wildlife habitat

Authors: Nathan M Tarr (North Carolina State University);Jennifer K Costanza (North Carolina State University);Matthew J Rubino (North Carolina State University);Robert C Abt (North Carolina State University);Alexa J McKerrow (US Geological Survey);Jaime A Collazo (US Geeological Survey and North Carolina State University);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: One step in the process of landscape design is the development of data and models to understand potential future landscape outcomes. Understanding likely future landscape effects of biomass production for bioenergy will be crucial as society considers renewable energy alternatives such as wood pellets and liquid biofuels. We investigated the effects of alternative bioenergy production scenarios on landscapes and wildlife species habitat in North Carolina. We linked forest economics models, landscape state-and-transition simulation models, and species habitat models for 16 avian and amphibian species to simulate the effects of increased forest management and land conversion in bioenergy scenarios, compared with a business-as-usual baseline scenario. Landscape simulation results indicate that, compared with the baseline scenario, forest biomass production leads to more forest and, specifically, more intensively managed forest on the landscape by 2050. Results from wildlife habitat models indicate that no single scenario of bioenergy production was best for all species, but under scenarios of forest biomass production, wildlife species with affinities for early-successional or open forests are likely to do better than under the baseline scenario while some mature forest associated species would do worse. The scenarios and analysis here are one starting point for landscape design and should be refined with input from stakeholders as part of a collaborative framework to ensure sustainability of bioenergy production.

Presenter: Theobald, David M

Title: From corridors to transboundary landscape connectivity and permeability

Authors: David M Theobald (Conservation Science Partners);

Session: Connected and permeable landscapes provide for change: Practical examples and challenges in the application of models to real world conservation

Abstract: A variety of sources and stressors are causing landscape change – due to urbanization, extractive energy production, and increasingly from climate change. These changes force conservation scientists to understand the world over broader and longer scales. A consequence is that boundaries are often crossed – ecological, political, and administrative. Here I describe lessons learned in developing and applying landscape permeability maps across western North America, especially for the Great Northern and Southern Rockies LCCs.

Presenter: Thieme, Alison N

Title: Comparing the utility of CLASLite forest monitoring for REDD+: Seima Protection Forest, Maya Biosphere Reserve, Takamanda Mone Landscape, Makira Natural Protected Area

Authors: Bernadette Arakwiye, Heather Cormier, Molly Cox, Marissa Gallant, Mandy Gaudreau, Sean McCartney, Bridget Naphen, Sarah Stanley, and Alison Thieme (Clark University);

Session: Engaging People

Abstract: The rate and geographic extent of land-use and land-cover change in many of the world's remaining natural forests has increased rapidly in recent decades, with deforestation and forest degradation considered to be the second largest anthropogenic source of atmospheric carbon (approximately 17% per year) contributing to global climate change (Asner et al., 2009; Buckiet al., 2012; Poffenberger, 2009). Monitoring deforestation and forest degradation is vital to assessing changes in carbon storage, biodiversity, and various other ecological processes in these regions, however, the range of estimates for global emissions reveals remaining uncertainties and much methodological variability (Bucki et al, 2012). As the United Nations Framework Convention on Climate Change continues with the program for Reduced Emissions from Deforestation and Degradation (REDD+),more concrete methodologies will be required for monitoring forest cover changes and accurately estimating changes in carbon stocks in REDD+ project areas CLASlite is a software developed "for non-experts who support environmental conservation, forest management, and resource policy development" (Carnegie Institute for Science, 2015). As such, the utility across different forest types is essential to its value as a practitioner's tool. This project serves to determine the best tools and practices for use in REDD+ projects by evaluating the effectiveness of CLASlite, an automated software for mapping forest cover and change, in mapping deforestation and forest degradation in four different Wildlife Conservation Society (WCS) REDD+ project areas; (1) SeimaProtection Forest, Cambodia; (2) Maya Biosphere Reserve,Guatemala; (3) Takamanda Mone Landscape, Cameroon and; (4) MakiraNatural Protected Area, Madagascar.

Presenter: Thompson, Jonathan R

Title: New England Landscape Futures: Stakeholder envisioned land-use scenarios and their impacts on the land

Authors: Jonathan R Thompson (Harvard Forest);Kathy Fallon Lambert (Harvard Forest);Katie Theoharides (Theoharides Consulting);Matthew Duveneck (Harvard Forest);

Session: Dynamics in landscapes dominated by family forests

Abstract: The New England Landscape Future Project is a participatory process that engages researchers, conservation practitioners, and land owners in the development, modeling, and use of land-use scenarios, with a goal of better anticipating the future of this family-forest dominated region. In the fall of 2015, we held six scenario-building workshops – one in each New England state. In each, the participants created a four-quadrant scenario matrix, storylines for each scenario, and supporting details for expected changes to the land. The scenarios are divergent but plausible and include specific trajectories for the major land uses in the region: forest conversion, forest harvest, and forest conservation. The scenarios are now being used to drive a series of land change and ecosystem process models to map the consequences of each scenario and to estimate their impacts on a suite of ecosystem services. Overall, we find that integrated scenario analyses offers a powerful approach for overcoming challenges to working in coupled human and natural systems, advancing sustainability science, and informing land-use planning.

Presenter: Thompson, Frank R

Title: Linking climate, landscape, and population models to understand climate and management effects on forests and wildlife

Authors: Thompson R Frank (USDA Forest Service);Bonnot W Thomas (University of Missouri);Wang J Wen (University of Missouri);Dijak D William (USDA Forest Service);Fraser S Jacob (University of Missouri);Hong S He (University of Missouri);Joshua J Millspaugh (University of Missouri);

Session: Intersecting Forest Management, Adaptation, and Climate Change: Biodiversity Implications

Abstract: We are linking climate, landscape, ecosystem, and population models to evaluate changes in forests and wildlife under scenarios representing alternative forest management strategies and climates. We linked the ecosystem model LINKAGES with the landscape model LANDIS PRO and demonstrated that for four regions of the Eastern US succession and management had the greatest effect on forest composition and structure in the near future but within 300 years climate change had important effects on many species. We linked outputs from the LANDIS PRO model with a patch based demographic simulation model to demonstrate impacts of climate change and management on wildlife population viability. We demonstrated the amount and spatial distribution of management was an important predictor and climate had both direct and indirect effects on wildlife through impacts on demographics and habitat, respectively. For example, prairie warbler populations in the central hardwood region responded positively to climate induced effects on forests but negatively to declines in habitat

resulting from levels of management that were not sustaining early successional habitats. Acadian flycatcher populations declined in response to climate warming because of its predicted effects in nest predation levels. The ability of simulation models to mechanistically simulate responses to climates, succession, disturbance, and management has enabled us to consider novel combinations of these factors to define scenarios and evaluate conservation strategies.

Presenter: Thompson, Emily S

Title: Abandonment in shrinking cities: mapping the contemporary urban landscape using LiDAR

Authors: Emily S Thompson (Department of Geography and Environmental Sustainability, University of Oklahoma);Kirsten M de Beurs (Department of Geography and Environmental Sustainability, University of Oklahoma);

Session: LiDAR Techniques for Advancing Applications in Landscape Ecology

Abstract: According to the U.S. Census Bureau, approximately 80% of the population of the United States resides in an urban area. A majority of U.S. cities have experienced population growth since the mid-twentieth century; however, several cities have experienced drastic losses in population over the same time period. Population loss in these shrinking cities has led to an increase in the number of abandoned structures which have become increasingly dilapidated, ultimately placing growing pressure on the city to demolish them. While many studies exploring urban abandonment focus primarily on the socio-economic implications of the issue, there is a lack of research investigating the physical artifacts of urban abandonment using remotely sensed data. Shrinking cities have been making efforts to clear abandoned properties over the course of the last two decades; however, currently there are no maps which allow us to see where cleared properties are located. The goal of this study is to provide updated maps of the contemporary urban landscape in shrinking cities, specifically focusing on several post-industrial rust belt cities. We use LIDAR data to extract building footprints which we use to create a 3D building model, showing where neighborhoods have been cleared. The model is validated using property-specific GIS data from Detroit. These maps will allow us to better visualize how socio-economic pressures impact the structure of urban environments.

Presenter: Tian, Yuqiang

Title: Spatial-temporal-chemical variations effect on nitrogen uptake pattern by two typical communities in a temperate grassland

Authors: Yuqiang Tian (Beijing Normal University);

Session: Poster

Abstract: Background and aims Considering that Leymus chinensis and Stipa grandis differ in their life forms, we hypothesize that each species possesses distinct nitrogen (N) acquisition strategies. To test this hypothesis, we investigated both the organic and inorganic N uptake of two plant communities of the temperate steppes over two months and at two different soil depths. Methods A four-factor experimental field study (2 communities, 3 N forms, 2 seasons, 2 soil depths) was conducted using a short-term 15N labeling technique to explore the plants' 15N acquisition strategies. Results In both communities, Leymus chinensis and Stipa grandis directly absorbed all three of the common forms of N, including substantial portions of organic N, although they absorbed more inorganic N. 15N uptake rates increased during the late (compared to the middle) growing season, and when measured from topsoil vs. subsoil. Overall, plant 15N uptake rates were higher in Stipa grandis than Leymus chinensis, in August vs. July, for NH4+-N and NO3--N compared to Gly-N and at 0-5 cm vs. 5-15 cm soil depth. Gly-15N uptake rates by plants did not differ significantly across communities, seasons or soil depths. Conclusions In the mono-dominant plant communities of our two temperate steppe sites, Leymus chinensis showed a more flexible N acquisition strategy; however, Stipa grandis performed more concentrated and relatively more stable N acquisition. These distinct N acquisition strategies varied greatly across different seasons and soil depths.

Presenter: Tien, Tracy

Title: The Virginia Agricultural Model: A tool for conservation planning and prioritization

Authors: Kirsten R Hazler (Virginia Natural Heritage Program);Tracy Tien (University of Richmond);

Session: Poster

Abstract: The Virginia Agricultural Model is one of several in a suite of conservation planning and prioritization models developed by the Virginia Natural Heritage Program and partners, known collectively as Virginia ConservationVision. Agricultural lands are important to the economy, in addition to providing myriad benefits that cannot be readily quantified in dollars. Nonetheless, over five million acres of Virginia's farmland were lost to other land uses between 1960 and 2012. The Virginia Land Conservation Foundation provides state funding to purchase

or establish conservation easements on various lands of conservation concern, including farmlands. Given limited funds, it is essential to have a means of prioritizing lands worthy of preservation. The Virginia Agricultural Model is a raster model quantifying the relative suitability of land for agricultural purposes. It is derived from three main components: soil quality, foodshed potential, and current land cover. Each component is a scored value ranging from 0 (unsuitable for agriculture) to 100 (optimal). The Soil Quality Score is based on three agricultural productivity variables extracted from the Gridded Soil Survey Geographic (gSSURGO) Database. The Foodshed Score is derived from travel times between agricultural producers and consumers. The Land Cover Score reflects how current land cover affects potential for agricultural use. It is applied as a multiplier to the weighted average of the Soil Quality and Foodshed Scores, which are weighted 80% and 20%, respectively.

Presenter: Tonini, Francesco

Title: Collaborative solutions to invasive species management using Tangible Landscape

Authors: Francesco Tonini (Center for Geospatial Analytics);Douglas Shoemaker (Center for Geospatial Analytics);Anna Petrasova (Center for Geospatial Analytics);Brendan Harmon (Center for Geospatial Analytics);Ross K Meentemeyer (Center for Geospatial Analytics);

Session: Modeling with Stakeholders

Abstract: Implementation of local control and eradication strategies following introduction of invasive species into a new region has been largely unsuccessful due in part to the complexity of system dynamics and failure to inform and mobilize stakeholders into collective decision-making and timely action. Participatory approaches using dynamic, spatially-explicit simulation models can be used to engage stakeholders and learn about short- and long-term consequences of realistic management scenarios. Yet, for complex problems, barriers to understanding still exist for both professionals and the lay public, particularly when specialized computational environments are used, or high levels of abstraction are needed to interpret multidimensional data. As a consequence, we fail to create ideal conditions for effective learning, collaboration, and consensus building. We demonstrate a novel deployment of a tangible geospatial user interface that allows participants to direct computational modeling through tangible gestures on a physical, 3D embodiment of environmental data. Tangible Landscape, a generalizable, open source geospatial modeling framework, was deployed among role-played stakeholders to evaluate outcomes of virtual management on sudden oak death (SOD), an invasive forest epidemic impacting California. We found Tangible Landscape allowed participants to quickly learn salient details of complex processes of epidemiological spread and impacts; allowed decision making to be geographically and contextually informed; facilitated the development and testing of management alternatives; and created opportunities to

incorporate near-real time feedbacks into adaptive strategies. In all, Tangible Landscape constituted a powerful shared environment fostering co-learning and co-management among participants.

Presenter: Torres, Aurora

Title: Telecouplings of limited resources: The case of sand

Authors: Aurora Torres (Museo Nacional de Ciencias Naturales - Spanish Research Council);Jodi Brandt (Human-Environment Systems Program, Boise State University);Kristen Lear* (Warnell School of Forestry and Natural Resources, University of Georgia);Gabriel Zegers (Ecosystems and Environment Department, Pontificia Universidad Católica de Chile);

Session: Landscape networks as telecoupled human and natural systems

Abstract: Telecouplings are socioeconomic and environmental interactions over distances. Sand is mined worldwide for many uses and accounts for the largest volume of solid material extracted globally, making sand mining and trade an important telecoupling. Sand is extracted at a rate far greater than its renewal and is therefore a limited resource. Historically, extraction was from inland deposits. However, declines of these deposits have caused a shift to coastal sand mining. Coastal sand extraction has immense effects on natural and social systems in sending systems, including impacts on biodiversity, erosion, and tourism. Receiving systems are also impacted via introduction of invasive species and diseases. Furthermore, sand trade has spillover effects, such as exacerbating climate change due to carbon dioxide emissions from sand transportation. The increasing demand for sand will likely increase conflicts and potentially lead to a “tragedy of the sand commons”. The sheer scale of these problems and the complex web of jurisdictional boundaries make it difficult to assess this issue from a traditional perspective. Therefore, we apply the telecoupling framework to untangle the complex interlinkages resulting from sand mining and trade. Our goals are to (1) describe the problem of sand mining and trade, (2) identify actors and analyze their interconnections, and (3) identify current and future threats of this issue to the sustainability of telecoupled systems. We present a conceptual model of sand mining and trade in which we highlight the global dimension of the problem, the flows associated with the resource, and links to other sustainability challenges.

Presenter: Torres, Melanie L

Title: Using remote sensing and GIS to evaluate vectors of disease dispersal

Authors: Melanie L Torres (Murray State University);Howard H Whiteman (Murray State University);

Session: Poster

Abstract: Emerging infectious diseases are a global problem that negatively impacts both ecosystems and humans alike. To better manage these diseases, understanding their dispersal abilities is vital. Many diseases use vectors to travel to new areas, and these vectors can be impacted by numerous environmental factors, including changes in climate and topographic conditions. One method that can aid in understanding disease dispersal pathways is the combined use of remote sensing and Geographic Information Systems (GIS) analysis, mapping, and modeling functions. Building upon research conducted by Murray State University and Colorado Parks and Wildlife, this project uses remote sensing and GIS tools to test biotic variables related to the dispersal of an amphibian-killing chytrid fungus, Batrachochytrium dendrobatidis (chytrid), in west-central Colorado. Chytrid causes the lethal disease, chytridiomycosis, which has been implemented in global amphibian population declines and several species extinctions. Chytrid's spread is typically blamed on anthropogenic activity, but in some systems, chytrid is found in remote areas. Using remotely sensed temporal data and GIS mapping and analysis tools, I have gathered the geographic distribution of chytrid from 91 sites in west-central Colorado and, using a combination of field and remote sensing data, I am creating a habitat suitability model for chytrid in this region. Once a habitat suitability model has been created, it will be used in conjunction with other distribution models aimed at highlighting high-risk areas for chytrid spread. Understanding the contributing biotic factors towards chytrid's dispersal will support conservation efforts aimed at restoring amphibian populations impacted by this fungus.

Presenter: Tracy, James L

Title: Feature selection and transferability for Maxent and Envelope Score ecological niche models of four species of tamarisk beetles (Diorhabda spp.) introduced to North America

Authors: James L Tracy (Deptartement of Entomology, Texas A&M University);Robert N Coulson (Department of Entomology, Texas A&M University);Allen E Knutson (Texas AgriLife Extension, Texas A&M University);

Session: Disturbance

Abstract: Maxent and Envelope Score ecological niche models are developed to project distributions of four tamarisk beetles (Diorhabda spp.; Coleoptera: Chrysomelidae) introduced

for biological control of tamarisk (Tamarix spp.) in western North America. A novel semi-supervised embedded hybrid wrapper singlet/doublet feature selection algorithm (SDFSA), which incorporates tests for model overfitting and transferability, is used in evaluating subsets of 60 climate variables for both Maxent and Envelope Score models. The SDFSA is compared to the MaxentVariableSelection package for Maxent models. Subtropical tamarisk beetles, D. sublineata, are projected to have the greatest potential to spread westwards from Texas and New Mexico and dominate most of the Chihuahuan, Sonoran, and Mojave deserts. Models project that northern tamarisk beetles, D. carinulata, already occupy most of the potential southern portion of their North American range in suitable habitats of the Colorado Plateau Shrublands and Great Basin Shrub Steppe. They may spread mostly to the east into the Western Short Grasslands from Texas to Kansas. Larger tamarisk beetles, D. carinata, are projected to continue spreading north and west from grasslands of Texas, Oklahoma, and Kansas to eventually reach California and Nevada (excluding most of the Sonoran Desert). Mediterranean tamarisk beetles, D. elongata, are projected to remain mostly confined to currently occupied areas of the California, west Texas, and eastern New Mexico. Subtropical tamarisk beetles have the greatest potential to spread into critical habitat of the endangered Southwestern Willow Flycatcher (Empidonax traillii extimus) where it nests in dense tamarisk in central New Mexico and central Arizona.

Presenter: Trammell, E. Jamie

Title: Managing at Landscape Scales: How does landscape science inform resource management and planning?

Authors: E. Jamie Trammell (Alaska Center for Conservation Science; Geography and Environmental Studies Department, University of Alaska, Anchorage);Jason Taylor (Bureau of Land Management, Alaska State Office);

Session: Planning

Abstract: Managing resources at landscape-scales is an emerging priority for resource managers across the United States. Ranging from state-led efforts like the Western Governors' Crucial Habitat Assessment Tool to Department of the Interior policies on a landscape approach and regional mitigation strategies, landscape-level management is experiencing a renaissance. The Bureau of Land Management (BLM) launched their landscape approach to resource management by completing Rapid Ecoregional Assessments (REAs) and implementing a national Assessment, Inventory, and Monitoring (AIM) initiative. REAs are designed to quickly synthesize the state of landscape knowledge across an ecoregion so that managers can better understand current and plan for future landscape conditions. AIM collects quantitative information on the status, trend, amount, location, and spatial pattern of renewable resources

on the nation's public lands. Built on the fundamentals of landscape ecology, REAs and AIM have developed a huge amount of spatial information on general trends of ecological systems across expansive geographies. However, the direct policy and applications for landscape scale resource management have been less developed. Merging scientific and management requirements into how resources and threats are identified, REAs and AIM provide a fundamental resource to begin incorporating landscape ecology into land use planning. Here we present examples of current thinking on how to better translate landscape science into resource management using the BLM Landscape Approach and how landscape ecological principles are guiding management decisions in the arctic and boreal systems of Alaska.

Presenter: Trombulak, Stephen C

Title: Landscape-scale conservation planning: A retrospective

Authors: Stephen C Trombulak (Middlebury College);

Session: Landscape-scale Conservation: Modeling New Frontiers

Abstract: Conservation work today is increasingly taking an expansive view of the spatial extent over which planning must take place. While the precise geographical extent of a "landscape" is largely contextual, influenced by both biotic and abiotic factors, most conservation goals cannot be achieved unless plans encompass areas of hundreds of square kilometers or larger and are thus considered to take place on a "landscape scale." Numerous conservation initiatives today operate at this scale, including the Landscape Conservation Cooperatives (LCC's) and the ecoregional portfolios of The Nature Conservancy, among others. While such initiatives take advantage of advances in remote sensing and computationally based spatial analysis, it is worth remembering that landscape-scale planning has a long historical tradition. In this talk I will reflect on many of the pioneering efforts to expand the both our awareness of and tool kit for landscape-scale planning, including the emergence of thinking about ecoregions (e.g., Greater Yellowstone Ecosystem), continental conservation (e.g., the Wildlands Project), connectivity (e.g., the Yellowstone to Yukon Conservation Initiative), and systematic conservation planning (e.g., SPEXAN). Consideration of how this field developed provides an important opportunity to reflect on where it needs to go in the future to more effectively achieve our conservation goals.

Presenter: Tuch, David P

Title: Integrating ecology into landscape planning and design solutions

Authors: David P Tuch (Equinox);Owen Carson (Equinox);

Session: Planning

Abstract: This presentation will showcase examples from the western North Carolina region on how local landscape architects, land planners and ecologists work to together to craft solutions to land development projects that are environmentally responsible and balance environmental, economic, and quality of life factors.

Presenter: Tuch, David P

Title: The building of a sustainable brewery: The story of New Belgium Brewing's east coast brewery

Authors: David P Tuch (Equinox);

Session: Urban II

Abstract: The presentation will address the key landscape elements of the brewery built on a brownfields site including innovative stormwater design, multimodal transportation, stream restoration, revegetation along the French Broad River, invasive exotic plant management, and native plantings based on a pollinator theme.

Presenter: Tucker, Madelyn M

Title: Post-wildfire biological legacies in northern Lower Michigan: Effects on stand structure and plant community diversity

Authors: Madelyn M Tucker (Department of Biological Sciences, Wayne State University);R Gregory Corace, III (Seney National Wildlife Refuge, US Fish and Wildlife Service);Daniel M Kashian (Department of Biological Sciences, Wayne State University);

Session: Wildland Fire II

Abstract: Jack pine-dominated ecosystems of northern Lower Michigan are currently and were historically characterized by frequent, large, stand-replacing wildfires that often produce

unburned strips, “stringers,” representing legacies of the pre-fire ecosystem. These remnants may persist for years on the recovering post-fire landscape, but the potential effects of their presence on ecosystem processes and patterns are poorly understood. For example, stringers may act as post-fire seed sources or refugia for individual plant species, or may provide a prolonged jack pine seed source for reseeding into the burned landscape. Management practices have altered both the disturbance regime and the structural variability of forests in the region through fire suppression and plantation plantings designed to provide habitat for the federally-endangered Kirtland’s warbler. Jack pine plantations lack the structural variability found in wildfire-regenerated ecosystems, and the living, more mature trees that comprise stringers are often targeted by managers for clear-cuts. We investigated the effects of stringers on post-fire plant community composition and stand structural development using four wildfires representing a temporal, successional gradient. We used non-metric multidimensional scaling and principal components analysis to investigate the distribution of plant communities, and compared age distributions along perpendicular transects to determine structural effects of stringers on post-fire regeneration. We found that both plant diversity and the age of post-fire regeneration are influenced by adjacent stringers. Increased understanding of the effects of stringers has the potential to influence forest management practices to more closely resemble naturally-regenerated ecosystems, and may be useful for guiding future retention patterns in managed areas.

Presenter: Tumas, Hayley R

Title: Landscape genetics of a dominant foundation species in the Gulf of Mexico

Authors: Hayley R Tumas (University of Georgia);Brian M Shamblin (University of Georgia);Nathan P Nibbelink (University of Georgia);Mark S Woodrey (Grand Bay National Estuarine Research Reserve);Richard B Chandler (University of Georgia);Campbell J Nairn (University of Georgia);

Session: Poster

Abstract: Severe declines in salt marsh habitat due to anthropogenic impacts are fragmenting populations of salt marsh species with unknown negative effects on the genetic diversity, and consequently resiliency, of the marsh ecosystem. Furthermore, these coastal habitats are highly vulnerable to further fragmentation and degradation from impending sea level rise. To conserve ecosystem function and population persistence in the face of landscape change, species management must address the preservation of population connectivity, a source of genetic diversity. High genetic diversity in clonal macrophytes has been linked to greater resistance to disturbance and increased restoration success. The dominant foundation species in the Gulf of Mexico, black needlerush (Juncus roemarianus), is a clonal macrophyte that

provides habitat for many other marsh species and plays a critical role in marsh restoration efforts. We are conducting a landscape genetic analysis on J. roemarianus within irregularly flooded marshes on the Gulf coast between eastern Mississippi and the Florida panhandle. Significant genetic structure between populations located in Mississippi and Florida has been indicated using a panel of 19 microsatellite markers. We will implement additional sampling and model resistance layers to identify natural and unnatural barriers to gene flow that shape this structure. Models of projected sea level rise will be used to predict future changes to population connectivity. Results from this study will inform management decisions and restoration strategies to preserve and restore natural levels of genetic diversity in J. roemarianus, ensuring marsh resiliency to future landscape changes.

Presenter: Tuttle, Julie P

Title: Invasions in Great Smoky Mountains National Park, North Carolina and Tennessee: Impacts, long-term questions, and data needs

Authors: Julie P Tuttle (University of North Carolina at Chapel Hill);Peter S White (University of North Carolina at Chapel Hill);

Session: Understanding Macroscale Invasion Patterns and Processes

Abstract: The southern Appalachian mountains are characterized by steep environmental gradients and a complex vegetation pattern. Great Smoky Mountains National Park (GRSM), founded in 1934, preserved approximately five percent of the southern Appalachian high-mountain region. Approximately 25 percent of the park was not directly disturbed by logging or farming and comprises some of the largest tracts of old-growth forest in the eastern United States. However, human-caused disturbances, particularly species invasions, have continued to affect both the old-growth and second-growth forests in GRSM. Here we briefly review documented invasions in GRSM for a variety of taxonomic groups, and then we focus on four invaders that have had significant effects on forest composition, structure, and dynamics: chestnut blight (starting just before park establishment), balsam woolly adelgid (starting in the 1960s), beech bark disease (starting in the 1990s), and hemlock woolly adelgid (starting in the early 2000s). We show how these invasions are distributed on the landscape, and compare and contrast the traits and biology of the invaders, the traits and biology of their host species, and the effects of these invasions on the landscape. We then consider unanswered questions about the long-term dynamics of these invasions and discuss the data and modeling needed to forecast the future of this landscape.

Presenter: Unks, Ryan R

Title: An interdisciplinary analysis of semi-arid landscape change in Laikipia, Kenya

Authors: Ryan R Unks (University of Georgia);Elizabeth G King (University of Georgia);Jeffrey Hepinstall-Cymermann (University of Georgia);Forest Isbell (University of Minnesota);

Session: Mapping spatiotemporal pattern and process: re-imagining arid grassland mapping from local to global scales

Abstract: Mobility in semi-arid lands is essential to wildlife and herders alike to gain access to highly spatially and temporally variable key resources. On the Laikipia Plateau, as in many other East African semi-arid lands, decreases in pastoralists' seasonal grazing access have increasingly produced constraints to herding practices. Herder adaptations to these constraints are thought to produce large changes in landscape processes, but how these changes relate to recent shrub and succulent encroachment, reduction of perennial grasses and lianas, and local extirpation of a canopy species is not well understood. Explicitly considering how herder mobility and vegetation are interrelated, and using an interdisciplinary approach, our research focuses on recent changes in livelihoods and interrelated ecological dynamics. We used household survey and interview data to model species-specific livestock pressure and analyze the drivers of changes in herding practices. We used Landsat imagery to analyze change in landcover along gradients of livestock pressure under conditions of varying soils, topography, and rainfall. Current field-based, fine-scale plant community composition was also compared to both livestock and environmental gradients. Preliminary analysis indicates that there is a strong relationship between plant community composition gradients, land-cover change, and novel domesticated herbivore pressure. The role of novel herbivore pressure is being explored and analyzed as situated in a complex social landscape where changes in access, markets, and politics at different spatial scales have impacted herding practices. We draw from alternative stable-state theory and consider the role of this novel herbivore pressure in vegetation state transitions.

Presenter: Updyke, Erin A

Title: Eco-epidemiological risk and sylvatic vectors of Chagas disease in Panama

Authors: Erin A Updyke (University of Illinois at Urbana Champaign);Brian F Allan (University of Illinois at Urbana Champaign);

Session: Poster

Abstract: Chagas disease, a neglected tropical disease transmitted by multiple species in the subfamily Triatominae (Hemiptera: Reduviidae), currently affects over 8 million people throughout Central and South America. In Panama, Chagas disease seroprevalence is estimated to average 2-5%, and is presumed to be transmitted primarily by Rhodnius pallescens. However, several other species of triatomine in Panama are competent vectors, most of which are generally considered sylvatic in nature. This project combined household surveys of communities across a human land-use gradient in central Panama with entomological surveys of triatomines to examine the factors potentially contributing to human Chagas disease exposure risk, especially as it relates to vector species typically considered sylvatic in nature. Household surveys explored social and behavioral factors, such as living conditions, education level, socioeconomic status, vector control methods, and knowledge of both triatomine bugs and Chagas disease. In rural areas, participants were significantly more likely to be familiar with triatomines and to have seen a triatomine previously. Additionally, presence of domestic and wild animals around the home is positively correlated with the likelihood of having seen triatomines around the home. Entomological surveys captured multiple species of triatomines in households in both urban and rural areas, including several sylvatic species. These results indicate significant differences in potential risk factors may vary with human land-use. Better understanding of the eco-epidemiology of vector-borne disease is integral to successful control efforts.

Presenter: Urza, Alexandra K

Title: Ultimate and proximate controls on lower treeline position in the Intermountain West

Authors: Alexandra K Urza (University of Nevada-Reno);Peter J Weisberg (University of Nevada-Reno);

Session: Biogeography

Abstract: Lower and upper treelines jointly determine the distribution of forests in many mountainous regions. Although upper treelines across the world have received extensive scientific attention, generalizable studies of the climate controls of lower forest edges are largely absent from ecological literature. Lower treelines are thought to be ultimately limited by plant water balance, and are expected to contract with predicted increases in water deficits. However, where the position of lower treeline is directly constrained by land use and disturbance rather than by water balance, the distribution of forests will likely be less sensitive to climate changes. In this study, we investigated the relative importance of climate, land use, and disturbance for determining the position of lower treeline in the western US. We used land cover classifications to map lower treelines of the Intermountain West, a semi-arid region encompassing gradients of precipitation (magnitude and seasonality), temperature, and

geology. We used boosted regression trees and linear modeling to identify the effect of climate and soils on lower treeline position and the influence of land use and disturbance. Consistent with expectations, our analysis revealed a threshold of seasonal water balance, beyond which trees are rarely found. In some regions, soil available water balance was found to be negatively associated with the presence of trees, suggesting that understory competition for water may be limiting to tree establishment in deeper, finer-textured soils. Furthermore, land use and disturbance often coincide with the lower treeline boundary, frequently constraining forests above their climate potential.

Presenter: Van Appledorn, Molly

Title: Linking spatially-explicit hydroperiod quantification and forest functional composition in Maryland Piedmont floodplains

Authors: Molly Van Appledorn (University of Maryland Baltimore County);Matthew E Baker (University of Maryland Baltimore County);Andrew J Miller (University of Maryland Baltimore County);

Session: Disturbance

Abstract: Flood dynamics are expected to drive compositional patterns of woody overstory species in bottomland ecosystems, but are often summarized with implicit measures, confounding ability to establish predictive pattern-process relationships. We related systematic surveys of functional composition and spatially-explicit quantifications of hydroperiod to develop trait-flood regime relationships for floodplain forests. We used 2D hydrodynamic models to characterize inundation patterns for 4 floodplain segments representing contrasting valley morphologies, contributing areas, and flow regimes. We systematically inventoried forest composition across each segment and classified assemblages based on distributions of ecologically-relevant phenotypic traits. Forest functional groups were examined across gradients of flood frequency, duration and depth. We also examined predictions of group distributions in response to combinations hydroperiod and location variables. Inundation dynamics observed within and among segments were consistent with general hydraulic expectations where wider, low-slope valley settings experienced longer, valley-filling floods, whereas narrower, steeper valleys experienced brief, shallow floods over more limited extents. Comparisons relating functional groups to hydroperiod revealed that relatively high moisture use and anaerobic tolerance were associated with more frequent, deeper floods, whereas assemblages with little anaerobic tolerance and slower growth rates were associated with infrequent inundation. Despite such differences, each segment contained nearly the full spectrum of functional traits, albeit in differing proportions. Interacting relationships among hydroperiod and position variables in the predictive model underscored complex relationships

between river-valley flood regime and floodplain topography. We demonstrate the utility in linking spatially-explicit hydrodynamic models with vegetation patterns to generate process-based knowledge useful for disentangling complex biophysical relationships.

Presenter: Van Appledorn, Molly

Title: Linking flood inundation modeling, ecosystem studies, and ecosystem services assessments for improved research and management of floodplain landscapes

Authors: Molly Van Appledorn (USGS Upper Midwest Environmental Sciences Center);Nathan R De Jager (US Geological Survey);

Session: Watersheds and Hydrology

Abstract: Flooding is a dominant physical process structuring bottomland ecosystems, forming the physical template that influences biogeochemical cycling, sediment transport, habitat quantity and quality for aquatic and terrestrial organisms, and patterns of plant succession and diversity. These ecosystem functions, in turn, directly impact the services floodplain ecosystems provide to society such as water quality improvement or recreational opportunities. As new data (e.g., LiDAR) and technological advancements in hydrodynamic and GIS modelling have emerged to examine biophysical relationships in floodplain ecosystems, so too has the potential to conduct broad-scale, interdisciplinary research at the intersection of hydrology, ecology, and ecosystem services. This presentation reviews the state of the science in flood inundation modeling, floodplain ecosystem science, and ecosystem services assessments. A particular focus is placed on identifying the connections among these fields of study and highlighting ways in which the outputs of one discipline can be used as inputs to another field of study. We argue that a better integration of these research areas is needed to fully take advantage of new data and technological advancements and improve research and management of floodplain landscapes.

Presenter: Van Berkel, Derek B

Title: Scaling future urban change: Simulation of urbanization scenarios across the southern Atlantic States, U.S.

Authors: Derek B Van Berkel (Center for Geospatial Analytics, NC State University);Ashwin Shashidharan (Center for Geospatial Analytics, NC State University);Raju Vatsavai (Center for

Geospatial Analytics, NC State University);Anna Petrasova (Center for Geospatial Analytics, NC State University);Vaclav Petras (Center for Geospatial Analytics, NC State University);Helena Mitasova (Center for Geospatial Analytics, NC State University);Ross K Meentemeyer (Center for Geospatial Analytics, NC State University);

Session: Urban II

Abstract: In the United States, urban sprawl continues to increase in response to trends in per-capita demand for low density housing and loose urban and regional planning. Population growth in the South Atlantic States (SAS) is resulting in rapid landscape change, including loss of natural and working lands that can provide food, fiber, and recreation opportunities. In this presentation, we simulate urbanization for the entire SAS using FUTURES -- a new open source urbanization model designed to accurately represent landscape change processes based on demand for development, local site suitability factors, and a stochastic patch growing algorithm. Advances to the FUTURES modelling framework allows for projections at large spatial extents and high resolution by computing with parallel algorithms. We also address the potential for adopting different urban growth strategies for the SAS as alternatives to increased sprawl through settlement densification. Our comparisons reveal that while urbanization at the fringe of megaregions will continue, (i.e. Miami, Charlanta) infill incentives will lessen its impacts. Simulations contribute to further understanding the multiscale consequences of urbanization that are only possible through large scale analysis. Total loss of farm and forest lands will impact food security and carbon sequestration, while urban spillover into periurban areas will impact wildlife habitat and recreation potentials.

Presenter: van der Hilst, Floor

Title: Variation in carbon balances of wood pellet production in Southeast US

Authors: Floor van der Hilst (Utrecht University);Anna S Duden (Utrecht University);Steef Hanssn (Utrecht University);Martin Junginger (Utrecht University);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: In order to meet the EU Renewable Energy targets, a large role is expected from co-firing wood pellets in coal fired power plants. The majority of the wood pellets consumed in Europe are produced in the Southeast of the United States. Last decade, international wood pellet trade increased threefold, and it is expected that the growth in wood pellet production will continue towards 2030. However, the sustainability of the wood pellets is heavily debated. Key concern is the carbon debt resulting from increased removal of standing carbon stocks. The

carbon balance of wood pellet production depends on the type of wood (hard wood vs soft wood), characteristics of the forest (plated vs natural), age of the standing stock, biophysical context (highland vs bottomland and type of soil and climate), part of the tree used (whole tree vs residues), type of management applied (e.g. thinning and replanting regime), and the design and efficiency of the supply chains. Furthermore, the calculated carbon balance depends on the method applied (stand level vs landscape level; time horizon; allocation to end products, etc) and the counterfactual assumed (what would have happened to the forest without wood pellet production?). Industry, NGO's, and policy makers have articulated a strong need for more research on this topic. The objective of this research is to quantify the carbon balance of wood pellet production spatially explicitly given different conditions, counterfactuals and calculation methods in order to allow for informed decision making by industry and policymakers on sustainable wood pellet production.

Presenter: Vélez, Juliana

Title: Diet and food availability for the lowland tapir (Tapirus terrestris) in the Middle Caquetá River Basin (Amazonas, Colombia)

Authors: Juliana Vélez (Universidad Nacional de Colombia);Orlando Rivera (Universidad Nacional de Colombia);Josep M Morral (Universidad Autónoma de Barcelona-Center for Ecological Research and Forestry Applications);Tania M González (Universidad Nacional de Colombia);Dolors Armenteras (Universidad Nacional de Colombia);

Session: Wildlife II

Abstract: Lowland tapir (Tapirus terrestris) lives in lowland forests of South America where it is considered a keystone species. They are frugivorous and browsers that ingest large amounts of fruit and plant material per day and consume approximately 460 plant species throughout its distribution range. Although the diversity of the lowland tapir diet, it is not completely understood and it changes as a consequence of spatial and temporal variation on food availability. Understandig how the food available is used, is essential to clarify the functional role of the tapir and to perceive how they locally fulfill their food requirements. This study analyzes the relationship between the diet of T. terrestris and the availability of food in the Colombian Amazon. Diet was determined from the macroscopic analysis of fruit residuals in feces and the record of browsing signs. In the home range reported for a subadult male, food availability was determined estimating fruit productivity on a line transect of 8,67 km and calculating the importance value index of the species available for browsing in 0,1 ha. Samples from diet and food availability were obtained in different types of habitats and in two different phenological periods to evaluate spatial and temporal variation in the use of resources. The relationship between species use and availability was established with regression analysis. We

found 28 new species consumed by T. terrestris, from 50 species identified in its diet. The results of this investigation give basic parameters, useful for making decisions about conservation.

Presenter: Verdade, Luciano M

Title: Vegetation biomass as a surrogate for birds' diversity

Authors: Luciano M Verdade (University of Sao Paulo);Cristiane H Millan (University of Sao Paulo);Jefferson L Polizel (University of Sao Paulo);Hilton Thadeu Z Couto (University of Sao Paulo);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: There are only four categories of humans' intervention in nature at the population level: biological conservation, control, sustainable use or monitoring. Considering that the vast majority of wild species are neither endangered, nor damaging or valuable, monitoring is by far the most demanding field in wildlife management as populations can have their status changed. As it is virtually impossible to monitor everything everywhere all the time, wildlife biologists are frequently searching for indicators of environmental change. In such context, 2-D landscape metrics have been extensively used to predict patterns of species distribution and abundance. However, such patterns tend to be molded by the complexity of ecological and evolutionary processes usually more related to 3-D landscape metrics. In this study birds' species richness and abundance showed a significant correlation with native vegetation biomass estimates. Regression equations have been established between NDVI and local field estimates of native vegetation biomass and also birds' species richness and abundance with promising results ($p<0.01$; $r^2>0.6$). However, mammals showed unclear patterns of such relationship. We are currently testing the possible relationship between birds' phylogenetic and functional diversity with native vegetation biomass and also the possible interaction between the matrix biomass pulse and mammals' diversity. We are also validating the models developed in the field. Our results suggest that native vegetation biomass might be used in regional scale as a surrogate for birds' diversity. Already existing long-term crossing scale ecological monitoring programs might be used to validate and improve the models here generated at local levels.

Presenter: Vigness-Raposa, Kathleen J

Title: Mapping animals reactions to human activity: It "sounds" more complex because it is

Authors: Kathleen J Vigness-Raposa (Marine Acoustics, Inc.);Jennifer L Giard* (Marine Acoustics, Inc.);Adam S Frankel (Marine Acoustics, Inc.);William T Ellison (Marine Acoustics, Inc.);Brandon L Southall (Southall Environmental Associates, Inc.);

Session: Coastal and Marine

Abstract: Soundscapes, or acoustic scenes, emphasize the way in which the acoustic environment is perceived by an individual, species, or society. Traditional maps of soundscapes have focused on integrated sound levels of sources, whereas potential impacts are usually assessed on the basis of exposure to one sound source. Recent studies have demonstrated that perception is dependent not only on sound level, but the context under which sound exposure occurs, including the type of sound source, the state of the individual, and the quality of the environment. In addition, encroachment parameters that measure whether a sound source is moving towards or away from the animal, particularly the vessel's speed and direction, have profound implications for the type and level of reaction of the animal to the human activity. We demonstrate simulation results of in-situ measured scenarios to propose metrics of the soundscape that include context-dependent parameters. A holistic and multi-dimensional assessment of the exposure scenario is needed to address the spatial relationships among noise environment, animal hearing and behavior, and anthropogenic sound sources. We present a layered mapping approach that considers each facet of the exposure scenario in a spatially-explicit manner. Our exemplar is the underwater environment of the Gulf of Mexico with layers for ambient noise, shipping, and distant anthropogenic sources, where exposure to a nearby seismic survey is filtered by the animal's hearing sensitivity, encroachment parameters of the vessel, and nominal loudness of the signal.

Presenter: Vogt, Peter

Title: Generic cost analysis via geodesic time

Authors: Peter Vogt (EC-JRC);Pierre Soille (EC-JRC);

Session: Monitoring and assessment of landscape change

Abstract: Satellite data from the past decades clearly demonstrates the increased impact of human activities on our land cover. The long-term monitoring and quantitative assessment of landscape changes is a prerequisite for a meaningful understanding of the landscape dynamics as well as the design of ecological based political directives aiming at a sustainable use of our environment. We present a generic cost assessment scheme, which employs concepts of mathematical morphology to derive the generalized geodesic time on a given resistance map.

The methodology can be used to calculate a cost map for a single target or, and in the case of providing a start and target object, a combined cost map depicting different cost zones and including the least cost pathway. The principal processing steps are explained and then illustrated on a sample data set. The outlined generic and quantitative cost analysis may be used for a variety of landscape change scenarios, such as detecting alternative pathways of similar cost, deriving species-specific movement patterns, and modelling and measuring the impact of land use change due to fire- or flooding events and pest outbreaks. The use and evaluation of this methodology is facilitated via the free software GuidosToolbox (http://forest.jrc.ec.europa.eu/download/software/guidos), which includes many additional generic tools for the assessment of landscape pattern, fragmentation, and connectivity.

Presenter: Voltura, Elise V

Title: Red-crowned Parrot (Amazona viridigenalis) ecological niche model in the Lower Rio Grande Valley, Texas using aerial imagery for conservation planning in an urban landscape

Authors: Elise V Voltura (Texas A&M University, Department of Veterinary Pathobiology, Schubot Exotic Bird Health Center);James L Tracy (Texas A&M University, Department of Entomology);Robert N Coulson (Texas A&M University, Department of Entomology);Donald J Brightsmith (Texas A&M University, Department of Veterinary Pathobiology, Schubot Exotic Bird Health Center);

Session: Avian II

Abstract: The Red-crowned Parrot (Amazona viridigenalis) (RCP) is an endangered amazon parrot native to northeastern Mexico. The long-term viability of the RCP in its native range is uncertain due to insufficient conservation regulatory mechanisms. It is being considered for ESA listing by USFWS. Historically, the RCP was an occasional migrant to the Lower Rio Grande Valley (LRGV) of Texas, however, a resident population has become established in certain urban areas in the region in recent decades. Conservation of this population is paramount since it currently represents 15-33% of the total global numbers. This study aimed to identify suitable RCP habitat in the LRGV and to make recommendations regarding habitat protection and enhancement actions for the region. We used MaxEnt to create a high-resolution ecological niche model using variables primarily derived from USDA NAIP aerial imagery, including raw vegetation, landscape composition, and texture indices. The model clearly projects highly suitable habitat to occur within urban boundaries, particularly where certain ornamentals are frequently cultivated. Second-order contrast NDVI texture indices and elevation were the most important variables in the model, followed by landscape composition indices, and then raw vegetation indices. This suggests heterogeneity and spatial arrangement of urban landscape features may be key factors in explaining RCP presence patterns in the LRGV. Suitable habitat

beyond what is currently being occupied appears limited. Increasing ornamental plantings throughout the LRGV urban landscape would likely encourage the persistence and growth of the RCP population, and could thereby serve as one avenue to conserving this species.

Presenter: Vukomanovic, Jelena

Title: Making it spatial, makes it personal: engaging stakeholders with geospatial participatory modeling (GPM)

Authors: Jelena Vukomanovic (Institute of Arctic & Alpine Research - CU Boulder);Derek B Van Berkel (Center for Geospatial Analytics - NC State);Ross K Meentemeyer (Center for Geospatial Analytics - NC State);

Session: Modeling with Stakeholders

Abstract: Decisions that comprehensively involve stakeholders in environmental management – from data collection to policy – are more likely to be viewed as legitimate, more likely to be accepted, and more likely to succeed. Yet, most public science projects fail to get traction in shaping collaborative solutions, because they either don't follow best practices for participatory research or they use abstract or aspatial representations of data and models that don't engage stakeholders. We are at an exciting point in time when advancements in geospatial analytics are helping generate more data and better models; the question is: how do we most effectively use geospatial technologies to make a difference? In this presentation, we describe the need for Geospatial Participatory Modeling (GPM) – dynamic, adaptive models that enable multiple stakeholders to visualize and explore the roles of place, spatial interaction, and multi-scale processes through all steps of a research process. Why? Contextualizing 'place' in a problem strongly motivates people to explore how an issue affects them; making it spatial, makes it personal. Visualizing 'spatial interaction' catalyzes new understandings of the connectedness of our world; people learn that what happens here, affects there! Defining 'spatial scale' helps visualize geographical boundaries of a problem, including knowledge of where policy and funding mechanisms operate at multiple and overlapping levels. We must move beyond specialized computational environments (and so-called "decision-support tools") that continue to block discussion and co-learning of complex problems between professionals and the public. Technical solutions alone can't provide sustainable futures for environmental management, rather we need integrated approaches with new tools for envisioning the future and evaluating tradeoffs that arise from multiple social, economic, and environmental drivers.

Presenter: Wagner, Helene H

Title: Moran spectral randomization of irregularly spaced ecological data

Authors: Helene H Wagner (University of Toronto);Stephane Dray (Université de Lyon);

Session: Assessment I

Abstract: Moran Eigenvector Maps (MEM) provide a flexible tool for non-parametric modeling of spatial structure in ecological data. So far, MEM have mostly been applied for assessing the relative contributions of pure environmental, pure spatial, and shared variation (variation partitioning) and for partialling out spatial variation in regression-type analysis (spatial filtering). We show how MEM can be used for restricted randomization of irregularly spaced ecological data. The proposed Moran spectral randomization method requires a minimum of parameterization and is able to address uni- or multivariate data with spatial structure at multiple scales, with the option of controlling levels of correlation with the original data. It can provide technically unlimited numbers of randomizations even for small samples while closely maintaining the spatial characteristics of uni- or multivariate data at all spatial scales. The method is applicable for correlation analysis of stationary, autocorrelated spatial or temporal series. Further research is needed to assess whether the method can be extended to multiple regression analysis.

Presenter: Wang, Wen J

Title: Forest biomass and species distributions under climate change in the Northeastern U.S: accounting for effects of succession and harvest

Authors: Wen J Wang (University of Missouri);Hong S He (University of Missouri);Frank R Thompson III (USDA Forest Service);Jacob S Fraser (University of Missouri);William D Dijak (USDA Forest Service);

Session: LANDIS Modeling

Abstract: Forests in the Northeastern United States are currently in the early- and mid-successional stages recovering from the historical land use. Succession, harvest, and climate are potentially important factors affecting forest structure and distribution in the region. We addressed how aboveground biomass (AGB) and tree species distribution will change under multiple climate change scenarios (PCM B1, CGCM A2, and GFDL A1FI) while accounting for forest succession and harvest effects in the Northeastern United States. We used LANDIS PRO forest landscape model to simulate forest succession, harvest, and climate change to predict

forest changes from 2000 to 2300. We analyzed the effects of climate change on AGB and species distribution. Total AGB increased from 2000 to 2120 irrespective of any climate scenario, followed by slight decline as trees aged and died, but then increased again to 2300. Total AGB averaged 10% greater under CGCM A2 and GFDL A1FI than for under PCM B1 and current climate. Climate change effects on tree species distribution were not evident from 2000 to 2100. However by 2300, occurrence of northern hardwood maple/beech/birch forest species and spruce/fir forest species decreased in occurrence and central hardwood and southern tree species increased in occurrence and shifted northward. The future dynamics of forest biomass were primarily attributed to succession but warmer climates had positive effects on forest biomass. Southern species and central hardwood tree species increased at the expense of the Northern Hardwood and Spruce-Fir forest species under warming climates.

Presenter: Wang, Zhifang

Title: Changing landscape pattern and functions of traditional pondscapes during Chinese rapid urbanization

Authors: Zhifang Wang (Peking University);

Session: Urban III

Abstract: Worldwide, pondscape in farmlands has been found to be an integrated water resource utilization and management system with multifaceted functions especially for biodiversity. And urbanization has been proved to have negative influences to farmland pondscape. Most of the studies focus on small scale monitoring and structural analysis without much concern of pondscape systematically. This paper aims to explore how urbanization process destroyed pondscape in its landscape pattern as well as landscape functions. The study site located at Liangjiang District, Chongqing, Sichuan Province. Aerial photos in 2000,2006,2012 were used to analyze the changes of landscape pattern. landscape index of pondscape was calculated using ArcGIS. Related function changes were surveyed using questionnaires. The study found that pondscape disappeared rapidly during urbanization process and its landscape functions also change drastically. Pondscape in the study period had experienced decreased patch number, increased average patch size and fragmentation. Its biodiversity and irrigation functions decreased at the same time while social and tourism roles increased. Multiple factors led to these changes including economic development, agricultural policies, urban planning, social behavior changes etc. Based on the research findings, adaptation strategies of pondscape into new urban green infrastructure are suggested to mitigate the negative impacts of urbanization while bridging the tradition and the future.

Presenter: Wang, Fang

Title: Shared resources, species interaction, and management options: An integrated conservation planning in a tele-coupled world

Authors: Fang Wang (Michigan State University);Jianguo Jack Liu (Michigan State University);McShea J William (Smithsonian Institution);Dajun Wang (Peking University);Sheng Li (Peking University);

Session: Wildlife II

Abstract: Giant panda are restricted to 30 isolated habitat patches, 13 of which are small enough to be considered a high extinction risk. However, there is a gap of knowledge on the degree and direction of their interaction with human activities, regional developments, and sympatric mammals. In this study, we constructed an integrated framework to combine species habitat modeling, inter-species co-occurrence analysis, and scenario analysis for conservation planning at a large scale. We surveyed 953 sites with camera traps, sign transects and vegetation plots in Qinling Mountains, Minshan Mountains, and Qionglai Mountains, China. Occupancy models were constructed for giant panda and other focal species to determine the relationship between species distribution, species co-occurrence, environmental variables, and anthropogenic interferences. We then quantitatively evaluated the cost-effectiveness of different management options, and proposed optimal plans for each mountain range. We found that due to giant panda's association with areas of low elevation and flat terrain, human infrastructures in the same area have resulted in significant habitat fragmentation. We further measured the degree of negative interactions between giant panda and human activities, and revealed transportation, tourism, and grazing were the major limiting factors but had different significances in each mountain. We proposed an integrated conservation plan to focus the future conservation effort on the areas that not only had highest importance to giant panda's long-term survival, but also feasible in practical applications. The framework has general value in any conservation activities that anticipate improving habitat quality and connectivity in human modified landscapes.

Presenter: Watanabe, Yosuke

Title: Development of techniques for transplanting partial myco-heterotrophic Orchidaceae species

Authors: Yosuke Watanabe (Institute of Technology, Shimizu Corporation);Sotaro Yonemura (Institute of Technology, Shimizu Corporation);Naoki Shiomi (Graduate School of Frontier

Sciences, The University of Tokyo);Kazuhide Nara (Graduate School of Frontier Sciences, The University of Tokyo);Tsuyoshi Seike (Graduate School of Frontier Sciences, The University of Tokyo);Kenji Fukuda (Graduate School of Agricultural and Life Sciences, The University of Tokyo);Tomochika Tokunaga (Graduate School of Frontier Sciences, The University of Tokyo);Takeshi Tange (Graduate School of Agricultural and Life Sciences, The University of Tokyo);Makoto Yokohari (Graduate School of Engineering, The University of Tokyo);

Session: Poster

Abstract: Based on “Mitigation hierarchy”, transplanting rare plants as compensatory measures has frequently been attempted to conserve biodiversity in association with construction projects in Japan. Among various kinds of rare plants, this study has focused on two endangered Orchidaceae species —Cephalanthera falcata and Cephalanthera erecta. As representative native plants in SATOYAMA forests, Cephalanthera species have attracted citizen conservation groups. These species have been known as partial myco-heterotrophic plants, where they partly obtain carbon from surrounding host trees through shared mycorrhizal fungi. Because of the complicated tripartite symbioses, effective transplanting techniques have not yet been developed. This study aims to develop transplanting techniques for the partial myco-heterotrophic Cephalanthera species based on detailed habitat characterization. First, distribution of symbiotic mycorrhizal fungi and trees, vegetation cover types, soil environment, and photoenvironment were surveyed in natural habitats of the two Cephalanthera species. We found that the two orchid species were mainly located in fagaceous patches with few other coexisting plants on forest floor and were preferentially associated with specific fungal lineages. Using the data of vegetation cover types, distribution of symbiotic tree and mycorrhizal fungi in potential transplanting sites, habitat suitability of the sites was evaluated and visually mapped by GIS. Then, 180 orchid plants were transplanted to new sites, using several different transplanting techniques in two different seasons. Next spring, we surveyed the transplants to evaluate the success of the transplantation. The ratio of shooting transplants was higher in the technique that kept belowground root systems least disturbed.

Presenter: Wear, David N

Title: Land use futures in the Southeast: The interaction of urban and rural market forces

Authors: David N Wear (USDA Forest Service);Jennifer K Costanza* (North Carolina State University);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: Southeastern land uses have exhibited considerable flux over the past century reflecting change in the economic productivity of land and other economic and demographic changes. Economic productivity derives from both biophysical productivity and market base returns to various activities. Developed uses of land are steadily increasing but are also shifting as large regions depopulate and urban centers grow. The flux between agricultural and forest uses of rural land reflects especially the dynamics of economic productivity for the various uses. Future land conditions will depend on the interaction of agricultural, energy, and forest product markets and I explore plausible future dynamics of these markets. The presentation examines anticipated trajectories of land use change across market and climate scenarios.

Presenter: Wei, Wei

Title: Responses of landscape change to urbanization and human activities in the Bohai rim Region, Northern China

Authors: Wei Wei (RCEES,CAS);Liding Chen (RCEES,CAS);

Session: Urban III

Abstract: During past decades, great changes in landscape have taken place in the context of global urbanization and accelerated human activities. Such changes can markedly influence local environment and residents' welfare. In this study, the rapid-expansion Bohai Rim Area in Northern China was selected as the case study region. Three typical periods were analyzed from 2000 to 2010. Results showed that land uses varied in different periods. Cropland declined highest, from 59.3% in 2000 to 53.3% in 2010, while urban and impervious area sharply increased from 9.7% to 12.8%. Under strong human disturbance and urbanization, forestland and grassland also decreased. Due to reforestation, the declining rates of total areas of forests and grasses remained low. Secondly, mean ecological capacity generally declined. Compared with the earlier stage of 2000-2005, the decreasing rate of ecological capacity in the later stage of 2005 to 2010 was much higher, mainly due to accelerated development and increased population density. More attention thus should be paid to this situation. Thirdly, surface water quality remained a big problem in the three major watersheds (Liaohe, Haihe and Yellow rivers) within the Bohai rim area. The major contributors can be attributed to the distribution and development of various industries and extensive water based managements. Meanwhile, due to the increased extreme rainfall events and improper urban pattern design, the increased urban flooding in the city zones was also blamed. Complicated countermeasures and solutions should be carried out, targeting for achieving the sustainability of the relationship between human and nature.

Presenter: Weisberg, Peter J

Title: Cheatgrass die-off in the Great Basin: Using the Landsat archive to infer mechanism from spatiotemporal pattern

Authors: Peter J Weisberg (Department of Natural Resources and Environmental Sciences, University of Nevada, Reno);Thomas E. Dilts (Department of Natural Resources and Environmental Sciences, University of Nevada, Reno);Owen W. Baughman (Department of Natural Resources and Environmental Sciences, University of Nevada, Reno);Elizabeth A. Leger (Department of Natural Resources and Environmental Sciences, University of Nevada, Reno);Susan E. Meyer (Provo Shrub Sciences Lab, Rocky Mountain Research Station, US Forest Service);

Session: Arid Landscapes

Abstract: The exotic annual grass Bromus tectorum (cheatgrass) dominates vast acreages of rangeland in the western USA, leading to increased fire frequency and ecosystem degradation. Increasingly common in cheatgrass monocultures is the sporadic occurrence of 'die-off' or stand failure, likely caused by interactions among soilborne pathogens and environmental conditions for seed germination. We developed a novel remote sensing approach for mapping historical die-off annually at 30-m resolution from the Landsat archive (1985 – 2015). A Random Forests classification of image-derived spectral endmembers, trained on 2009 data, predicted die-off with 93% accuracy when validated independently using 2014 data. Die-off varied greatly across years and usually lasted only a single year. Persistent die-off (observed in consecutive years) was an order of magnitude less extensive but strongly clustered. Die-off hotspots (> 9 die-off years) occupied only 0.06% of the study area. Die-off occurrence was strongly associated with climate variables indicative of winter drought and lagged effects of previous years' precipitation. Die-off in hotspot areas was associated with low winter precipitation and high spring temperatures, and most commonly persisted for four consecutive years (39% pixels) and less commonly for shorter or for longer durations (26% < 4 years, 35% > 4 years). Results suggest that die-off occurrence is predictable as the interaction of site environment with annual climate conditions, but may also depend upon biotic feedbacks among cheatgrass dominance, litter production, establishment microsites, and seed pathogen expression. Our spatial models will provide predictive tools to support improved cheatgrass management and native plant restoration on die-off areas.

Presenter: Welsh, Erin C

Title: Ticks like it hot: Potential for climate change-induced shifts in vector-borne disease risk

Authors: Erin C Welsh (University of Illinois at Urbana-Champaign);Brian F Allan (University of Illinois at Urbana-Champaign);

Session: Connectivity

Abstract: In tropical regions, global climate change is expected to promote reduced and increasingly variable precipitation, with potential to alter vector-borne disease transmission. The consequences of climate change for tick distributions in Central America have received scant attention, despite the presence of several important tick-borne diseases. This study evaluates the relative contributions of abiotic and biotic factors in determining current tick and tick-borne pathogen distributions in Panama, which will inform predictions of how pathogen exposure risk will be impacted by climate change. Field efforts were conducted throughout twelve months at three sites spanning a natural precipitation gradient across Panama, which provides a proxy for future climate change, wherein conditions at the driest site represent the predicted result of climate change for wetter regions. Tick abundance and survival were monitored weekly at each of these sites, and local mammal species richness was estimated using camera traps. Preliminary findings indicate that overall tick abundance is negatively correlated with rainfall, and the lowest abundance of nymphs and adults occurred at the wet site. Tick mortality was highest at the dry site, suggesting that future potential increases in abundance may be tempered by a corresponding increase in mortality. These results, in combination with pathogen and mammal community data, will be used to model current tick-borne disease risk and how disease dynamics may shift as a result of forecasted climate change. The applicability of this model extends beyond this disease system and can serve as a framework for studies of climate change-vector interactions in other regions.

Presenter: White, Gwen M

Title: Mississippi Basin / Gulf Hypoxia Initiative: Seven LCCs meet largescale agricultural conservation challenges from grassland birds to Gulf coast shrimp.

Authors: Gwen M White (Eastern Tallgrass Prairie LCC);Greg Wathen (Gulf Coast Plains & Ozarks LCC);Bill Bartush (Gulf Coast Prairie LCC);Nicole Athearn (Great Plains LCC);Michael Schwartz* (The Conservation Fund);

Session: Reshaping Landscapes: Bioenergy and Biodiversity II

Abstract: According to water quality model assessments, Midwest states within the Mississippi River Basin contribute the greatest nutrient load to the Gulf of Mexico hypoxic zone. The Gulf Hypoxia Initiative, spearheaded by seven Landscape Conservation Cooperatives, is undertaking

a strategic and transparent process to create an integrated framework that supports planning, design, configuration, and delivery of wildlife conservation practices within targeted locations across the watershed. Work Teams of researchers and managers described the design/policy considerations for 13 highly effective conservation practices (including bioenergy crops) that benefit wildlife habitat, water quality and agricultural production through ecosystem services ("what to do"). The Conservation Fund is developing datasets and decision support tools to be utilized as part of the Conservation Blueprint 1.0 to map, evaluate, and select the most strategic and cost effective places to implement these actions ("where to do it"). Future scenario planning for landscape change could provide climate forecast and adaptation strategies over a range of time scales in response to ecological or economic drivers. The Landscape Conservation Cooperatives will use this framework to guide collaborative science needs, enhance organizational capacity, avoid duplication of effort, streamline prioritization, and align the work of agencies and organizations across multiple scales. This effort is intended to be complementary to related on-going efforts, such as the Gulf of Mexico Hypoxia Task Force, Mississippi River Basin Initiative, and state nutrient reduction initiatives, but with an added emphasis on the ecological and social values of wildlife habitat.

Presenter: Whiteman, Ari B

Title: Modelling den habitat for eurasian brown bears In Croatia amid renewable energy development

Authors: Ari B Whiteman (Imperial College London);

Session: Wildlife I

Abstract: In the hopes of surpassing the European Union's 2020 renewable energy protocol, Croatia plans to introduce nearly 700 wind turbines to their energy grid in the next five years. As required by law, the State Institute for Nature Protection must review all applications for wind farms and deem whether they pose significant risk to protected areas and species. In the absence of literature examining the direct impact of wind farm development on large carnivores, I have modeled the probability of denning sites around the country for Eurasian brown bears (Ursus arctos), a protected species. With 53 dens used between 1982-2011 by at least 18 known individual bears, I used the presence-only distribution modeling software Maxent in order to illustrate highly valued denning habitat around Croatia. I found landscape ruggedness and elevation to be the most important habitat variables, with both metrics relating positively to den presence probability. Conversely, the variables indicative of human development were one of the least important in predicting den presence. This is in contrast to established results from most other brown bear denning studies, except for results found in bordering Slovenia, which found similar responses indicating the possible exposure of bears in

the Dinaric alps to an environmental variable not found in other populations. Overall, since the most important habitat variables for denning were structural rather than anthropogenic, and the overlap of proposed wind farm sites in predicted high-quality denning areas is low, I found that any impact of wind farm construction on bear denning habitat overall would be minimal.

Presenter: Wiafe, Edward D

Title: Impacts of forests fragmentation due to high voltage transmission lines on liana communities

Authors: Edward D Wiafe (Presbyterian University);

Session: Fragmentation

Abstract: Lianas are a type of climbing plants found throughout tropical rainforests. They begin life on the forest floor but depend on trees for support as they climb upwards towards the sunlight they need for survival. Two forest reserves were assessed to evaluate the impacts of high voltage transmission lines on liana community in the forest ecosystem. The forests were stratified into two as edge and interior. Thirty (30) plots of 20m by 20m were established in each stratified area. The results indicated that at the edge of Tano-Offin forest reserve, the density was 293 lianas/ha and interior 197 lianas/ha. At the Afram Headwaters forest reserve the liana density at the edge and interior were 986 lianas/ha and 373 lianas/ha. In terms of diversity, the edge of Tano-Offin forest reserve was 2.36 (evenness= 0.53) and the interior was 2.69 (evenness= 0.674). One liana was supported by 2.9 trees at the edge part whereas one liana was supported by 2.8 trees at the interior part of the forest. Diversity of lianas at the edge of Afram Headwaters was 2.39 (evenness=0.437) and that of the interior was 2.16 (evenness=0.458). it was found that an average 1.3 lianas depended on one tree at the forest edge whereas one liana was supported by 2.8 trees at the interior part of the forest. In conclusion, the transmission line increases the abundance of lianas though; it has little influence of the diversity and the sizes.

Presenter: Wickham, James D

Title: Spatial and temporal patterns of impervious cover relative to watershed stream location

Authors: James D Wickham (US EPA);

Session: Monitoring and assessment of landscape change

Abstract: The influence of spatial pattern on ecological processes is a guiding principle of landscape ecology. The guiding principle of spatial pattern was used for a U.S. nationwide assessment of impervious cover (IC). Spatial pattern was measured by comparing IC concentration near streams and water body shorelines to its overall amount across a watershed for three dates (2001, 2006, 2011). IC near streams increased by nearly 10,000 km between 2001 and 2011, and, across all three dates, ~27% of the ~82,250 watersheds analyzed had higher concentrations of IC near streams than across the entire watershed (i.e., a proximally distributed impervious cover spatial pattern). In addition to its use as an indicator of watershed condition, IC is now also being used to guide watershed planning and management, including reporting under the Clean Water Act (33 U.S.C. §1251 et seq.). The use of IC spatial patterns to inform watershed planning and management is discussed.

Presenter: Wiederholt, Ruscena

Title: Spatial subsidies of ecosystem services provided by the migratory Mexican free-tailed bat

Authors: Ruscena Wiederholt (The University of Arizona);Laura López-Hoffman (The University of Arizona);John Loomis (Colorado State University);

Session: Ecosystem Services I

Abstract: In coupled natural-human systems, drivers of change in one location can have large impacts on human well-being in distant locations, often across international borders. Analytical approaches are needed to determine feedbacks between ecosystem change in one area and societal benefits in other areas. We use a novel approach—spatial subsidies—to measure the degree to which a migratory species' ability to provide services in one location depends on habitat in another location. We calculate spatial subsidies for a migratory species: Mexican free-tailed bats Tadarida brasiliensis mexicana, which migrates between the U.S. and Mexico. We tested the importance of different regions for the bats' population viability using a migratory network model. We then calculated the value of two ecosystem services provided by Mexican free-tailed bats: ecotourism and pest control provided to cotton farmers. Finally, we estimated the spatial subsidy between Mexico and the U.S. under current conditions and a global change scenario of wind energy development. Our subsidy calculations indicated that currently, overwintering habitats in southern Mexico are subsidizing – by contributing to population viability – the provision of ecosystem services in Texas and New Mexico. We recommend using the spatial subsidies approach to direct conservation funds for habitat protection and educational programs. We believe this approach can be useful to facilitate

transboundary conservation efforts for Mexican free-tailed bats and other vulnerable migratory species.

Presenter: Wilsey, Chad B

Title: Impacts of simulated climate and land-use on grassland bird distributions

Authors: Chad B Wilsey (National Audubon Society);Gary M Langham (National Audubon Society);Duane B Pool (Bird Conservancy of the Rockies);

Session: Ecosystem Services II

Abstract: Due to disappearance of grasslands ecosystems, grassland bird populations have been among the fastest and most consistently declining suite of species in North America over the past 40 years. Yet, land conversion continues to threaten remaining grasslands. In addition, the Central Plains of North America are predicted to have high rates of climate change velocity in the coming century, perhaps exacerbating an already challenging situation for grassland birds. We explore the impact of projected climate and land-use change on a suite of more than 40 grassland birds. Species distributions models are based on point datasets, not previously available for this type of predictive modeling, with coverage including Mexico, the United States, and Canada. We apply a novel approach towards data filtering using environmental binning and evaluate models based on spatially stratified test datasets. We quantify the relative importance of climatic and land-use variables in modeling current distributions and explore response curves to identify critical species-habitat relationships. We predict future distributions based on simulated land-use and downscaled climate projections under multiple greenhouse gas emissions scenarios (RCP 4.5 & 8.5) across eight general circulation models. Projections highlight the potential risks of future land-use and climate change on grassland birds in the Central Plains of North America and suggest those impacts are additive.

Presenter: Wiselogel, Arthur E

Title: DOE’s moves toward forest landscape design

Authors: Arthur E Wiselogel (AST);Kristen Johnson (DOE);

Session: Landscape Designs that Incorporate Sustainable Wood-based Bioenergy: A Focus on the Southeastern United States

Abstract: In the release of the 2016 Billion Ton Update the DOE projects that southern pine plantations will become the primary resource for woody biomass. Pine plantations will not only supply biomass for the production of liquid fuels and chemicals, but will also continue to provide wood for solid construction products, paper pulp, and wood pellets. Much of the increase in future pine plantation wood resources to meet the demand will come from more intense management practices along with a slight increase in acres. For some biofuels production technologies wood will be a preferred feedstock. Wood is one of the most homogenous forms of biomass for many important conversion criteria and has a low ash content. In the Southern US there is a well-established work force with experience harvesting, shipping, storing, and handling trees. And, in many areas pine plantations provide a concentrated amount of potential feedstock within an acceptable area to supply a potential commercial biofuels facility. The DOE has funded a watershed scale landscape design study in the Southeast focused on pine plantation ecosystems. The DOE has also funded several pine plantation harvest management studies that incorporate aspects of sustainability and has funded a pine plantation life cycle analysis. In addition, Idaho, Oak Ridge, and Argonne National Laboratories have conducted research efforts involving southeastern forest woody biomass resources. This presentation will review and summarize the findings of these studies and discuss the interest of DOE in landscape design in southeastern forests.

Presenter: Woods, Jeremy

Title: The role of land and a bio-based economy as mediators of climate mitigation and adaptation

Authors: Jeremy Woods (Imperial College London);Lorenzo Di Lucia (Imperial College London);

Session: Opportunities and Barriers for Sustainable Bioenergy

Abstract: The role of the bioeconomy in mitigating climate change will come under increasingly intense scrutiny following the Paris Climate Agreements. Whilst the focus of successful global climate mitigation strategies is currently primarily directed towards reducing emissions from fossil fuel combustion, agricultural (including livestock) and forestry emissions will inevitably occupy an increasingly significant share of total annual emissions in the coming decades. In 2015, agricultural emissions were 6.1 GtCO2eq and forestry and other land use (FOLU) emissions were 5.2 GtCO2eq, while global annual emissions were estimated to be 51.7 GtCO2eq. By 2050, under two major global emissions reduction scenarios which aim to limit global warming to a 2°C rise by 2100, agricultural emissions are projected to be 8.0 GtCO2eq (IEA 2-Degree Scenario) or 5.7 GtCO2eq (IPCC Representative Concentration Pathway 2.6 –RCP 2.6) and FOLU -6.0 GtCO2eq (IEA 2-Degree Scenario) and -14.6 GtCO2eq (RCP 2.6). Under both

these scenarios, the scope for reducing agricultural emissions is seen as either extremely limited or not feasible as a result of the need to ensure food security. Strategies aimed at ensuring climate-resilient agriculture may also be partly dependent on enhancing the carbon stocks of terrestrial vegetation and reducing emissions from crop, livestock and biomaterials production. Such strategies often include the introduction of high productivity perennial crops (grasses and trees) into conventional agricultural landscapes, driven by novel markets for lignocellulosic products. However, the introduction of perennials needs to be carefully managed so as to maximize co-benefits and minimize any negative tradeoffs. We assess the development of data and knowledge intensive, spatially explicit, landscape management tools to project, measure, guide and monitor the impacts of perennial-based integrated land management projects at scales ranging from sub-field to global.

Presenter: Woznicki, Sean A

Title: Effects of landscape-based green infrastructure on stormwater runoff in suburban developments

Authors: Kelly L Hondula (National Socio-Environmental Synthesis Center, University of Maryland);Sean A Woznicki (USEPA);S Taylor Jarnagin (US EPA);

Session: Urban III

Abstract: The development of impervious surfaces in urban and suburban catchments affects their hydrological behavior by decreasing infiltration, increasing peak hydrograph response following rainfall events, and ultimately increasing the total volume of water and mass of pollutants reaching streams. These changes have deleterious effects on downstream surface waters. Consequently, strategies to mitigate these impacts are now components of contemporary urban development and stormwater management. This study evaluates the effectiveness of landscape green infrastructure (GI) in reducing stormwater runoff volumes and controlling peak flows in four subdivision-scale suburban catchments (1.88 – 12.97 acres) in Montgomery County, MD, USA. Stormwater flow rates during runoff events were measured in five minute intervals at each catchment outlet. One catchment was built with GI vegetated swales on all parcels with the goal of intercepting, conveying, and infiltrating stormwater before it enters the sewer network. The remaining catchments were constructed with traditional gray infrastructure and “end-of-pipe” best management practices (BMPs) that treat stormwater before entering streams. This study compared characteristics of rainfall-runoff events at the green and gray infrastructure sites to understand their effects on suburban hydrology. The landscape GI strategy generally reduced rainfall-runoff ratios compared to gray infrastructure because of increased infiltration, ultimately reducing the burden of development on downstream aquatic ecosystems.

Presenter: Wright, Alexander D

Title: Long-term population ecology and large-scale movement patterns of gopher tortoises (Gopherus polyphemus) in southwestern Georgia

Authors: Alexander D Wright (Warnell School of Forestry and Natural Resources, UGA & Joseph W Jones Ecological Research Center);Jeffrey Hepinstall-Cymerman (Warnell School of Forestry and Natural Resources, UGA);Lora L Smith (Joseph W. Jones Ecological Research Center);Clinton T Moore (U.S.G.S., Georgia Cooperative Fish and Wildlife Research Unit & Warnell School of Forestry and Natural Resources, UGA);

Session: Conservation Biology II

Abstract: Habitat loss and fragmentation have led to an estimated 80% range-wide decline of gopher tortoise populations across the southeastern Coastal Plain. Recently, the gopher tortoise was identified as a candidate for listing under the Endangered Species Act in the eastern part of its range. We will report final results of a study that is part of a collaborative effort developing an adaptive landscape planning and decision framework for tortoise conservation in Georgia. This study examined the population dynamics and functional connectivity of four populations on a large private reserve in Georgia, where tortoises were previously marked/recaptured from 1995-1999. Each population was re-trapped once in 2014-2015. In 2015, we used a probabilistic sampling frame to select grid cells (120, ~2 ha cells) located within 3 km of the populations to locate migrant, marked tortoises. The data was analyzed in a Bayesian framework using a multi-state model (states: core v. outer area) to estimate survivorship, recruitment, and dispersal. Additionally, we combined environmental data with mark-recapture movement data to estimate landscape resistance to dispersal. Preliminarily, we found survivorship differed among size-classes and sites, and a difference in recruitment among sites. Dispersal was limited to adults, although ~50% of all tortoises moved less than 100 m from the original capture location. All dispersed tortoises moved to areas connected through contiguous, high quality habitat corridors (low cost distance). By understanding these processes, we can better evaluate the connectivity and viability of populations to inform reserve design and decision analysis for the species' conservation.

Presenter: Wu, Jianguo

Title: Landscape sustainability science: Coupling ecosystem services with human wellbeing in changing landscapes

Authors: Jianguo Wu (Arizona State University);

Session: Climate change and landscape sustainability of global drylands

Abstract: Landscapes and regions represent a pivotal scale domain for sustainable development, coupling influences from the national and global scales with actions on local scales. Landscape sustainability may be defined as the capacity of a landscape to consistently provide long-term, landscape-specific ecosystem services essential for maintaining and improving human well-being. Landscape sustainability science (LSS) then is a place-based, use-inspired science of understanding and improving the dynamic relationship between ecosystem services and human well-being in changing landscapes under uncertainties arising from internal feedbacks and external disturbances. While LSS emphasizes place-based research on landscape and regional scales, significant between-landscape interactions and hierarchical linkages to both finer and broader scales (or externalities) must not be ignored. To advance LSS, spatially explicit methods are essential, especially experimental approaches that take advantage of designed landscapes and multi-scaled simulation models that couple the dynamics of landscape services (ecosystem services provided by multiple landscape elements in combination as emergent properties) and human well-being. In this presentation, I will discuss the key concepts, research questions, and methods in LSS, and illustrate how to link ecosystems services and human wellbeing in drylands through cases studies.

Presenter: Xu, Xia

Title: Integrating global socio-economic influences into a regional land use change model for China

Authors: Xia Xu (State Key Laboratory of Earth Surface Processes and Resource Ecology);Yawei Cheng (State Key Laboratory of Earth Surface Processes and Resource Ecology);Xia Li (State Key Laboratory of Earth Surface Processes and Resource Ecology);Honglei Jiang (State Key Laboratory of Earth Surface Processes and Resource Ecology);

Session: Poster

Abstract: With rapid economic development and urbanization, land use in China has experienced huge changes in recent years; and this will probably continue in the future. Land use problems in China are urgent and need further study. Rapid land-use change and economic development make China an ideal region for integrated land use change studies, particularly

the examination of multiple factors and global-regional interactions in the context of global economic integration. We presents an integrated modeling approach to examine the impact of global socio-economic processes on land use changes at a regional scale. We develop an integrated model system by coupling a simple global socio-economic model (GLOBFOOD) and regional spatial allocation model (CLUE). The model system is illustrated with an application to land use in China. For a given climate change, population growth, and various socio-economic situations, a global socio-economic model simulates the impact of global market and economy on land use, and quantifies changes of different land use types. The land use spatial distribution model decides the type of land use most appropriate in each spatial grid by employing a weighted suitability index, derived from expert knowledge about the ecosystem state and site conditions. A series of model simulations will be conducted and analyzed to demonstrate the ability of the integrated model to link global socioeconomic.

Presenter: Yanez, Alfonso

Title: The SLEUTH Wizard: Python scripts to automate the SLEUTH urban growth model

Authors: Alfonso Yanez (Shippensburg University);Claire A Jantz (Shippensburg University);Tiernan Erickson (US Census Bureau);

Session: Poster

Abstract: SLEUTH (Clarke, Hoppen, and Gaydos 1997) is one of the more broadly applied models for the study of land use change and urban dynamics. When the model is being applied to a large region, it is often desirable to partition the study area into sub-regions, such as states, counties, or watersheds. This sub-regionalization greatly increases the workload, requiring the preparation of each sub-region's input data sets and run parameters and then evaluating multiple output files for each sub-region. To solve this problem, we developed two Python scripts that automate much of the workflow, saving time and minimizing user error. To use the scrips, the user must first have all of the base data sets prepared for the entire study area. The first script uses arcpy to extract the information for user-specified sub-regions (e.g. counties or watersheds) and then stores it in the correct format, using the correct naming convention, in a directory system that is ready to use for SLEUTH. The second script, called SWizard, is able to perform calibration, validation, and prediction automatically depending on the user needs. To demonstrate the SWizard capabilities, we applied SLEUTH to the continental United States, using counties as our sub-regions, at a resolution of 360m. Extracting the input data for 3,109 counties took 1 hour 6 minutes, while running SWizard on a single Linux desktop computer took 19 hours and 23 minutes. We were thus able to model urban land change for the entire continental US in less than 24 hours.

Presenter: Yang, Lei

Title: Linking landscape pattern and soil moisture in re-vegetation watersheds

Authors: Lei Yang (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Qindi Zhang (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Liding Chen (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Wei Wei (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);

Session: Arid Landscapes

Abstract: Soil water is a critical constrict factor to vegetation restoration in the arid and semi-arid Chinese Loess Plateau because of low rainfall and water scarcity. For decreasing soil erosion and improving environmental conditions, large-scale re-vegetation was initiated in this area in late 1990s. However, these activities may result in excessive water consumption and soil water deficit if no appropriate scientific guidance were offered. This in turn impacts significantly the regional ecological restoration and environmental improvement. In this study, 6 watersheds with different land use pattern were selected. Soil water content and its spatial variability in depth of 0-5 m were analyzed based on field observation and geostatistical method. The results showed that: (1) Soil water drastically decreased by introduced vegetation when compared with traditional farmland and native grassland. Introduced vegetation consumed excessive amount of soil water and induced temporally stable soil desiccation. (2) The analysis of differences in soil water for different land use patterns indicated that the land use had significant influence on soil water spatial variability. Soil water content at watershed scale increased with the increasing area of farmland, and decreased with increasing area of introduced vegetation. Land use pattern determined the soil water condition and its spatial variation at watershed scale. (3) Large-scale re-vegetation with introduced plants diminished the spatial heterogeneity of soil water at the watershed scale. The improvement of landscape management was suggested to improve the water management and maintain the sustainability of vegetation restoration.

Presenter: Yang, Hongbo

Title: Feedback effects of telecoupling: The case of a payment for ecosystem services program

Authors: Hongbo Yang (Center for Systems Integration and Sustainability, Michigan State University);Frank Lupi (Center for Systems Integration and Sustainability, Michigan State University);Jianguo Liu (Center for Systems Integration and Sustainability, Michigan State University);

Session: Landscape networks as telecoupled human and natural systems

Abstract: Over the last half century, remote rural areas are increasingly connected by telecouplings (i.e., environmental and socioeconomic interactions over distances) such as tourism, labor migration, and payments for ecosystem services (PES) programs. This trend has profoundly affected natural resource use in many rural areas and has generated complex effects on landscape changes around the world. However, existing literature rarely elucidates the feedback effects of telecouplings, e.g., how landscape changes caused by telecouplings will in turn strengthen or weaken the telecouplings themselves. Considering feedback effects is critically important for the design and management of telecouplings as feedbacks may generate unexpected outcomes. Ignoring them may lead to biased estimates of the long-term effects of telecouplings and information for management decisions. To address this knowledge gap, we used biophysical and socioeconomic data collected in China's Wolong Nature Reserve for giant pandas (Ailuropoda melanoleuca) to empirically evaluate the feedback effects of one of the largest PES programs in the world — the Grain-to-Green Program (GTGP), which converts crop land to forest land or grassland. We found the landscape changes in Wolong caused by GTGP have significantly intensified the local human-wildlife conflicts (e.g., crop raiding) on the remaining cultivated crop land. The intensified human-wildlife conflicts in turn have significantly increased people's willingness to participate in similar PES programs in the future to avoid more crop damage. Our findings suggest that evaluating telecouplings should properly quantify the feedback effects to achieve reliable results and design effective policy interventions.

Presenter: Yang, Shuncheng

Title: Public perception of smog: A case study in Ningbo City, China

Authors: Shuncheng Yang (Institute of Urban Environment, CAS);

Session: Poster

Abstract: Since 2011, most areas of China have been affected by smog. The occurrence of smog seriously lowers air quality, causes transportation risks, and harms public health. As a public environmental crisis, smog has mainly been studied with respect to its causes, alert systems, and prevention measures. However, in-depth research on the public perception of smog has

not yet been conducted. A survey of residents living around eight state-controlled atmospheric environmental monitoring sites was conducted using stratified sampling. The collected data was statistically analyzed to investigate people's perception and behavioral tendencies in smog weather, the influence of different media reports on public cognition, and public opinions on the local atmosphere and pollution management in different areas. The results showed that people's perception of smog differs greatly from actual conditions according to monitoring results, indicating that the public opinion tends deviate when faced with a public crisis. Mainstream media (TV, newspaper), accounting for 67% of the total media sources, hold a predominant position in the dissemination of smog information, whereas new media such as WeChat and microblogs, making up only 23% of the total media sources, occupy a relatively low position. The major sources of pollution according to the residents of Ningbo City are ranked in order of decreasing contribution as follows: motor vehicle exhaust, industrial coal combustion, large-scale construction, biomass burning, and kitchen fumes.

Presenter: Young, Brian D

Title: Modeling and mapping forest diversity within the boreal forest of interior Alaska

Authors: Brian D Young (Landmark College);John Yarie (University of Alaska Fairbanks);David Verbyla (University of Alaska Fairbanks);Falk Huettmann (University of Alaska Fairbanks);F. Stuart Chapin (University of Alaska Fairbanks);

Session: Machine Learning and Data Mining Applications in Land- and Seascape Ecology: What it is, Why it matters, and Where the Progress Still Sits

Abstract: Context. Patterns of forest diversity are less well known in the boreal forest of interior Alaska than in most ecosystems of North America. Proactive forest planning requires spatially accurate information about forest diversity. Modeling is a cost-efficient way of predicting key forest diversity measures as a function of human and environmental factors. Objectives. Investigate the patterns and processes in tree species and tree size-class diversity within the boreal forest of Alaska Methods. For the boreal forest of Alaska, USA, we employed Random Forest Analysis (machine learning) and the Boruta algorithm to predict tree species and tree size-class diversity for the entire region using a combination of forest inventory data and a suite of 28 predictors from public open-access data archives that included climatic, soil, distance, and topographic variables. We developed prediction maps for the current levels (Year 2012) of tree size-class and species diversity. Results. The method employed here yielded good accuracy for the huge Alaskan landscape despite the exclusion of spectral reflectance data. The results indicate that the geographic pattern of tree species diversity differs from the pattern of tree size-class diversity across this forest type. Conclusions. The results suggest that human factors

had a greater impact than ecological factors in predicting the patterns of diversity within the boreal forest of interior Alaska.

Presenter: Yu, Deyong

Title: Landscape sustainability: Mitigating and adapting to climate change in drylands via ecosystem service optimization

Authors: Deyong Yu (State Key Laboratory of Earth Surface Processes and Resource Ecology, Beijing Normal University);Ruifang Hao (State Key Laboratory of Earth Surface Processes and Resource Ecology, Beijing Normal University);Qian Cao (State Key Laboratory of Earth Surface Processes and Resource Ecology, Beijing Normal University);

Session: Climate change and landscape sustainability of global drylands

Abstract: Landscape sustainability means the capacity of a landscape to consistently provide long-term, landscape-specific ecosystem services essential for maintaining and improving human well-being (Wu, 2013). Ecosystem services are influenced by many factors, such as human preference, land use/cover change, and climate change. Current studies have shown that regional climate can be sensitive to even small changes in land surface. The degradation of ecosystem services is primarily resulted from a mismatch in scale between ecological processes and ecosystem management. However, existing studies have not sufficiently quantified the relationships and threshold features among ecosystem services. The Agro-Pastoral Transitional Zone (APTZ) of north China, locating in the semi- and dry areas, is especially sensitive to changing climatic conditions. Human-induced landscape modification within APTZ has been dramatic in recent decades, largely due to China's economic reform. Firstly, we develop an approach that integrates a constraint line model and threshold features to quantify the relationships between paired ecosystem services that can be used to detect the effects of land management schemes and natural factors on ecosystem services. Secondly, we detect the joint effects of climate change and land use/cover change on the ecosystem services during 2000-2014, especially in the areas where dramatic changes in ecosystem services occurred. Thirdly, we assess the impacts of land use/ land cover change on regional climate elements. Finally, we put forward a methodology to optimize the ecosystem services from the joint consideration of meeting human requirements, and meanwhile mitigating and adapting to climate change.

Presenter: Yue, Huanbi

Title: How did urban land expand in global drylands from 1992 to 2012？ A multi-scale landscape analysis

Authors: Huanbi Yue (Beijing Normal University,China);

Session: Poster

Abstract: Global drylands have experienced fast and extensive urban expansion over the last two decades, which has led to a number of environmental and ecological problems. Understanding the spatial and temporal characteristics of urban expansion in global drylands is important for protecting fragile habitats and improving dryland's sustainability. However, the dynamics of urban expansion in global drylands in recent years remain poorly understood, because of the difficulty in obtaining urban land information timely and accurately. Recent nighttime light data provide a consistent and comparable data source for extracting urban land information at a large scale. The main objective of this study was to quantify the spatial and temporal patterns of urban expansion in global drylands from 1992 to 2012. First, the urban land information was extracted from the nighttime light data. Then, urban expansion in drylands was analyzed at multiple scales, including the global, continental and national scales. Our results showed that urban land in global drylands increased from 127142 km2 in 1992 to 227936 km2 in 2012, with an annual growth rate of 2.96%. China is the world's largest country in urban land expansion in drylands, with an increase of 13543 km2. The annual growth rate of urban land in China's dryland was 7.53%, which was over twice the global average. In addition, more than half of the expanded urban land (57150 km2) were converted from grassland. Therefore, great attentions should be paid to the grassland habitat loss in global drylands due to the urban expansion.

Presenter: Zeller, Katherine A

Title: Sensitivity of resistance surfaces and corridors to landscape definiton

Authors: Katherine A Zeller (University of Massachusetts);Kevin McGarigal (University of Massachusetts);Samuel Cushman (USDA Forest Service);Paul Beier (Northern Arizona University);Winston Vickers (UC Davis Wildlife Health Center);

Session: Connectivity

Abstract: Resistance surfaces are often the building blocks for connectivity and corridor identification. Resistance estimation starts with how the landscape matrix between individuals or populations is represented. That landscape matrix may be defined using different variables represented at different spatial and thematic scales. Our interest is in determining how

sensitive resistance surfaces are to how the landscape matrix is defined. To assess we (1) use seven GIS predictor variables (roads, land cover, percent vegetative cover, elevation, slope, terrain ruggedness and percent imperviousness), (2) define these variables continuously and categorically, where possible, and (3) represent these variables at 5 different spatial grains (30m, 60m, 120m, 180m, 240m). We then sample from this suite of 300 predictor variables to create 1000 different resistance surfaces using puma (Puma concolor) data in a Path Selection Function framework. We compare the differences among these surfaces in a regression analysis to tease out which factors (layer choice, thematic representation or spatial scale) most strongly drive the sensitivity of resistance surfaces to landscape definition. We also use the AIC weights of the model variables to determine which variables and at what definitions are important for quantifying resistance for pumas in our study area. Finally we model corridors across a handful of resistance surfaces to assess how landscape definition may affect conservation decisions.

Presenter: Zhang, Jindong

Title: Animal activity characteristics is related to ecological landscape properties -a pioneering GPS collar study on giant pandas

Authors: Jindong Zhang (Center for Systems Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University);Vanessa Hull (Center for Systems Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University);Jinyan Huang (China Conservation and Research Center for the Giant Panda);Zhiyun Ouyang (State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-environmental Sciences, Chinese Academy of Sciences);Jianguo Liu (Center for Systems Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University);

Session: Wildlife I

Abstract: The exploration of behavioral characteristics driving the distribution of animals across their heterogeneous environments is a fundamental area of inquiry in landscape and behavioral ecology. However, poorly understanding of how the animals may be using different types of habitats associating with different behaviors or functions. We present an analysis of the relationship between individual animal activity and underlying habitat characteristics in the first GPS collar studies on the endangered giant panda (Ailuropoda melanoleuca). In this spatially-explicit analysis, we integrated remotely sensed imagery with GPS collar data on individual panda locations and activity (measured using activity sensors in GPS collar), we explored animals' activity characteristics across habitat properties at different saptiotemporal scale. We found that pandas were more active in core area than the periphery of the home range, pandas were more active on steeper slope, pandas were less active in higher elevation interval where distribute arrow bamboo (Bashania fangiana) with high nutrition, pandas were more active in

forest area than non-forest area, the activity level of pandas was decreased with solar radiation, there were significant interacted effects activity among environmental factors and season on pandas. This study has implications for appreciating the multi-faceted nature of habitat (i.e. habitat use, habitat selection and habitat suitability) in relation to behavioral minimalism of animals not only are pandas but also other wildlife.

Presenter: Zhang, Chi

Title: Climate change effect on the ecosystem productivity of the Central Asia dryland

Authors: Chi Zhang (Xinjiang Insitute of Ecology and Geography, Chinese Academy of Sciences);Shihua Zhu (Xinjiang Insitute of Ecology and Geography, Chinese Academy of Sciences);

Session: Climate change and landscape sustainability of global drylands

Abstract: More than 80% of world's temperate desert locates in Central Asia, a 517×106 km2 dryland that experienced strong warming and significant changes in precipitation pattern in the recent decades. The objectives of this study were to quantify spatiotemporal patterns of net primary productivity (NPP) in Central Asia over the past 36 years (1979-2014), and investigate the relative contribution and interactive effect of climate controls including temperature, precipitation, and CO2, using the Arid Ecosystem Model, which performed well in predicting the dryland ecosystems' responses to climate changes according to our evaluation. Our results showed the 36-year averaged annual NPP of Central Asia amounted to 1,125 Tg C yr-1, or 218 g C m-2 yr-1, with an overall declining trend of 0.71 g C m-2 yr-1. The northern Kazakhstan had relatively high NPP of 349 g C m-2 yr-1, while the southern Xinjiang of China had relatively low NPP of 122 g C m-2 yr-1. The Temperate Needleleaf Forest had the highest NPP of 558 g C m-2 yr-1. The Non-Phreatophytic Shrub had the lowest NPP of 158 g C m-2 yr-1. During the last 36-years, the NPP of the southern Xinjiang of China subregion declined significantly with a trend of 2.05 g C m-2 yr-1. Comparing the NPP of the 1985-2014 against the NPP of the 1980-1984, we found the regional NPP decreased 118 Tg, with positive contribution of 35.4 Tg from temperature change, positive contribution of 99.7 Tg from CO2 change, negative contribution of 221 Tg from precipitation change, and negative contribution of 5.7 Tg from the integrative effects from the climate factors. The temperature was the dominant factor on NPP in 8.3 % of the study area, mainly in the Tianshan mountain and northern Kazakhstan, where the temperature increased by 0.03 ℃ yr-1 from 1979-2014. Precipitation was the dominant factor on NPP in 66.8 % of the study area, mainly in the desert subregion and the dryland of southern Xinjiang of China， where the vegetation were limited by water stress.CO2 was the dominant factor on NPP in 18.2 % of the study area, mainly in the lower altitude regions of Tianshan mountain， where the hydrothermal condition was suitable for vegetation growth.

Presenter: Zhang, Xiaoyang

Title: Real-time monitoring of land surface phenology from polar-orbiting and geostationary satellites

Authors: Xiaoyang Zhang (South Dakota State University);Yunyue Yu (NOAA/NESDIS/);Lingling Liu (South Dakota State University);Dong Yan Yan (South Dakota State University);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Land surface phenology has been frequently characterized using time series of AVHRR and MODIS data. Recently, the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument on board the polar-orbiting JPSS satellite provides daily land surface observations in a timely fashion operationally. Moreover, next generation geostationary meteorological satellite sensors provide land surface observations every 15 minutes in real time, which include the Spinning Enhanced Visible and InfraRed Imager (SEVIRI) on Meteosat Second Generation (MSG) Satellites, Advanced Hiwawari Imager (AHI) on Hiwawari, and Advanced Baseline Imager (ABI) on Geostationary Operational Environmental Satellite R-Series (GOES-R, which will launch in October 2016). These satellites have the capability to monitor phenological development in near real time for assisting agriculture, natural resource management, and land modeling for weather prediction systems. Here we introduce an algorithm to monitor in real time and forecast in the short term phenological development based on daily VIIRS and 15-minute SEVIRI and AHI observations with one-day latency. The algorithm integrates a climatological land surface phenology and timely available satellite observations to simulate a set of potential temporal trajectories of greenness development at a given time and pixel. The greenness trajectories, which are qualified using daily and 15-minute two-band Enhanced Vegetation Index (EVI2), are applied to identify spring green leaf development and autumn color foliage status in real time and to predict the occurrence of future phenological events. We present here the results of monitoring vegetation development across the North America and Africa every three days.

Presenter: Zhang, Yonglin

Title: Urban landscape study in 360 degrees

Authors: Rencai Dong (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Yonglin Zhang (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Shanlin Li (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);Yuan Shen (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences);

Session: Poster

Abstract: City skyline is shown on the city in the horizon of urban space environment contour, and is also a vital landscape in the relationship between human and city. Moreover, the skyline is rooted in the urban environment of the formation and evolution, which is the product of the urban environmental development and shows the changes of urban landscape ecological factors.And the artificial construction elements are stacked in the landscape construction which impact on the urban environment. The traditional quantitative analysis of city skyline comes mainly from the psychology and visual impact analysis, giving an independent research of skyline spatial form, and using simple methods of digital expression for the coefficient of skyline sinuosity and layering. However, the traditional method directly cut off the natural links between skyline and urban landscape, which difficultly reflect the interactions between them. And this method only shows city skyline from single angle, scope and field, severely restricted the city landscape image acquisition as well as the quantitative research and analysis. In this paper, we adopted the 360-degree panoramic imaging system used in shooting city skyline, and proposed the research method of urban landscape in 360 degrees, to expand the traditional skyline information in a single direction to 360-degree circular skyline without any dead angles. According to the quantification and assessment of the skyline of fractal characteristics, we evaluated the fractal characteristics of the city skyline. Furthermore, we analyzed annular sinuosity and hierarchical coefficient of skyline. Proved by the experiment, the method in this study can make full 360-degree vision, with no dead angle, and can get any point for in situ skyline information in the city. Compared with the traditional method spatial scales were magnified by our method, either in the center of the city central business district (CBD) or the open space outside the city, will show a more comprehensive urban landscape image. Therefore, with greater advantages of multi-scale, comprehensive angle,large scope, and high resolution, the urban landscape in 360 degrees is better than the traditional urban landscape information acquisition and quantitative analysis methods.

Presenter: Zhao, Wenwu

Title: Pattern-process-service-sustainability: the changing landscape ecology

Authors: Wenwu Zhao (Beijing Normal University);

Session: Ecosystem Services II

Abstract: Landscape ecology focus on understanding the dynamics of ecological patterns and processes, and highlight the integration of multiple disciplines. Pattern-process-scale is the key research framework in landscape ecology for several decades. While, more and more global scientists are paying more attentions on ecosystems services and sustainability now. “Pattern-Process-Services-Sustainability” (PPSS) is becoming the new and key research framework in landscape ecology, and how to evaluate landscape service and sustainability may be the hot issues in the near future.

Presenter: Zhao, Yuanyuan

Title: Quantifying spatiotemporal patterns of ecosystem services across landscapes: China’s sandy lands

Authors: Yuanyuan Zhao (Beijing Forestry University);Jianguo Wu (Arizona State University);Chunyang He (Beijing Normal University);

Session: Climate change and landscape sustainability of global drylands

Abstract: Context The four mega-sandy lands (Hulunbeir, Horqin, Otindag, and Mu Us) are the most widespread and seriously desertified grasslands in China. Ecosystem services in these regions are of great value for improving human well-being. Objectives The main objectives of this study were to quantify the spatiotemporal patterns of ecosystem services across the sandy landscapes and explore the possible driving forces over the past fifteen years. Methods We estimated multiple ecosystem services including food and meat production, soil conservation, and carbon sequestration, using a revised wind erosion model and statistical methods based empirical data. Then the relationships between ecosystem services and main factors were investigated. Results We found a significant overall increase in ecosystem services in all sandy lands during the past 15 years. Changes in all ecosystem services were positively correlated with those in vegetation cover. Wind speed was significantly correlated with the soil conserved from wind erosion. However, the correlation strength varied among the four sandy lands, and ecosystem services and their dynamics exhibited large spatial heterogeneity across the study region. Conclusions Vegetation cover and wind speed interactively determine ecosystem functions and thus ecosystem services in these drylands. Vegetation coverage was a major determinant for the variations and spatial patterns of provisioning services. Both vegetation and wind speed played important roles in regulating soil erosion. To improve ecosystem services in drylands such as sandy lands, we need to adopt measures focusing on the major drivers and landscape heterogeneity.

Presenter: Zhao, Zhiqiang

Title: Spillover network of multiple telecouplings

Authors: Zhiqiang Zhao (Center for Systems Integration and Sustainability, Michigan State University);Jianguo Liu (Center for Systems Integration and Sustainability, Michigan State University);

Session: Landscape networks as telecoupled human and natural systems

Abstract: Spillover systems are the least understood components of telecoupled human and natural systems. Here we address spillover systems based on a recent integrated study which shows that there are multiple telecouplings between Wolong Nature Reserve in China (a high-profile nature reserve for the world-famous endangered giant pandas) and the rest of the world (Liu et al. 2015). Results show that those telecouplings have spillover effects on 67 other nature reserves for giant pandas. As the other nature reserves are also ecologically and socioeconomically connected directly and indirectly, they constitute a spillover network. Wolong has flows (of pandas, tourists, and information) with the spillover network and shares the supply of and demand for ecosystem services, conservation subsidies, and agricultural and industrial products. Through analyzing other components (agents, causes, and effects) of the spillover network under the telecoupling framework, we have found that there are a diverse set of agents, ranging from government agencies, reserve staff, non-governmental organizations, local residents, to researchers. The causes behind the spillover flows consist of several factors, such as the exceptional support for Wolong from the Chinese government and the international community. There are both socioeconomic and ecological effects, including community development, management skill improvement, and forest changes. This study contributes to a better understanding of the telecoupled world and has significant implications for reserve management and sustainability policy.

Presenter: Zhao, Feng Aron

Title: U.S. forest disturbance history from 1986 to 2010 observed from Landsat

Authors: Feng A Zhao (University of Maryland);Chengquan c Cheng (University of Maryland);Samuel N Goward (University of Maryland);

Session: Mapping spatiotemporal pattern and process: re-imagining arid grassland mapping from local to global scales

Abstract: As a core activity of the North American Carbon Program (NACP), the North American Forest Dynamics (NAFD) project is designed to produce a detailed assessment of forest dynamics over the U.S in a quarter century from 1986 and 2010 to better understand how forest disturbance and recovery modulate biosphere-atmosphere carbon fluxes. The NAFD study is enabled by the NASA Earth Exchange (NEX) collaborative computing facility, which provides massive computing and storage capacity, as well as convenient access to all required Landsat and ancillary datasets. This disturbance product provides detailed depictions of individual forest disturbance patches across the conterminous US for each year from 1986 to 2010. Over the 25 years analysis period (1986-2010), extensive regions of the US forests are disturbed one or more times. Nationally, the mean disturbance rate for the coterminous United States is calculated as 1.4+/-0.4% per year. The product has been validated using reference data derived using the TimeSync tool at sample locations selected from across the nation. Further analysis is being conducted to identify causal agent and to evaluate the impact of forest disturbance history on regional carbon budget.

Presenter: Zhou, Weiqi

Title: Mapping the “invisible” urban greenspace and change with high-resolution imagery: a comparative study of 9 Chinese cities

Authors: Weiqi Zhou (Research Center for Eco-Environmental Sciences,Chinese Academy of Sciences);Jing Wang (Research Center for Eco-Environmental Sciences,Chinese Academy of Sciences);Yuguo Qian (Research Center for Eco-Environmental Sciences,Chinese Academy of Sciences);

Session: Urbanization and Landscape Change: Socioeconomic Drivers and Ecological Consequences

Abstract: Quantifying the composition and configuration, and change of urban greenspace is crucial to understand the myriad ecosystem services provided by urban greenspace. Previous studies on urban greenspace changes have largely focused on loss of greenspace due to urban expansion, using medium resolution imagery. Here, we quantify the spatiotemporal patterns of greenspace in the highly urbanized areas of 9 major cities from two urban agglomerations, Beijing-Tianjin-Hebei and the Yangtze Delta region, China. We compare and contrast the changes in urban greenspace from 2005 to 2010 based on two different datasets, the most commonly used Landsat TM data with 30 m resolution, and 2.5 m high spatial resolution imagery. We found urban greenspace in all the 9 cities to be very dynamic, in contrast to

findings from previous research that greenspace in inner cities tends to remain largely unchanged. Such dynamics, however, could only be revealed by high spatial resolution imagery because medium resolution data, such as TM data greatly underestimated the percent cover of greenspace, as well as the change. The underestimate neglects smaller elements of greenspace as well as changes in configuration of larger patches, limiting the ability of TM data to detect such changes. Our results underscore the importance and necessity of using high spatial resolution data to adequately quantify the distribution of urban greenspace and its change, and thus the ecosystem services provided by urban greenspace. Results from this study have important implications for urban greenspace management and planning.

Presenter: Zimmerman, Emily K

Title: Linking ecology & economics: Spatially targeting for diverse ecosystem service outcomes in an agricultural matrix

Authors: Emily K Zimmerman (Iowa State University);Lisa A Schulte Moore (Iowa State University);John C Tyndall (Iowa State Unviversity);

Session: Ecosystem Services II

Abstract: Row-crop agricultural landscapes are highly productive with respect to the production of provisioning ecosystem services (ES), but neglect to deliver other increasingly more demanded regulating and cultural ES. This research investigates opportunities to help state and federal agencies explore options to enhance and diversify ES outcomes obtained from agricultural landscapes. We hypothesize that using a spatially targeted conservation approach to strategically implement best management practices (BMPs) on parcels of the landscape that disproportionately contribute to water quality concerns in a watershed can exact the greatest ecological benefits at the lowest economic costs, leading to the production of a broader suite of ES in agricultural landscapes. We use a two-stage modeling approach in an Iowa watershed to examine the concept. Using an innovative GIS-based, spatially-targeted conservation protocol developed by USDA-ARS (the Agricultural Conservation Planning Framework) coupled with the Agricultural Policy/Environmental eXtender (APEX), we assess the impacts on water quality from nutrient and sediment losses under current and alternative land management scenarios. Alternative land management scenarios were designed to assess land-use tradeoffs associated with efficient and cost-effective ES production at varying levels of strategic adoption of BMPs (i.e., random placement or coordinated placement of BMPs based on fields with highest vulnerability).We predict that relatively large reductions in nutrient and sediment loss at the watershed level can be achieved by coordinated placement of BMPs on relatively few, high-contributing parcels (>10% area), resulting in relatively high ES outcomes achieved at relatively low economic costs.

Presenter: Zuckerberg, Benjamin

Title: The emerging role of citizen science in capturing the geography of avian phenology

Authors: Benjamin Zuckerberg (University of Wisconsin);Eric J. Ross (USGS);William B Hills (University of Wisconsin);

Session: Phenology and Seasonality as Integrative Indicators of Ecosystem Health: Recent Developments and Prospects

Abstract: Changes in migration phenology have been a primary focus of recent work on ecological responses to modern climate change. The basis of migration phenology in birds relies on the analysis of time-series data and changes in phenological metrics, such as first arrival dates to breeding grounds, over time. Previous studies have found that many birds are responding to warming conditions in the Northern Hemisphere by arriving earlier. Using data from an international citizen science program, Project FeederWatch (PFW), we analyzed shifts in spring arrival of temperate migrants to their breeding grounds in the Upper Midwest (1990 to 2013), and the role of climatic and environmental conditions on their non-breeding grounds leading up to departure. We identified separate phenophases associated with migration (first and median arrival dates) and found that shifts in phenology are non-uniform across these different phenophases and driven by different environmental factors. Additionally, we explored the spatial distribution of patterns of first arrival and how these change over time. Our results suggest that different environmental drivers can drive complex shifts in the arrival distribution of migrants with important implications for the spatiotemporal dynamics of phenomena such as phenological mismatches. Our findings emphasize the power of citizen science in quantifying the spatiotemporal characteristics of avian migration.

US-IALE 2016 Conference Abstracts

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K. Riitters
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