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US - IALE

**25th Annual Landscape Ecology Symposium
Is What Humans Do Natural?
Athens, GA | April 5-9, 2010**

ABSTRACTS

1. Vertex centrality predicts patch occupancy and dynamics in a directed spatial network

Authors: **ACEVEDO**, Miguel, University of Florida; Robert Fletcher, University of Florida
Offered Presentations: Network Theory - Thursday, April 8: 1:40-2:00 - Q

Abstract: Landscape connectivity has been identified as one of the most important factors affecting the movement of genes and individuals at different spatial and temporal scales. Graph theory has been recently proposed as an effective way to measure landscape connectivity. We used a graph-theoretic approach to test whether vertex centrality (i.e. connectivity of each patch relative to others in the graph) is able to predict patch occupancy and dynamics in directed spatial network. We described the Lepanthes rupestris orchid metapopulation as a directed graph in which patches (boulders and trees) are represented as vertices while the connection between patches are represented by edges. The dataset includes >900 occupied and unoccupied patches that have been surveyed more than 17 times. Lepanthes rupestris is an endemic orchid to the island of Puerto Rico that lives along rivers in the mountains. It is wind dispersed with an average dispersal distance of 5m. We used wind direction and the average dispersal distance to construct the directed network. We found that two vertex centrality measures, degree and graph strength, significantly predicted patch occupancy and dynamics, and that directed graph descriptions of landscape connectivity provided better explanatory power than undirected ones. While metapopulation theory has long emphasized how patch characteristics influence patch occupancy and dynamics, our application of directed graphs further refines our ability to understand (and predict) the role of patches in a spatially explicit context.
Keywords: graph theory, Lepanthes, metapopulations, patch dynamics, spatial networks

3. Impacts of land use change in tropical rainforest ecosystem, Ondo State, Nigeria on forest landscape, rural livelihood and soil properties

Authors: **ADEKUNLE**, Victor, Federal University of Technology, Akure, Nigeria
Offered Presentations: Resource Management I - Tuesday, April 6: 2:00-2:20 - K-L

Abstract: This study examined the effects of land use change in a tropical rainforest ecosystem on forest landscape, rural livelihood and soil physical, chemical and biological properties. The study was carried out in a Strict Nature Reserve (SNR) and Gmelina arborea and Tectona grandis plantations located in Akure forest reserve. While tree species identification were carried out in randomly located four one-hectare plots in the SRN, composite soil samples were collected from the three different forest types at two depths. The soil samples were taken to the departmental laboratory for analyses. Data were also collected with well-structured questionnaire administered on 50 randomly selected household head in six rural communities around the forest. There are 393 trees/ha, belonging to 72 tropical hardwood species, in 28 families in the SNR, The most abundant species was Pterygota macrocarpa, Sterculiaceae family had the highest number of species. Shannon-Wiener diversity index and evenness are 3.34 and 0.82 respectively. All essential nutrients were present in the soil samples in different proportion with significantly higher values ($p<0.05$) for SNR. Twenty-three species of bacterial and twelve of fungi were isolated in the SNR. The most occurred bacterial species was Pseudomanas syringage (2.28 x 106) and Clostridium sporogenes had the lowest number of occurrence (0.37 x 106). For fungi, Mamaria echinobotryides had the highest population (0.41 x 102) while Varicoloporium elodeae had the lowest population of 0.02 x 102. Majority of the respondents were male, household heads and breadwinners. Their major occupation is farming and the major source of farmland for crop production is through taungya agroforestry system. There is economical, social, ecological and environmental contributions of the forests to rural dwellers. They are involved in the

conservation and maintenance of the SNR and the plantations by cleaning the boundaries and footpaths and guarding the forests.

Keywords: forest Reserves, Fungi, nutrient status, Rural livelihood, Strict Nature Reserve

4. Future challenges for US-IALE, Jack Ahern, Chair 1998-2000

Authors: **AHERN**, Jack, UNIVERSITY OF MASSACHUSETTS

Invited Symposium: US-IALE Presidents' Symposium I - Tuesday, April 6: 11:40-12:00 - Masters Hall

Abstract: I became involved with US-IALE explicitly because of its interdisciplinary nature and applications focus. I believe that I was elected as US-IALE Chair to direct planning and programs to strengthen these defining characteristics. During my tenure as chair I worked to expand communications, to engage more academics and professionals from the applications discipliners and professional fields, and to strengthen international collaborations with IALE. Some 10 years later, I see new challenges and opportunities ahead. US-IALE is poised for leadership in the scholarship and practice of sustainability - deriving, in large part from its fundamental focus on landscape pattern:process dynamics. Our empirical and modeling research will continue to build a robust foundation for practitioners to base informed actions and decisions. In a context of increasing uncertainty and dynamics, landscape ecology can help to build the capacity to think – and act – adaptively, promoting learning-by-doing, and safe-to-fail design experiments. The challenge to bring "landscape" theory, methods and knowledge to urban environments, is critical in this century of urbanization. Resilience is increasingly understood as the fourth dimension of sustainability. Under a non-equilibrium view of the world, particularly an urban world, the capacity to recover from disturbance is fundamental to sustainability. Advancing and applying resilience theory to build resilience capacity is, arguably, the fundamental challenge for the global quest for sustainable conditions. Landscape ecology has reached a level of intellectual maturity at which it is prepared for these challenges.

Keywords: adaptation, resilience, uncertainty, urbanization

5. Measuring boundary convexity at multiple spatial scales using a linear "moving window" analysis: an application to coastal river otter habitat selection

Authors: **ALBEKE**, Shannon, University of Georgia; Nathan Nibbelink, University of Georgia; Lan Mu, University of Georgia; Daniel Ellsworth, University of Texas

Offered Presentations: Technological Innovation - Thursday, April 8: 4:40-5:00 - Q

Abstract: Landscape metrics have been used to quantify ecological patterns and to evaluate relationships between animal presence/abundance and habitat at multiple spatial scales. However, many ecological flows occur in linear systems such as streams, or across patch/landscape boundaries (ecotones). Some organisms and flows may depend on the boundary shape, but metrics for defining linear boundary characteristics are scarce. While sinuosity and fractal dimension address some elements of shape, they fail to specify the dominate shape direction (convexity / concavity). We propose a method for measuring boundary convexity (BC) and assess its utility, along with sinuosity and fractal dimension, for predicting site selection by coastal river otters. First, we evaluate the characteristics of BC using a hypothetical boundary. Second, to compare convexity with other linear metrics BC, sinuosity and fractal dimension were calculated for the coastline of a set of islands in Prince William Sound, AK. Finally, we use logistic regression in an information-theoretic framework to assess site selection of river otters as a function of these linear metrics. Boundary convexity, fractal dimension and sinuosity are

relatively uncorrelated at all scales. Otter latrine sites occurred at significantly more convex locations on the coastline than random sites. Using logistic regression and convexity values at the 100 meter window-size, 69.5% of the latrine sites were correctly classified. Coastal terrestrial convexity appears to be a promising landscape-scale metric for predicting otter latrine sites. We suggest that boundary convexity may be an important landscape metric for describing species use or ecological flows at ecotones.

Keywords: Boundary shape, Convexity, ecotone, habitat selection, patch metrics

7. Effects of landscape change on the transmission of tick-borne diseases in the southeastern United States

Authors: **ALLAN**, Brian, Washington University, Tyson Research Center; Lisa Goessling, Washington University; Robert Thach, Washington University; Jonathan Chase, Washington University

Offered Presentations: Invasion I - Tuesday, April 6: 2:20-2:40 - Y-Z

Abstract: Human alteration of natural landscapes can create hotspots for emerging zoonotic diseases through a complex pathway of ecological interactions between hosts, vectors, and their environment. Here, we examine the impacts of human-mediated landscape change in the Saint Louis, Missouri region, on the emergence of several bacterial pathogens (e.g., Ehrlichia spp., Borrelia lonestari) transmitted by the lone star tick (Amblyomma americanum). Utilizing a natural gradient in human disturbance in the Saint Louis metropolitan region, we implemented a combination of field- and laboratory-based approaches to assess the effects of landscape change in this region on the abundance of ticks and their vertebrate hosts, tick infection rates with pathogens, and the distribution of tick bloodmeals among vertebrate host species. We found a positive relationship between the abundance of lone star ticks and white-tailed deer (Odocoileus virginianus), the preeminent host for all three life stages of this tick species. We also found a unimodal relationship between the density of white-tailed deer and Geographic Information System (GIS)-based estimates of the percent forest cover associated with our study sites. Further, the density of lone star ticks was similarly related to percent forest cover, indicating a potential indirect mechanism by which landscape change may alter the abundance of ticks in this region via the response of a key vertebrate host. Finally, for a subset of these sites, we determined the prevalence of lone star tick-associated pathogens and thereby calculated the density of infected ticks. We found a unimodal relationship between the density of infected ticks and percent forest cover, suggesting that intermediate levels of forest cover are correlated with high human risk of exposure to tick-borne diseases. Our results indicate that the potential impact of tick-borne diseases on human health should be incorporated in landscape planning decisions in this emerging hotspot for vector-borne pathogens.

Keywords: GIS, landscape change, pathogens, ticks, white-tailed deer

9. Effective Planning for Sea Level Rise in Coastal Georgia with Diverse and Novel Visualization Methods

Authors: **ALLEN**, Hunter, Center for Remote Sensing and Mapping Science, UGA; Timothy Carter, Center for Urban Ecology, Butler University; Dean Hardy, River Basin Center, University of Georgia

Offered Presentations: Climatic Influences II - Tuesday, April 6: 4:20-4:40 - R

Abstract: As population growth continues in the coastal zone, it becomes increasingly important for coastal communities to address the risks associated with climate change and sea level rise as

more populated areas are exposed to these threats. When conveying various, complex information about a coastal area's vulnerability to current and future sea level rise, the efficacy of communication becomes increasingly important. In addition, public outreach related to this issue often involves individuals who have important roles in shaping the future outcomes of development in coastal areas and who also may have little or no skill with standard GIS maps or model output. This study bridges the gap between concerned parties, scientists and planners using novel methods for communicating various modeling scenarios, vulnerability maps, and mitigation plans on the coast of Georgia. Georgia contains a fragile estuarine ecosystem supporting one-third of the remaining salt-marsh along the Atlantic coast and Georgia's shallow coastal shelf exacerbates vulnerability from rising sea levels. Using Sea Level Affects Marsh Model (SLAMM) 5.0.1, future coastal growth patterns and prioritized conservation areas, we created state-wide visualizations that quantify effects of sea level rise on coastal marshland. Additionally, we identify high priority areas where development should be limited to allow for upland migration of the salt marsh. We used a diversity of output media for these visualizations ranging from interactive 2D maps, animations, integration of model outputs with Google Earth, photorealistic geovisualization and web-based applications to communicate our results with coastal stakeholders. Additionally, these results were disaggregated for use at the county level as well to inform how sea level rise models and visualizations can be adapted to local community needs and planning time horizons.
Keywords: coastal planning, geovisualization, public outreach, sea level rise, SLAMM 5.0.1

10. The city bird and the country bird: how does urbanization affect West Nile virus exposure in wild songbird communities?

Authors: **ALTIZER**, Sonia, Odum School of Ecology, University of Georgia; Catherine Bradley, Fisheries Resources, Nez Perce Tribe, Idaho

Invited Symposium: Pathogens in Heterogeneous Landscapes - Wednesday, April 7: 10:00-10:20 - Masters Hall

Abstract: Urbanization is widespread, intensifying globally, and will likely influence the prevalence and impact of both human and wildlife pathogens. In this study, wild songbird populations were sampled in replicate forest patches representing an urban-rural gradient in the greater Atlanta area (Georgia, USA) area and tested for antibodies to West Nile virus (WNV). The level of urbanization among sites was quantified using GIS-derived landscape variables. Results showed that WNV antibody prevalence increased with greater measures of urbanization, and was most strongly associated with reduced core forest area measured at the largest (1km radius) spatial scale. Furthermore, antibody prevalence among Northern Cardinals (Cardinalis cardinalis) was significantly higher than in other songbird species along the urban gradient. Because lower antibody prevalence in more rural areas could be caused by the 'dilution effect,' whereby vector-borne transmission is reduced by a high diversity of birds that are poor amplifying hosts for WNV, we examined the association between urbanization, avian community composition and WNV. Results showed that total passerine abundance and a composite measure of functional diversity based on the ability of host species to amplify WNV were the strongest indicators of WNV exposure across sampling locations. Importantly, avian community diversity increased and host community competence decreased with greater core forest area at each site. Our results support the idea that urbanization influences factors that underlie WNV transmission, and point to a role for the conservation of core forest habitat as a

management tool in reducing WNV risk.
Keywords: avian ecology, Infectious disease, urbanization, Vector-borne disease

11. Are conservation benefits offset by natural disasters? The case of the May 12, 2008 Wenchuan Earthquake (China)
Authors: **ANDRES**, Vina, Michigan State University; Chen Xiaodong, Michigan State University; Liu Wei, Michigan State University; McConnell William, Michigan State University; Xu Weihua, Chinese Academy of Sciences; Ouyang Zhiyun, Chinese Academy of Sciences; Liu Jianguo, Michigan State University
Offered Presentations: Disturbance I - Tuesday, April 6: 1:40-2:00 - F-G

Abstract: Conservation actions are becoming more widespread around the world in order to stem ecological degradation. However, natural disasters can offset the benefits obtained through these efforts. On May 12, 2008 an earthquake struck with its epicenter located in Wenchuan county, China. In addition to dramatic loss of human life and extensive destruction of infrastructure, the earthquake induced the formation of landslides that damaged many forest areas. Through a comparison of satellite imagery acquired before and after the earthquake, we analyzed the amount and distribution of the forest areas damaged. Earthquake-induced landslides affected more than 10% of the forests in the study area. However, less than 10% of the benefits (in terms of forest recovery and avoided forest loss) obtained from the implementation of two national conservation policies designed to protect and restore the forests of China (the National Forest Conservation Program and the Grain-to-Green Program) were overturned. Moreover, the combined effects of human disturbance and the earthquake-induced landslides would have been devastating to the forests in the region, without the implementation of these conservation programs. But actions oriented towards the socioeconomic recovery of the region could induce further forest cover losses that could weaken the conservation of forests in the region. Therefore, the implementation of conservation actions not only needs to continue but also intensify in order to reduce the impacts of the combined effects of human disturbance and natural disasters, not only in the study area but also in many other biodiversity hotspot areas that overlap with hotspots of tectonic activity around the world.
Keywords: Conservation, Forest Cover Dynamics, Natural disasters, Wenchuan earthquake

12. Idiosyncratic responses of Pacific salmon species to land cover, fragmentation, and scale
Authors: **ANDREW**, Margaret, Canadian Forest Service; Michael Wulder, Canadian Forest Service
Offered Presentations: Fragmentation - Wednesday, April 7: 10:20-10:40 - Y

Abstract: Salmon are critical to the ecology and livelihood of the Pacific Northwest, and are declining throughout much of their range. Freshwater conditions contribute in large part to population trends. Due to the connecting nature of streams, salmon are strongly influenced by the characteristics of terrestrial systems. We analyzed the relationships between the population trends of Pacific salmon (1953-2006) and land cover, fragmentation, and forest age derived from remotely-sensed, national level datasets. Analyses included 425 populations of all native salmon species in 156 watersheds on Vancouver Island, British Columbia, Canada. Escapements were corrected for temporal variation in marine survival and the resulting trends were related to landscape variables at watershed and riparian scales with regression trees. Results were species specific. Chum and coho had strong negative relationships with fragmentation, pink had a strong positive relationship with wetland abundance, and Chinook and sockeye were most closely

related to geomorphology. There was no "single best" scale of analysis. Efforts to restore salmon habitat will be complicated by processes occurring throughout watersheds and the idiosyncratic requirements of each species.

Keywords: forest pattern, GIS, Oncorhynchus spp., remote sensing

13. Using individual-based modeling to investigate the influence of landscape variables on persistence of gopher tortoise populations

Authors: **ANDREWS**, Kimberly, Savannah River Ecology Lab; Tracey Tuberville, Savannah River Ecology Lab; James Westervelt, U.S. Army ERDC-CERL; John Macey, Ft. Stewart Military Installation; Larry Carlile, Ft. Stewart Military Installation

Poster #45: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria

Abstract: Population viability analysis (PVA) is often used to predict the effects of proposed management actions or of future landscape changes on target species. Unfortunately, PVA requires detailed life history data, which are often lacking for rare species, particularly long-lived species such as the gopher tortoise (Gopherus polyphemus). In some cases, however, the natural history and individual behavior of the target species is well-characterized. Using data published in the literature, we developed a spatially explicit individual behavior model (IBM) for gopher tortoises using the program NetLogo, and we illustrate how we apply it in a theoretical landscape. By tracking the behavior of many individuals over time, population-level dynamics can emerge. We conducted model simulations under a range of landscape conditions that varied in patch size, distance between patches, and patch quality to examine the effects of these landscape variables on persistence of gopher tortoise populations. Our results from the individual-based modeling will be used to make management recommendations and will be compared to minimum reserve requirements developed using other analytical techniques and from field data reported in the literature.

Keywords: behavior, gopher tortoise, individual-based model, NetLogo, population viability

14. What is natural in Louis XIV's "Manière de montrer les jardins de Versailles"?

Authors: **ASSAF**, Francis, University of Georgia - Dept. of Romance Languages

Offered Presentations: Landscape Aesthetics I - Tuesday, April 6: 3:20-3:40 - K-L

Abstract: Louis XIV wrote five times his guide to the gardens of Versailles, "Manière de Montrer les Jardins de Versailles", the last time in 1705. This very short text (1344 words) is divided in 25 sections, which constitute a guide to viewing optimally the gardens he had spent decades organizing, enlarging, and embellishing with fountains, statues, and geometrically-ordered flowers, trees and greenery. When viewing the gardens, the first thing that comes to mind is not necessarily unfettered nature, but a sense of order, organization, and the imposition of one man's will over the natural realm. Yet nature is present everywhere, whether the water fountains, the richly-colored flower beds, or the majestic alleys lined with trees. I shall endeavor, in my talk, to present both elements: the artificial and the natural, that make the gardens of Versailles the wonder that they are to this day.

Keywords: Gardens, Louis XIV, Nature, Versailles

15. Looking Back and Looking Ahead: Reflections of a Past Chair of US-IALE

Authors: **AUGUST**, Peter, University of Rhode Island

Invited Symposium: US-IALE Presidents' Symposium II - Tuesday, April 6: 2:00-2:20 - Masters Hall

Abstract: I inherited a strong organization from past-Chair Eric Gustafson and enjoyed every moment serving the society during my tenure from 2004 to 2006. It is difficult to highlight individual events of importance or excitement during my term because there were so many. I was inspired by the enthusiasm among our student members and was proud of the activities that US-IALE sponsored to advance the professional development of tomorrow's landscape ecologists. I am proud of the work that we did with the web team to create a strong web presence for the organization and to use it to provide value to our membership. Engaging a professional conference coordinator to provide logistic support when local hosts do not have the capacity to do so was important because it strengthens our "corporate memory" and relieves US-IALE of the burden of complex business negotiations associated with hosting our annual conference. Looking ahead, the opportunities and challenges for US-IALE are considerable. IALE has the opportunity to be unique among its peer organizations; we aspire to serve the community of scientists/scholars AND practitioners. We are doing a wonderful job of engaging scientists and the caliber of scholarship coming from US-IALE is impressive. We have not succeeded in fully engaging practitioners. We must make US-IALE meaningful to people who manage landscapes – state and federal resource managers, NGO conservationists, and landscape planners. In addition, IALE is unique in that it uses science to discover how landscapes work and engages the planning and design communities to use this knowledge to protect and create functional landscapes. To be successful, US-IALE must provide a space where the science and design communities can engage, share, debate, and learn in an atmosphere of respect and excitement. Creating and maintaining a fertile ecotone between these disciplines is an opportunity unique to US-IALE.
Keywords: Design, future, Multidisciplinary, planning, science

16. Using landscape metrics to quantify the impact of stress caused by Diuraphis noxia within wheat fields.
Authors: **BACKOULOU**, Georges, Oklahoma State University; Norm Elliott, USDA-ARS; Kristpher Giles, Oklahoma State University
Offered Presentations: Agrarianism II - Wednesday, April 7: 10:00-10:20 - R
Abstract: The Russian wheat aphid, Diuraphis noxia, is an important pest of winter wheat, Triticum aesticum, and barley, Hordeum vulgare that caused an economic loss estimated at over one billion dollars since it first appeared in the United States in 1986. The objective of this study was to determine the potential of combining multispectral imagery with spatial pattern recognition to identify and spatially delineate D. noxia infestations in wheat fields. Multispectral images were acquired using an MS3100-CIR multispectral camera. Stress observed within wheat fields was grouped into categories: D. noxia, drought and cultural issues, which encompassed the major types of stresses, present within fields. ERDAS Imagine software was used to process and analyze images, and FRAGSTATS was used to quantify spatial pattern. Seven metrics were computed for each stress factor. The analysis of metrics quantitatively differentiated the three types of stress. Detection and differentiation of wheat field stress may help in mapping stress and may have implications for site-specific monitoring systems to identify D. noxia infestations and pesticide applications.
Keywords: Diuraphis noxia., metrics, multispectral imagery, plant stress, remote sensing

17. A new method for detecting biodiversity and ecological community thresholds
Authors: **BAKER**, Matthew, University of Maryland-Baltimore County; Ryan King, Baylor University

Offered Presentations: Technological Innovation - Thursday, April 8: 3:20-3:40 - Q

Abstract: Despite their importance to ecology, conservation biology, and biomonitoring, species abundance data present a series of analytical challenges when used for identification of ecological thresholds along environmental gradients across space and time. All threshold estimates depend upon the assumed shape of the response and appropriateness of the corresponding statistical model. Due to highly variable abundances and low occurrence frequencies of individual taxa, most investigators reduce multidimensional community responses to univariate metrics (e.g., number of taxa), multivariate distance measures among samples, or multimetric indices. We perform several simulations to illustrate that summarizing community structure into a single value for each sample unit can result in a misleading response metric that can bias or even obscure underlying threshold behavior. We demonstrate that apparently weak, linear, or wedge-shaped responses of communities to anthropogenic gradients may be an artifact of combining taxa with different types of response curves, and by distinguishing these responses prior to combining data, synchronous threshold declines of multiple taxa become evident. We suggest that the apparent mismatch between idealized definitions of community thresholds and current analytical tools underscores the need for approaches that address the unique nature of ecological community data. We recommend that threshold estimates be developed by aggregating signals of individual taxa rather than seeking signal in aggregate measures. Such measures need to quantify and communicate uncertainty in both the environmental change point and the magnitude of ecological change. We introduce Threshold Indicator Taxa Analysis (TITAN) as a new analytical method that addresses these concerns and illustrate its application as an exploratory tool.
Keywords: biodiversity, Communities, Ecological Thresholds, Gradients, Statistics

18. Reconstruction of historical structure of ponderosa pine landscapes shows their heterogeneity

Authors: **BAKER**, William, Univ. of Wyoming, Program in Ecology & Dept. of Geography; Mark Williams, Univ. of Wyoming, Program in Ecology & Dept. of Geography

Offered Presentations: Restorative Ecology - Thursday, April 8: 11:20-11:40 - Y-Z

Abstract: Spatial variability in the historical structure of landscapes is poorly known in the western United States. Only limited information is available, largely from scattered plot-based reconstructions and qualitative historical records, hampering landscape restoration efforts. We use new methods to reconstruct forest-structure parameters (tree density, basal area, composition, and diameter distributions) using data in the General Land Office (GLO) survey notes from the late-1800s across 925,000 ha of ponderosa pine forests in two parts of the Mogollon Plateau, Arizona, the Blue Mountains, Oregon, and part of the Colorado Front Range. These reconstructions show that median tree density (> 10 cm diameter) was 124 and 136 trees/ha on the Mogollon Plateau, 146 trees/ha in the Blue Mountains, and 162 trees/ha in Colorado. About 11% and 15% of these landscapes in Arizona, 23% in Oregon, and 29% in Colorado had tree density > 200 trees/ha, more than twice as high as reconstructed in the past. The reconstructions show that these landscapes were not uniformly dominated by large trees. The percentage of small (< 30 cm diameter) coniferous trees (excluding junipers, piñons) was 15% and 33% on the Mogollon Plateau, 31% in Oregon, and 74% in Colorado, based on 19,812 recorded trees. In Colorado and Oregon, areas of abundant tree regeneration and dense shrubs were common. In general, forest structure was commonly spatially heterogeneous. Expanses of lower tree density occurred, but included dense patches, openings, and areas of scattered trees. Large expanses of dense forests also occurred. These reconstructions suggest that the common restoration paradigm

of thinning dry forests to low density by removing small trees warrants reconsideration. Landscape reconstructions using the GLO survey data can provide a quantitative basis for restoring the substantial heterogeneity in forest structure that historically characterized these dry forest landscapes in the West.
Keywords: historical, ponderosa pine, public-land survey, reconstruction, restoration

19. Using occupancy modeling to estimate species richness and determine the effects of exurbanization in the Southern Appalachian Mountains
Authors: **BARLOW**, Paige, University of Georgia; Jeff Hepinstall-Cymerman, University of Georgia; Myung-Bok Lee, University of Georgia
Poster #43: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: The Southern Appalachian Mountains are a biodiversity hot-spot and influence water quantity and quality throughout the Southeast. Research at the Coweeta Long Term Ecological Research (LTER) site has addressed regional ecology for many decades, and a current focus of Coweeta LTER is on the effects of land use. While traditionally forested and agricultural, this region is undergoing amenity-driven exurbanization. The effects of this development on the biodiversity of Southern Appalachia and the response of regional decision-makers have not yet been determined. However, previous research conducted across rural-urban gradients has shown that changes in land use and land cover affect avian species richness. We present results from a pilot study surveying bird species at 37 sites across a range of land uses and land cover classes around Coweeta. Several occupancy models were fit to these data, but the occupancy model with detection probability influenced by time was most suitable. Species richness was estimated for each of the 37 sites, and we are currently identifying significant environmental covariates. Beginning in the summer of 2010 we plan to expand the avian sampling and occupancy modeling. Further, the bird data, along with data on salamander and fish occupancy, will be used to develop a series of predictive occupancy models for the Southern Appalachian region. These models will be validated and modified in subsequent field seasons. Throughout this project, stakeholders from the region will be involved, and the goal for our final research product is to assist regional land planning and resource management.
Keywords: exurbanization, land use, Occupancy model, Southern Appalachian Mountains, species richness

21. Evaluating the spatiotemporal dynamics of ecosystem services using historical land cover data
Authors: **BATTISTA**, Bartholomew, University of Hawaii; Christopher Lepczyk, University of Hawaii; Daniel Rutledge, Landcare Research
Poster #26: Sustaining Systems - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Ecosystem services are increasingly being proposed as a new approach for conservation and management of landscapes. Understanding historical trends in provisioning capacity can provide a basis for land managers to incorporate ecosystem services into their management plans. This will require new tools to help characterize, quantify, and map both historic trends and future scenarios. We have developed a conceptual framework that analyzes spatial and temporal changes of specific ecosystem services, and allows managers to qualitatively assess current provisioning of these services compared to historical levels. Land cover maps for five time steps from the 1930s to the 1990s for the Huron River Watershed, Michigan, USA, were assessed for flood disturbance regulation, carbon storage, and biodiversity

refugia. We derived ecosystem service indicator metrics from the California Rapid Assessment Method for Wetlands for flood disturbance regulation, a low/med/high assessment for carbon storage capacity, and landscape metrics of non-urbanized terrain for biodiversity refugia. The analysis indicates marked changes in provisioning capacity with changes in land cover over time. Our methodology is of notable importance as it is the first spatiotemporal analysis of ecosystems services derived from historical data and because it allows land managers to identify such things as hotspots of ecosystem service in order to make informed decisions on conservation, restoration, and development
Keywords: biodiversity, carbon, Ecosystem Services, spatiotemporal mapping, wetlands

22. Habitat prioritization for the golden-cheeked warbler (Dendroica chrysoparia) in Central Texas, USA
Authors: **BELAIRE**, AMY, UNIVERSITY OF ILLINOIS AT CHICAGO; DEAN URBAN, DUKE UNIVERSITY
Offered Presentations: Network Theory - Thursday, April 8: 2:20-2:40 - Q
Abstract: Conservation planning requires a thorough and thoughtful examination of the landscape to achieve conservation goals as efficiently as possible in the face of limited financial resources. We examined the conservation opportunity for Golden-cheeked Warbler (Dendroica chrysoparia) habitat represented by the initiation of the Fort Hood Recovery Credit System in the area immediately outside the boundaries of Fort Hood, Texas, USA. To aid in the conservation planning process, we identified and delineated areas of Golden-cheeked Warbler habitat within 15 km of Fort Hood using a Geographic Information System (GIS). We determined habitat patch values with respect to area, quality, and connectivity. Calculations for the area and quality metrics were straightforward using GIS. We used graph theory in the connectivity portion of this analysis, to examine the relationships among patches in the context of the surrounding landscape. We assessed four aspects of connectivity using graph theory: (1) source/sink strength of each patch, (2) change in landscape traversability with patch removal, (3) the centrality (betweenness) of each patch, and (4) patch connection to important habitat areas within Fort Hood. The result of this analysis was a set of values (area, effective area, and four connectivity metrics) to accompany each patch identified in the region surrounding Fort Hood. This information can help guide the conservation planning process in the face of financial constraints and varying levels of landowner cooperation. This approach can be extended readily to other species and in other regions, providing a general toolkit for conservation planning that is sensitive to the spatial context of candidate sites.
Keywords: BIRD, connectivity, graph theory, network, SITE PRIORITIZATION

24. Landscape Change within the Eastern Terai, India – linking Grassland Loss, Deforestation, Agricultural Expansion, Tea Industry, and Species Conservation
Authors: **BISWAS**, Tanushree, Utah State University; R Douglas Ramsey, Utah State University; John A Bissonette, Utah State University; Juergen Symanzik, Utah State University
Offered Presentations: Agrarianism I - Tuesday, April 6: 11:40-12:00 - Q
Abstract: Landuse-land cover change was examined at two spatial extents within the Eastern Terai, India using multi-temporal satellite imagery from 1978 to 2006. The landscape extent, which included the Alipurduar Subdivision of Northern Bengal, percent area of forest reduced from 35% in 1978 to 22% in 2006. Forests were primarily replaced by cropland and tea estates. Within the Jaldapara Wildlife Sanctuary, the local scale of this study, the period of greatest

change occurred between 1978 and 1990. Within this sanctuary, grassland, the second most dominant land cover type, reduced from 20% in 1978 to 18% in 2006. The small amount of change is significant for such a small area, but more significantly, grasslands in one location of the sanctuary were replaced by grasslands in another location due to a significant diversion of the primary river channel, whose annual flooding maintains local grass communities. Mean rate of loss of forest and grassland equaled 78.8 ha/year and 34 ha/year, respectively inside the sanctuary as opposed to 1,685.6ha /year and 351.7ha/year outside (Alipurduar). Inside the sanctuary, areas were more likely to be converted to cropland (13.7 ha /year) than to tea estates (9.7 ha/year). Outside the sanctuary, area under tea estates and cropland increased at the mean rate of 1,056.7 ha/year and 298.3 ha/year, respectively. Within Jaldapara, seasonal monsoon driven flooding was the primary driver of change. At the landscape extent, anthropogenic disturbance, specifically the expansion of tea estates and cropland were the primary drivers of change. Growth of the tea industry and its linkage with forest loss seemed to be the potential driver of landscape change within the region. These results provide an insight into the broad patterns of landscape change both inside a protected area and the larger, surrounding spatial extent within the Eastern Terai raising concern for many endangered wildlife species.
Keywords: Deforestation, Drivers, India, landscape change, Tea

25. Linking farming systems to farmland bird diversity : an inter-disciplinary approach
Authors: **BONTHOUX**, Sébastien, INRA; Jean-Philippe Choisis, INRA; Annick Gibon, INRA; Gérard Balent, INRA
Offered Presentations: Agrarianism I - Tuesday, April 6: 10:20-10:40 - Q
Abstract: In agricultural landscapes, the ecological processes are generally constrained by the structure of the mosaic of habitats which results of the relationships between the farmers and their territory. Currently, ecological processes are studied at the patch or the landscape scale without explicitly considering the functional units of agricultural activities which are the farm's territories. In this study we examine the relationships which can be established between different farming systems, their spatial organization and farmland bird communities. From 34 farm surveys carried out in the LTER site "Vallées et Coteaux de Gascogne" in the South-western part of France, we characterized the local farming systems and their spatial organization. A typology was carried out by crossing the farming systems characteristics and their spatial structure. On the 34 farm territories, we carried out 363 bird point counts, sampled in a systematic way on a grid of 250m of side to compare farming systems territories with farmland bird communities. Five farming systems were defined, the most representative being the mixing crop-livestock system. Species richness and total abundance of birds were higher on livestock systems compare to cropping systems. Farmland specialist birds and forest birds showed preference for livestock systems, hedge species were equally distributed between livestock and cropping system territories. This study brings useful information for the management of the avifauna in agricultural landscape demonstrating that the avifauna is different according to farming systems which supposes that landscapes are different between farming systems.
Keywords: agricultural landscape, farming system, farmland bird diversity

26. A multiscale analysis of Etheostoma darter habitat in the Ohio River Basin
Authors: **BOSSENBROEK**, Jonathan, University of Toledo; Todd Crail, University of Toledo; Johan Gottgens, University of Toledo
Offered Presentations: Scale II - Thursday, April 8: 4:20-4:40 - T-U

Abstract: In order to better understand niche differentiation among sympatric populations of Etheostoma darters and to aid in recovery efforts of Ohio listed species in this genus, we developed quantitative niche models for nine species using localities from agencies, museums and our own field investigations. Using CCA and GIS classifications of geologic factors at the regional scale, our models documented relationships between bedrock type, drift, stream order and the presence or absence of darter species. For example, widely distributed E. nigrum was found on all rock types, in all drift thicknesses, at all stream orders. In contrast, the range limited, state endangered E. maculatum showed a preference for highly erodible, fissile bedrock rock types (shale and siltstone), increasing depth of till and greater stream orders – three factors in juxtaposition to one another. Using CCA of over 800 samples taken by seine at 16 riffles in nine streams of both glaciated and unglaciated origins in the Ohio River drainage, we examined microhabitat relationships between species on axes of flow, depth, and substrate composition. Common species such as E. blennioides and E. zonale were associated with sand and gravel while rarer species such as E. camurum and E. maculatum were associated with cobble, higher flow and deeper segments. The strength of these relationships was more apparent for E. camurum and E. maculatum when only males were examined. Our results suggest the distribution of range-limited species is determined by specialized factors that can only be quantified at particular locations (substrate size and shape), while others (bedrock type) can be used to make predictions across an entire region. By quantifying these factors, we hope to assist in making more deterministic predictions about suitable streams and stream reaches for recovery efforts of threatened species.
Keywords: Conservation, darters, niche, scale, streams

28. When do we know enough to change landscape patterns for endangered species?
Authors: **BRUGGEMAN**, Douglas, Michigan State University; Thorsten Wiegand, Helmholtz Centre for Environmental Research - UFZ; Michael Jones, Michigan State University
Offered Presentations: Simulated Environments I - Thursday, April 8: 10:00-10:20 - T-U
Abstract: A general theory useful for predicting changes in biodiversity in a dynamic landscape is still missing from ecology. For such non-equilibrium conditions, we argue that process-based models are needed such as individual-based, spatially-explicit population models (IB-SEPMs). This study demonstrates how IB-SEPMs can be used to value tradable credits for habitat protection given uncertainty in species' dispersal behaviors. Pattern Oriented Modeling was used to test the ability of alternative dispersal models to reproduce patterns of abundance and genetic diversity observed in nature. The suite of models that most faithfully reproduced observed patterns were then used to evaluate habitat trading scenarios. To incorporate the effects of habitat loss versus fragmentation into the conservation value of trades, Landscape Equivalency Analysis was used to estimate the credits and debits generated by each scenario and putative dispersal model. Landscape Equivalency Analysis is an extension of the resource-based compensation approach applied to a landscape-scale. The equivalency of two habitat patches is estimated by their contribution to abundance and genetic diversity measured at the landscape scale. This approach reduces the probability that a patch serving as a sink is traded for a patch that served as a source, and the probability that other patches in the landscape switch from being a source to a sink as a result of landuse change. Decision Analysis was then used to determine the most cost-effective trades that minimized the effects of habitat loss and fragmentation given uncertainty in dispersal.

Keywords: decision analysis, genetic diversity, landscape equivalency analysis, pattern-oriented modeling, spatially-explicit model

29. Are wolves in Wisconsin affecting the local species richness of understory plant communities via a trophic cascade?

Authors: **CALLAN**, Ramana, University of Georgia; Nathan Nibbelink, University of Georgia
Offered Presentations: Resource Management I - Tuesday, April 6: 1:20-1:40 - K-L
Abstract: Expansion of the Midwest wolf population presents a natural experiment in the long term ecological impacts of a keystone predator recovering from local extinction. Our research explores whether wolves are reducing local browse intensity by white-tailed deer thus mitigating the biotic impoverishment of understory plant communities. To assess the potential for a trophic cascade effect, we used a spatially explicit hierarchical vegetation survey. This method enabled us to evaluate if, and at what spatial scales, plant species richness differs between areas colonized and continuously occupied by wolf packs (wolf areas) and areas never successfully colonized by wolf packs (non-wolf areas). Preliminary results indicate a positive relationship between wolf pack occupancy and understory plant species richness in white cedar wetlands. As predicted, forb species richness was significantly higher in wolf areas (Wolf: 32.6 ± 3.4; Non-wolf: 23.9 ± 2.9, N=7, p = 0.04); as was shrub species richness (Wolf: 22.7 ± 1.3; Non-wolf: 18.1 ± 1.6, N=7, p = 0.02). Species richness of ferns, sedges and grasses was similar between wolf and non-wolf areas; however, as predicted for a trophic cascade response, percent cover of ferns was higher in non-wolf areas (Wolf: 8.0 ± 2.1; Non-wolf: 19.2 ± 4.9, N=7, p = 0.03). Sampling at multiple scales revealed that forbs show a stronger response at local scales (10m2), while shrubs show a consistent response across all scales sampled (0.01 m2 - 1,000m2). These results provide compelling correlative evidence of trophic effects; however, reciprocal relationships between wolves, deer and vegetation are lacking. Indications of the causal mechanisms responsible also remain speculative. In addition, understory vegetation in white cedar stands may be more influenced by hydrology than by changes in local deer densities. Continued research directed at ruling out confounding factors and differentiating between top-down vs. bottom-up effects is forthcoming.
Keywords: biodiversity, keystone predators, species-area relationships, trophic cascades, vegetation dynamics

32. Ecological restoration of degraded arid landscape with surface water allotting in human-dominated watershed: A case study of Ejin oasis in Heihe river basin, northwestern China

Authors: **CAO**, Yu, Department of Land Resource Management, Zhejiang University; Murugesu SIVAPALAN, Department of Geography, University of Illinois at UC; Yangjian ZHANG, Center for RS and Spatial Analysis, Rutgers University; He HUANG, Department of Land Resource Management, Zhejiang University
Offered Presentations: Restorative Ecology - Thursday, April 8: 11:40-12:00 - Y-Z
Abstract: Exploring the relationships, which are strictly influenced by water resource conditions, between oasis landscape pattern and hydro-ecological process in arid area, becomes the hot topic and difficult challenge in arid landscape ecology and one of the most important issues in arid area's ecological protection and reconstruction. The Heihe river basin, as the 2nd longest inland river basin, is located in the northwest arid regions of China. During the past few decades before 2002, increasing local population and social-economic development in the upper reaches of Heihe river basin have consumed surface water resource enormously. Consequently, a lot of

serious ecological and environmental problems were occurred in the Ejin natural oasis, which is in lower reaches of Heihe river basin. Especially, the Ejin natural oasis was in face of disappearing in the world with no surface water provided from the upper reaches for continuous several years around 2000. From the beginning of 2002, appropriate amount of surface water has been allotted to Ejin oasis from the upper reaches by the Chinese government every year to prevent the rigorously ecological crisis continuing and retrieve the environment restoring. Based on field investigation, remote sensing, and GIS technologies, Ejin natural oasis landscape spatial pattern and its dynamic change in different temporal and spatial scale before and after surface water allotted (1987~2002~2008) were analyzed in this paper. Moreover, the interactions between oasis hydro-ecological process and oasis landscape pattern change were discussed. Ecological restoration of degraded arid landscape with surface water allotting in human-dominated watershed were evaluated finally.

Keywords: Ecological restoration, Ejin natural oasis, hydro-ecological process, landscape pattern change, surface water allotting

33. Spatial scale and the relationship between woody vegetation and herbaceous species richness
Authors
Offered Presentations: Scale I - Tuesday, April 6: 11:40-12:00 - F-G
Abstract: The relationship between woody vegetation cover and herbaceous species richness has been the subject of many studies, yet this relationship is still unclear. Much of the incongruity about these relationships may be the result of differences in the scale of observation. Here, we present evidence for scale-dependence in the relations between woody vegetation and herbaceous species richness and find different responses of different herbaceous functional groups. At fine scale (10 m2) annual and perennial species richness declined with increased woody cover, while this relationship was hump-shaped for geophytes. In contrast, at broader scale (1000 m2), geophyte and perennial richness decreased as percentage of woody cover increased, while this relationship was hump-shaped for annuals. We also studied the relationships between landscape heterogeneity and herbaceous species richness at different spatial scales. At fine scale, species richness increased as heterogeneity increased for geophytes and perennials, whereas a hump-shaped curve was apparent for annuals. At broader scale, a decrease in species number as heterogeneity increased was obvious in all functional groups. A mechanism that may explain most of these observed scale-dependent responses concerns the edge and core proportions of woody patches; at fine scales, most of the woody patch is actually edge, while at coarse scales woody core areas comprise large proportions of the patch. This may explain much of the observed differential responses of different functional groups to woody patches at different scales.
Keywords: a, b, c, d, e

34. IndianApps: the future green infrastructure of Indianapolis
Authors: **CARTER**, timothy, Center for Urban Ecology, Butler University
Offered Presentations: Technological Innovation - Thursday, April 8: 4:20-4:40 - Q
Abstract: Since a city's infrastructure is, by definition, hidden from view, the general public has had little interest or awareness about the ecological problems these systems have caused. Additionally, citizens have not recognized the potential to "green" the city's infrastructure through personal actions. We propose a solution to this problem in the city of Indianapolis through a new initiative called "IndianApps". IndianApps enables the public to be involved in

the ecological stewardship of the city by engaging with the city's existing and future infrastructure through their GPS-enabled smart phones and Web-based applications ("Apps"). At the heart of IndianApps is a computer platform that links smart phones to citywide databases which can then be openly accessed and updated by the public. The Apps are organized in categories such as water, air, land cover, animals, and built environments; inherently linking the ecology of the city to its future development. The first IndianApp is the Rain Barrel App through which the public can report installation of their rain barrels as well as collect stormwater retention data from these structures. These data will be used in the future for stormwater modeling in Indianapolis's long term stormwater control plan. We demonstrate that without the "crowdsourced" data collected by this App, the additional stormwater retention capacity provided by the rain barrels would result in a gross underestimation in the performance of the stormwater management infrastructure of the city. We additionally conclude that the technology has significant potential for engaging the citizenry with their urban environment.
Keywords: green infrastructure, rain barrel, stormwater, technology, urban ecology

35. Application of geospatial analysis to freshwater inflow recommendation for the Mission-Aransas Estuary, Texas, USA
Authors: **CHEN**, Grace, Texas Parks and Wildlife Department
Offered Presentations: Resource Management III - Thursday, April 8: 2:00-2:20 - V-W
Abstract: Beyond mapping, geographic information systems (GIS) possess powerful analytical capability that can greatly enhances our understanding of the interaction between human and valuable environmental factors, such as freshwater inflows, habitats and fishery production. Through the assessment of biological response to freshwater inflow entering the Mission-Aransas (M-A) Bay, this study demonstrates how GIS functionality can be coupled with traditional statistical analysis to validate model output. A specific task of this study was to assess the effectiveness of target inflows generated by the Texas Estuarine Mathematical Programming Model on the maintenance of historical fishery productivity in the M-A Bay. Based on the conceptual model of production area, defined as the area where favorable dynamic and stationary habitats overlapped, this study approached the freshwater inflow recommendations by comparing the size and spatial distribution of favorable salinity zones resulting from observed against modeled salinity data. Common temporal and spatial components as well as baseline salinity patterns required for comparisons were obtained through five sequential analyses. Insights into the modeling and validation processes of the Texas State's Methodology for determining freshwater inflow needs for the bays and estuaries are discussed.
Keywords: favorable salinity zone, freshwater inflow, peak abundance season, salinity pattern, spatial overlay

36. Integrating a land-use model, a hydrological model and patch analyst into a geographical information system to simulate land-use changes and their impacts
Authors: **CHEN**, Horng-Yng, Department of Bioenvironmental Systems Engineering, NTU; Yu-Pin Lin, Department of Bioenvironmental Systems Engineering, NTU; Hone-Jay Chu, Department of Bioenvironmental Systems Engineering, NTU
Offered Presentations: Simulated Environments I - Thursday, April 8: 11:00-11:20 - T-U
Abstract: In this study, we have integrated the Artificial Neural Network-based hybrid land use model (ANN-CLUE-s), a precipitation-runoff model (HEC-HMS), and Patch analyst into a novel platform in a Geographical Information System (GIS, ArcGIS). Our objective is to simulate land

use changes and their impacts in the Taipei Metropolitan Area in Taiwan. The ANN-CLUE-s model is based on ANN and the empirical land use model (CLUE-s) in the ArcGIS platform. Given different conservation and development scenarios, future land uses in the study area are simulated by the ANN-CLUE-s model in the ArcGIS platform. To assess the impacts on hydrology and land use patterns of the potential land use changes, the simulated land uses are input to the HEC-HMS model in the ArcGIS platform. By simulating runoffs, it is possible to assess the impacts of land use changes on surface runoffs in the study area. In addition, to assess the impacts of land use changes on land use patterns, landscape metrics of the simulated land uses are calculated by the patch analyst in the ArcGIS platform. The simulation results demonstrate that the ANN-CLUE-s model and the developed platform can simulate land use change scenarios efficiently. The model can also integrate other models to simulate and assess the impacts of land use changes on watershed land use planning and management.
Keywords: Artificial Neural Network, CLUE-S model, GIS, hydrological model, landscape metrics

37. Assessing the spatio-temporal patterns of Africanized Honey Bees in Urban Landscapes

Authors: **CHEN**, Szu-Hung, Department of Ecosystem Science & Management, TAMU; Maria Tchakerian, Dept. of Entomology, TAMU; Robert Coulson, Dept. of Entomology, TAMU; Sandy Elder, Tucson Water Department

Poster #49: Urban Ecosystems - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria

Abstract: Africanized honey bee (AHB), hybrid between African honey bees (Apis mellifera scutelata) and European honey bees, arrived in the United States from South America in 1990. The first documented appearance of AHB in Arizona was in 1993. Now, the bee populations are growing and distribute widely in the greater Tucson metropolitan area. Comparing with surrounding deserts, Tucson city proposes relatively stable supply of food and other resources for bees. The presence of abundant resources in urban environments places bees in proximity to humans. Within the areas of AHB aggregations, public health and safety will be the main concern. Accordingly, patterns and structure of urban landscapes can determine the spatial arrangements of resources that may influence the occurring locations and utilization of AHB colonies. In this study, the information of AHB colony removal records from 1995 to 2004 was obtained from water meter checking lists of Tucson Water Department. Each record would contain information including occurred date, address, problem type, occurred location, and geographic coordinates, which derived through address matching process using ArcGIS software. We also integrated GIS and statistics methods to analyze the patterns of colony distributions and investigated the effects of climate (i.e. temperature and precipitation). We found out that the significant spatio-temporal clustering occurred in 1996, 1998, 1999 and 2001.Our studies also indicated that colony would occur more following with wet seasons. Moreover, the moderate winter temperature may associate with higher survival rate and quickly population growth for the following spring. A spatial datasets conducted by Wildlife Habitats Inventory Project (WHIP) of Pima County would be incorporate to investigate the effects of urban landscape characteristics on the occurrences of bee colonies. The results can provide useful information for bee behaviors in urban environments and bring the awareness of public safety for AHB.
Keywords: Africanized honey bee, GIS, spatio-temporal pattern, Tucson, urban landscape

39. Mitigating impacts of fuelwood collection on wildlife habitat through payments for ecosystem services

Authors: **CHEN**, Xiaodong, Michigan State University; Andres Vina, Michigan State University; Frank Lupi, Michigan State University; Jianguo Liu, Michigan State University

Invited Symposium: B-2 - Thursday, April 8: 2:00-2:20 - R

Abstract: Natural environment provides humans with various ecosystem services, such as bioenergy and biodiversity. Excessive extraction of bioenergy, such as fuelwood, may lead to deforestation and loss of wildlife habitat. Conservation efforts, including payments for ecosystem services, have been increasingly invested to mitigate such impacts. However, the impacts of these policy interventions are not well understood. We study the impacts of conservation investments in China's Wolong Nature Reserve, home to the world-famous endangered giant pandas and over 6,000 plant and animal species and more than 4,500 indigenous people. In response to the rapid deforestation and loss of wildlife habitat due to factors including excessive fuelwood collection by indigenous people, Natural Forest Conservation Program (NFCP) has been implemented in Wolong since 2001. Under the NFCP, indigenous households are assigned natural forest parcels for monitoring to prevent illegal harvesting. Participants receive an annual payment that is about 10% of the average household income. Participants use much of their NFCP payments to purchase electricity to replace fuelwood. The NFCP also promotes cooperation among indigenous people to prevent forest harvesting. As a result, forest cover had increased by about 11% from 2001 to 2007. Our results suggest that conservation efforts that improve the involvement of local communities in forest monitoring and policy enforcement can substantially mitigate the impacts of fuelwood collection on wildlife habitat.

Keywords: bioenergy, China, Natural Forest Conservation, payment for ecosystem services, wildlife

40. Developing Spatially-Referenced Riparian Metrics to Relate Upland Sources of Nutrients to Water Quality Parameters in the Coastal Plain of North and South Carolina

Authors: **CHRISTENSEN**, Jay, US EPA Landscape Ecology Branch; Anne Neale, US EPA Landscape Ecology Branch; Maliha Nash, US EPA Landscape Ecology Branch

Offered Presentations: Resource Management I - Tuesday, April 6: 2:40-3:00 - K-L

Abstract: In this study, spatially-explicit riparian metrics are compared with fixed riparian metrics in selected watersheds from the Coastal Plain of North and South Carolina for their ability to predict water quality parameters. Riparian areas have long demonstrated the ability to attenuate nutrients and sediments from agricultural runoff at the field scale; however the impact of riparian buffers on water quality services must be assessed at watershed scales. Fixed riparian metrics have been related to water quality at the watershed scale but fail to include the spatial relationship between riparian and agricultural areas. Spatially explicit riparian metrics were calculated using GIS models to incorporate the spatial location of natural areas and their connection to agricultural nutrient sources via flow paths. In this region, flow paths often include significant sub-surface flows and riparian buffer effectiveness can be influenced by this sub-surface flow. In addition, varied agricultural practices influence the amount of nutrients entering the stream network including tile drainage and fertilization with swine effluent. We present the preliminary results of relating and comparing a combination of fixed riparian, spatially-explicit riparian, GIS-based sub-surface flow, and agricultural practice metrics to water quality parameters in the Coastal Plain of North and South Carolina. Although this work was reviewed

42. Migrant-habitat relations and movement ecology of red-eyed vireos (Vireo olivaceus) during spring stopover: effects of landscape pattern.
Authors: **COHEN**, Emily, The University of Southern Mississippi; Frank moore, The University of Southern Mississippi; Richard Fischer, U.S. Army Engineer Research & Development Center, Environmen
Offered Presentations: Distribution I - Tuesday, April 6: 10:40-11:00 - Y-Z
Abstract: The movement biology of organisms is influenced by processes acting across spatial and temporal scales and plays a major role in determining the fate of individuals as well as the structure and dynamics of populations, communities and ecosystems that they comprise. Roughly two-thirds of all birds breeding in the forests of eastern North America are long-distance migrants from tropical wintering areas. While songbirds are capable of making long flights, the amount of time spent at stopover sites during passage far exceeds time spent in flight. Stopover periods provide an ideal setting for studying movement decisions because nocturnal migrants are energetically constrained, temporally restricted, and new to the landscapes within which they stopover. To gain an understanding of migrant movement decisions in relation to the composition and configuration of habitat types, migrants were transported to novel heterogeneous landscapes to simulate arrival at new stopover sites. We released radio-tagged red-eyed vireos at six locations in the same three habitat types and continuously followed their movements. Migrants moved the most during an initial exploratory phase when they selected habitat types with greater food resources. Hardwood habitat was characterized by the highest abundance of food and the amount of hardwood forest cover in the landscape positively influenced both the rate and distance of movement. However, the directionality of movement was not consistently related to the distribution of hardwood habitat around the release site. Our results indicate that the abundance of hardwood habitat in the landscape influences the movement ecology of songbirds during migratory refueling.
Keywords: Ecology, migration, movement, stopover, vireo

43. Patch Dynamics and climate indicators: On the potential of occupancy models to assess impacts of climate change.
Authors: **COLLAZO**, Jaime, USGS NC Cooperative Research Unit; James Nichols, USGS Patuxent Wildlife Research Center; Adam Terando, Biodiversity and Spatial Information Center; Alexa McKerrow, USGS-BRD and Biodiversity and Spatial Information Center
Offered Presentations: Climatic Influences II - Tuesday, April 6: 3:40-4:00 - R
Abstract: Predicting the potential consequence of climate change on species sustainability is at the center of current conservation challenges in the United States and globally. This capability is dependent on being able to make explicit inferences about how vital rates will respond to metrics of climate change often expressed as climate indicators such as growing degree days, drought indices, and frequency of below freezing days. We tested a-priori hypotheses regarding climate indicators and patch extinction and colonization probabilities, after adjusting for imperfect detection, using Breeding Bird Survey (BBS) data of 4 avian species in the South Atlantic Coastal Plain of US from 1992 to 2001. Two species (Brown-headed Nuthatch, Carolina Chickadee) are south-centric in distribution; the other two (Red-headed Woodpecker, Eastern Wood Pewee) are not. South-centric species were of interest because it permitted assessing

dynamics at the fringe of their distribution. We showed that the proportion of vegetation classes containing suitable habitat for the 4 species in 480 BBS route segments did not change significantly in 10 years (P >0.05), opening the opportunity to test the influence of climate indicators more explicitly. We decoupled the annual cycle of the species, identifying 6 covariates that offered the best chance to relate climate indicators and avian demography. The final candidate model set for each species included random effects, factoring the possibility that decadal dynamics could be explained by other factors. We discuss findings and plans to use hindcast analyses in a larger geographical extent to predict potential impacts stemming from climate change.
Keywords: BBS, climate change, colonization rates, extinction rates, occupancy models

44. Milling About: The use of minimally invasive archaeological techniques in interdisciplinary studies in Environmental History at the Wormsloe Plantation
Authors: **COOK HALE**, Jessica, University of Georgia, Department of Geology
Invited Symposium: Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History, Isle of Hope, Georgia - Tuesday, April 6: 11:20-11:40 - K-L
Abstract: For presentation during the Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History on the Isle of Hope, Georgia Symposium From 2008 to 2009, selected areas of the Wormsloe Plantation were surveyed using minimally invasive archaeological techniques ranging from shallow geophysical methods such as Ground Penetrating Radar (GPR), to soil coring and limited excavation. These techniques were deployed as one part of an interdisciplinary project that integrates archaeological data with environmental history as well as Geographical Information Systems in order to further high resolution studies of land use at Wormsloe through time and space. One survey site in particular, known as the Rice Mill Site, stands as a particularly pointed example of the effectiveness of this interdisciplinary approach; this combination of archaeological techniques alongside data from other disciplines has allowed secure identification of the building and its associated features, as well as more detailed information about possible activities within this area during the 19th century, without the use of extensive and highly invasive excavations. These findings are presented here, with new approaches to the integration of the archaeological datasets into the larger GIS database.
Keywords: environmental history, GPR, remote sensing, shallow geophysics, Wormsloe Plantation

45. Habitat Quality and Matrix Heterogeneity Influence Metapopulation Dynamics in a Pond-Breeding Amphibian
Authors: **COSENTINO**, Bradley, University of Illinois at Urbana-Champaign; Robert Schooley, University of Illinois at Urbana-Champaign; Christopher Phillips, University of Illinois at Urbana-Champaign
Offered Presentations: Distribution II - Wednesday, April 7: 11:20-11:40 - Q
Abstract: Simple habitat area and isolation measures are broadly used to predict metapopulation dynamics in basic and applied settings, but recent analyses indicate that empirical support for the area-isolation paradigm is not widespread. A major goal of landscape ecology is to examine the effects of habitat heterogeneity on population dynamics in systems in which area and isolation are poor predictors, yet integration of both habitat quality and matrix heterogeneity in metapopulation models is relatively rare. We hypothesized that spatial population dynamics (i.e. occupancy, colonization, and extinction probabilities) for Ambystoma tigrinum (tiger

salamander) are influenced by local habitat quality (fish occupancy) and a physiological constraint on movement imposed by matrix structure (desiccation risk). We documented metapopulation dynamics for A. tigrinum in a network of 90 wetlands in northern Illinois for three years. Patch occupancy was dynamic for both A. tigrinum (n = 16 colonizations, n = 13 extinctions) and predatory fish (n = 31 colonizations, n = 22 extinctions). Using occupancy modeling, we showed that fish presence, habitat area, and connectivity influenced A. tigrinum occupancy and extinction probabilities, whereas colonization probability was influenced predominately by fish and connectivity. Field experiments indicated that individual desiccation risk varied among upland habitats encountered during dispersal, and that this variation influenced individual movement decisions. Using cost-distance modeling, we showed that effective distances accounting for variation in desiccation risk among upland habitats – including agricultural crops – were more supported than Euclidean distances as predictors of occupancy and colonization probabilities. These results suggest that natural fish invasions and a physiological constraint on movement influence A. tigrinum occupancy dynamics in addition to simple metapopulation variables. Our results underscore the importance of incorporating both habitat quality and matrix heterogeneity into metapopulation models when assessing population dynamics in patchy systems.
Keywords: amphibian, dispersal, least-cost distance, metapopulation, occupancy

46. US-IALE, 1992-1994, The Formative Years
Authors: **CROW**, Thomas, USDA Forest Service, Rocky Mountain Research Station
Invited Symposium: US-IALE Presidents' Symposium I - Tuesday, April 6: 10:40-11:00 - Masters Hall
Abstract: My tenure as President of US-IALE (1992-1994) was relatively early in the life of the organization and much of our attention was given to formalizing the structure and function of the organization. The transition from one President to another literally involved handing over a box of materials. Annual meetings were small and it was possible to interact with almost all the participants. But this was changing rapidly as interest in landscape ecology increased. There was a sense that our science had an important role to play both in the realm of a scientific discipline and in the application of the science to important societal issues. Time has proven this to be true and going forward the challenge for landscape ecologists is to continue building a robust science that informs critical problems facing humanity. There is no shortage of problems and issues. We no longer need to "sell" our science, but the need for knowledge about pattern and process in dynamic landscapes is greater than ever.
Keywords: History, US-IALE

47. Earth, wind, and fire in the twenty-first century
Authors: **DALE**, Virginia, Oak Ridge National Laboratory
Invited Symposium: US-IALE Presidents' Symposium II - Tuesday, April 6: 1:20-1:40 - Masters Hall
Abstract: During 2000-2002, when I was president of the US chapter of IALE, I was fortunate to have several fascinating trips. Yet to my surprise, the US IALE meeting in Lincoln, Nebraska, was one of the most interesting experiences. The IALE field trip took us to a local prairie, where we observed the beauty and ecological benefits of native plants that are well adapted to the local region and proliferate in complex mixtures that provide habitat for a diversity of wildlife. The 2002 meeting in Lincoln, Nebraska coincided with the 100th anniversary of the death of James

Sterling Morton, the progenitor of Arbor Day. I had previously thought of Arbor Day as a way to celebrate and foster trees, but I observed on our field trip to local prairies how, in the wrong place, trees can be disruptive to natural ecological processes. Those prairies and the Arbor Day celebration are still a reminder to me of the key challenge faced over the coming decades by society, in general, and IALE, in particular. That is, how can we provide guidance for appropriate designs for land use and management that both protect our natural resources and provide social, economic, and environmental benefits? At the inaugural meeting of the US IALE twenty-five years ago, my presentation was titled "Earth, Wind and Fire" and focused on how a study of pattern and process could elucidate key drivers and effects of natural processes. Today, we landscape ecologists have expanded the repertoire of tools and approaches used to study landscape pattern and processes and are more focused on how human activities are a part of changes on the Earth. A major challenge is to develop strategies by which human activities can enhance the benefits received from the environment and the social and economic systems it supports.
Keywords: Ecosystem Services, landscape design

48. The phenologies of US cities
Authors: **DE BEURS**, Kirsten, Virginia Polytechnic Institute and State University; Geoffrey Henebry, South Dakota State University; Robert Oliver, Virginia Polytechnic Institute and State University
Invited Symposium: B-1 - Thursday, April 8: 1:40-2:00 - K-L
Abstract: According to the Unites States Census Bureau there were over 301 million inhabitants living in the U.S. in July 2007 and more than 84% of this population resided in one of 363 metropolitan areas. Metropolitan land surfaces often differ significantly from less urban settings as a result of the increased presence of impervious surfaces. For instance, vegetation in urban areas is typically different from surrounding vegetation as a result of significant landscaping efforts. In addition, urban land surfaces are often subject to rapid change. This research employs land surface phenology data to characterize the difference in urban and non-urban areas. Vegetation phenology is the study of the relationships between climate and the timing of biological events such as budburst, leaf-out, and flowering. Phenological timing differs among species and is influenced by many factors, including soil and air temperature, solar illumination, day length, and soil moisture, all of which depend on location and time. Here we present a satellite based overview of the land surface phenology of the 11 megaregions in the United States, as defined by America 2050, over the past 9 years (2001-2009). We use a global NASA MODIS product (MCD43A4) at 500m spatial resolution and a 16-day temporal resolution from 2001 through 2009. We relate the observed phenological changes with city specific parameters.
Keywords: City, phenology, remote sensing, Urban

49. Invasion dynamics of common reed in freshwater wetlands
Authors: **DENIS**, Jean-François, McGill University; Sophie Taddeo, McGill University; Sylvie de Blois, McGill University
Poster #18: Invasion - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: North America is currently experiencing an increase in rates of invasion by exotic species. Among them, common reed (Phragmites australis) is damaging wetland habitats and is an important weed along roadsides and agricultural ditches. Its tolerance to a wide range of environmental conditions allows it to invade disturbed areas and to create monotypic stands that

affect ecosystem functions and local biodiversity. Knowledge about reed dynamics in freshwater wetlands of North America is still fragmentary. Our objectives were 1) to assess the invasion dynamics of reed; 2) to quantify the effects of reed on plant communities; and 3) to define the ecological niche of reed in order to project their potential distribution in a protected wetland. We monitored colonies of reed and characterized their habitat in a protected wetland situated in an agricultural landscape in Southern Quebec. Nine colonies where followed for three years and changes to their density were measured. The spread of the colonies and the impact on plant community composition was assessed using five transects. We then used habitat modelling to project the species potential distribution in the area. Results suggest that reed spreads faster in disturbed than in non-disturbed areas and that distance to water and roads are the main factors that influence the location of projected habitats. Results of this study will provide guidance for wetland and biodiversity management.

Keywords: biodiversity, invasion dynamics, Phragmites australis, potential distribution

50. A Multisensor Global Land Surface Phenology Earth Science Data Record

Authors: **DIDAN**, Kamel, The University of Arizona

Invited Symposium: A Land-surface Phenology: A View Through the Lens of Vegetation - Thursday, April 8: 10:40-11:00 - R

Abstract: One of the stated goals of NASA Making Earth Science Data Records for Use in Research Environments (MEaSUREs) program is the support of the Earth Science research community by providing reliable Earth Science Data Records (ESDR). These products are expected not only to be of high quality but should also combine data from multiple sources to form the long and coherent measurements required for studying climate change impact on the Earth system. Vegetation indices (VI), which capture the aggregate functioning of a canopy, are robust and widely used measurements for extracting phenology information and studying large-scale ecosystem processes. In this context, knowledge of phenologic variability and the environmental conditions controlling their activity are further prerequisite to inter-annual studies and predictive modeling of land surface responses to climate change. Satellite phenology encompasses the analysis of the timing and rates of vegetation growth, senescence, and dormancy at seasonal and interannual time scales. Changes in vegetation phenology depict an integrated response to change in environmental factors and provide valuable information to global change research. However, these studies are limited to using one sensor, owing to the inter-sensor continuity challenge. And with satellite missions lasting only few years, long term studies of vegetation change trends and phenology will have to bring together multiple satellite data sources. To that end, this MEASUREs' project aims at generating a seamless and consistent sensor independent ESDR quality record of land surface phenology by fusing measurements from different satellite missions and sensors. We're developing algorithms based on the homogeneous vegetation phenology cluster to be applied to AVHRR, MODIS, and VIIRS data records. This effort will generate, characterize, and deliver 30+ years of consistent daily measurements of land surface vegetation index and annual phenology parameters at a climate modeling grid resolution (0.05o, 5.6km).

Keywords: climate change, multisensor, phenology, remote sensing, Vegetation Index

51. Potential Land-use Changes with Woody Energy Crop Production in Wisconsin and Minnesota

Authors: **DONNER**, Deahn, Northern Research Station, US Forest Service; Ronald Zalesny Jr,

Northern Research Station
Offered Presentations: Agrarianism II - Wednesday, April 7: 10:40-11:00 - R

Abstract: Modular biomass power plant systems are currently being installed throughout Wisconsin and Minnesota. These systems require a constant source of material on a long-term sustainable basis within a small radius putting pressure on the surrounding forests. Using short rotation woody crops (SRWC; hybrid poplars) to supplement required biomass requirements could reduce this pressure, but there are concerns of the potential land cover changes that would result. We identified in a spatially-explicit manner potential core areas that have a high potential for land conversion to SRWCs given environmental and sociopolitical constraints. Our approach was to rank lands based on current land use (i.e., open land cover types), land ownership (private vs. public), suitability of soil for agriculture (marginal vs. prime), and economic thresholds. Because the decision to convert lands for SRWC production is an economic decision by most landowners, we incorporated soil rental rates established by the Farm Service Agency, and estimated return on corn yield by county to establish economic thresholds beyond which conversion to SRWC production is not probable. Next, we determined the range of variability (i.e., mean and variance) in key soil (e.g., available water holding capacity, bulk density, pH) and climate properties (e.g., growing degree days, temperature, precipitation) for the resulting land base. This variability was used to establish thresholds below which establishing SRWCs is not feasible given the currently available genotypes that have been field-tested from broad-scale deployment; thereby further refining the potential land base for initial land cover conversion. Within the core areas, we will begin to examine landscape and multi-agent drivers of change (e.g., small versus large property owners, distance to market) that can be coupled dynamically with the regional analysis to develop a more realistic estimate of the amount and locations of potential land conversion with increasing use of SRWCs for energy production.
Keywords: energy crops, land change, Minnesota, Populus, Wisconsin

52. Application of land change modeling for resolving urbanization - conservation conflicts on the edge of metropolis

Authors: **DORNING**, Monica, University of North Carolina at Charlotte; Douglas Shoemaker, University of North Carolina at Charlotte; Ross Meentemeyer, University of North Carolina at Charlotte

Offered Presentations: Disturbance I - Tuesday, April 6: 2:20-2:40 - F-G

Abstract: Increases in population growth and per capita land consumption continue to threaten the persistence of natural lands and create conflicts between demands for development and protection of valuable natural resources. To address this issue, we used land change modeling, informed by satellite imagery and conservation mapping, to predict conflicts in North Carolina's Southern Piedmont, a biologically diverse and productive region at the intersection of three rapidly expanding metropolises. We used logistic regression of socioeconomic and environmental factors driving urban expansion, along with historical trends in per capita land use and population projections, to develop a dynamic, stochastic model of land change through 2030. Using this modeling framework, we forecasted multiple land change scenarios following the historical trajectory and various conservation planning strategies that increase the cost of development in locations with higher conservation value. Our results indicate that if historic trends continue, over 30% of land developed between 2010 and 2030 will conflict with existing conservation priorities. Our model based on an alternative future that integrates conservation planning, indicates that it is possible to reduce future conflict by 75% without hindering demands

for urban growth. However, our results also demonstrate that some strategies for biological conservation can increase landscape fragmentation. These landscape-level visualizations of urbanization-conservation conflicts are being used to motivate local planning and guide effective preservation of the region's remaining natural resources.
Keywords: Conservation, land change

53. Forest landscape composition response to fire and windthrow disturbances in Temiskaming, south-western Quebec

Authors: **DOYON**, Frédérik, UQO (université du Québec en Outaouais); Marie-Eve Roy, IQAFF; Daniel Bouffard, IQAFF; Phillippe Nolet, IQAFF
Poster #8: Disturbance - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: In the temperate deciduous forest, large catastrophic natural disturbances occur very infrequently. Although being rare, wildfire and windthrow nevertheless play a very structuring role in the landscape in regards of the response of forest communities over long period of time. In this study we investigated such role at a region wide scale (around 8000 km 2) in Temiskaming (Quebec) during the 20th century. For doing so, we characterised forest cover changes after natural disturbances (fire and windthrow) identified using old aerial photographs for the beginning of the 20th century and forest inventories for the middle and the end of the century. Our results show that both catastrophic disturbances help to maintain opportunistic species in the landscape like white birch and white pine while reducing tolerant hardwood species like sugar maple. Partial windthrow that create many small patches promotes a wide range of community types increasing landscape diversity. Severe windthrow with defined boundary were shown to increased intolerant hardwood and softwood while significantly decreasing tolerant hardwood community type. Landscapes with burnt area around 20 to 80% were shown to significantly increase the proportion of intolerant hardwood (8 to 30%) and softwood (12 to 18%) community types compared to area where wildfires were not detected in the last century. Those wildfires also decrease the proportion of tolerant hardwood (17 to 7%) and mixed hardwood (42 to 30%)in the landscape. Therefore we suggest that pioneer easy-disseminated species are more benefiting from severe windthrow and middle size burnt area (20 to 80%), than species relying on pre-established regeneration. The opposite situation would be observed in large burnt area (80 to 100%). Our results demonstrate that stochastic catastrophic disturbances play an important role in maintaining certain community types over large area.
Keywords: Community type, fire, Forest, Landscape, Windthrow

54. One century of forest vegetation change along a biogeographical gradient between the temperate and the boreal forest in southern Quebec.

Authors: **DOYON**, Frédérik, Université du Québec en Outaouais; Daniel Bouffard, Institut québécois d; Philippe Nolet, Institut québécois d; Éric Forget, Institut québécois d
Offered Presentations: Disturbance II - Wednesday, April 7: 11:20-11:40 - Z
Abstract: With their diversity of vegetation communities and ecological processes involved, biogeographical transition zones are likely to become very dynamic under climate change. In southern Quebec, we observe a sharp forest vegetation change in a 100 km latitudinal gradient, shifting from the Sugar maple-Yellow birch to the Balsam fir-White birch bioclimatic zones. Understanding vegetation and disturbance dynamics at the landscape scale along such gradient is important in order to predict the impact of climate change on forest-dependent communities. In this study, we have mapped the forest cover and the disturbances in ten 100 km2 sample-

landscapes, distributed along a latitudinal gradient using old aerial photographs, forest maps, and forest inventories for three periods during the 20th century. Map overlaying of these periods has allowed us to describe forest community transitions after different disturbance types and to assess the effect of latitude on them. In the southern portion of the gradient, the mixedwood type was much more abundant at the beginning of the century (+20%). Mixedwood mostly transited to the tolerant hardwood type, particularly after partial disturbances (harvest and spruce budworm outbreaks). In the northern portion, early century large wildfires and mid-century spruce budworm outbreaks contributed to increase the amount of mixedwood in replacement of softwood types. In the softwood type, spruce has replaced balsam fir, particularly in the northern landscapes. Latitudinal comparison of transition matrices shows that most vegetation response to disturbances is constant along the gradient. Therefore, most of the observed vegetation changes were driven by initial forest composition and disturbance type importance along the gradient. Such results suggest to put emphasis on the change in the disturbance regime for predicting future forest composition under climate change.
Keywords: Disturbance, Forest composition change, Latitudinal gradient, Transition matrix

55. Spatial and temporal scale of sampling affects individual-based measures of spatial genetic structure in Michigan black bear
Authors: **DRAHEIM**, Hope, Department of Zoology, Michigan State University; Kim Scribner, Department of Zoology, Michigan State University; Veronica Lopez, U.S. Forest Service, Allegheny National Forest; Scott Winterstein, Department of Fisheries and Wildlife, Michigan State Univers; Dwayne Etter, Michigan Department of Natural Resources, Wildlife Division
Offered Presentations: Distribution II - Wednesday, April 7: 11:00-11:20 - Q
Abstract: Landscape genetics seeks to understand how landscape features influence the spatial genetic structure of populations or individuals. Ideally, for individual-based approaches, spatial extent of study areas and lag distances among individuals is sampled continuously throughout the landscape to correlate measures of genetic similarity with landscape features or measures of resistance derived from them. However, the elusive nature of many wide ranging species makes continuous sampling difficult. As a result, genetic sampling of species such as the black bears (Ursus americanus) is often opportunistic, resulting in a mix of samples collected via research efforts and those obtained from harvest, and may include samples collected over multiple seasons and/or years. By pooling these samples researchers must assume that samples are derived from a common pool of individuals, though individuals commonly exhibit considerable seasonal variation in movements and heterogeneity in occupancy of different habitats. Sampling bias associated with temporal scales of sampling has serious implications for derivation of optimal resistance models that best account for the interaction between landscape features and spatial genetic structure. Our goal is to test the influence of timing and sampling protocols on the spatiotemporal patterns in measures of black bear spatial genetic structure and consider how these patterns could influence landscape genetic studies. We compared measures of spatial structure of black bear hair (n = 136) and tissue (n = 240) samples collected in Michigan's Lower Peninsula during the summer and fall, respectively during 2002 and 2003. To access differences in spatial patterns, spatio-temporal intra and inter-annual comparisons were evaluated using kernel density estimations and the K-function nearest neighbor technique. In addition, we will report on the similarity of microsatellite genetic relatedness estimates for the different sample configurations. Significant differences in mean relatedness between individuals collected during

the summer and fall indicate considerable movements at local scales.
Keywords: Black bear, landscape genetics, Sampling, Spatial structure, Temporal analysis

56. Percolation-like spread of West Nile virus in New York City
Authors: **DRAKE**, John, Odum School of Ecology; Waheed Bajwa, New York City Department of Health; Krisztian Magori, Odum School of Ecology
Invited Symposium: Pathogens in Heterogeneous Landscapes - Wednesday, April 7: 10:20-10:40 - Masters Hall
Abstract: Emergence of vector-borne diseases in urban environments is a leading public health problem throughout the world. Disease dynamics in the built environment depend on complex interactions between local weather, host abundance, proximity of major disease reservoirs and human intervention within a highly modified and structured space. We speculate that this structure mediates the spread of emerging pathogens. Particularly, we hypothesize that the heterogeneity of urbanized landscapes results in percolation-like patterns of spread rather than traveling waves. West Nile virus is a vector-borne disease of particular concern in the western hemisphere and a model for other vector-borne pathogens (e.g., the four virus serotypes that cause dengue fever and chikungunya virus). The epicenter of West Nile virus emergence in North America is New York City. We tested our hypothesis with data collected by the New York City Department of Health on the spatial distribution and chronosequence of infections of mosquitoes, birds, and humans; mosquito control; and environmental variables. Demonstration of concept was performed with a series of analytical and simulation models, tailored to reflect the putative mechanisms dominating West Nile virus transmission in New York City. These models revealed dynamical signatures that are diagnostic of percolation-like spread. Statistical analyses detected these signatures in observations of West Nile infection in New York City in 8 out of 9 years. The spatial distribution of West Nile virus positive dead birds indicated that transmission was disproportionately associated with particular land cover types. Percolation models suggest that there exists a critical fraction of the environment that must be exceeded by transmission promoting land cover types for large-scale propagation of the pathogen to occur. Geographical analysis suggests that New York City is located at this transition.
Keywords: percolation, urban ecology, West Nile virus

57. Field validation and updating of an expert-based Bayesian Belief Network model to set population and habitat objectives for King Rail, Rallus elegans
Authors: **DREW**, C. Ashton, North Carolina State University; Jaime Collazo, NC Cooperative Fish and Wildlife Research Unit
Offered Presentations: Distribution II - Wednesday, April 7: 11:40-12:00 - Q
Abstract: We present final results from our Bayesian Belief Network model predicting King Rail (Rallus elegans) occupancy of potential breeding habitat in eastern North Carolina and southeastern Virginia. This model was initially parameterized using local expert knowledge and literature review. The purposes of the model are to support (1) the setting of ecosystem- and refuge- scale population and habitat objectives by the US Fish & Wildlife Service, (2) the design of adaptive monitoring strategies that test key hypotheses and uncertainties, and (3) the easy integration of new data from diverse monitoring and research sources in management decisions. The model was field validated by conducting call-back surveys in a stratified random design, where the variables that contributed most to model uncertainty defined the sampling strata. Field data gathered in 2008 updated the original expert-based model and we compared whether the

original expert-only or the experts-plus-data model better predicted the second year field observations in 2009. Last, we present possible population and habitat objectives supported by our model and use sensitivity analyses to assess how different sources of error and uncertainty (e.g. inaccurate maps, incomplete knowledge, or false expert assumptions) each affect the confidence bounds around modeled answers to the common conservation and management questions: "How much?" and "Where?".
Keywords: adaptive monitoring, expert knowledge, model validation, occupancy, population objectives

58. Lakefront Competition
Authors: **DRIBIN**, Andrew, University of Illinois at Chicago
Poster #47: Urban Ecosystems - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: In 2003, the Graham Foundation for Advanced Studies in the Fine Arts sponsored a competition on the "21st Century Lakefront Park" to extend and complete Chicago's Lincoln Park, encouraging proposals to consider the possibility of 'both/and' between the built and natural environment. Soliciting over 100 entries from professionals across the nation, the six competition winners highlight the many changes in the disciplinary practice of architecture addressing some of the most complex political, ecological, and aesthetic challenges facing public lands and waters in cities today. Tackling issues related to history, context, energy, biodiversity, branding, globalism, and infrastructure, Chicago's lakefront offers a site rich with landscape and programmatic diversity to challenge park-city relations. The various attitudes evident in the competition entries questioned how one might participate in the nature-society relation today and re-appropriate the role of landscape as a constructive activity. Following a brief account of the landscape and planning activities that have shaped Chicago's lakefront, an evaluation of the winning entries helps to cultivate more active participation, renew discussion and develop fresh ideas about the role of the constructed landscape to expand the possibilities of the twenty-first century city.
Keywords: biodiversity, Design, public lands, stewardship, urban ecology

59. Soundscapes as Natural Resources: Implications for Management and Conservation
Authors: **DUMYAHN**, Sarah, Purdue University; Bryan Pijanowski, Purdue University
Poster #35: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Humans have altered the Earth's ecosystems and biodiversity significantly. With the conversion of land and the loss of biodiversity, the world loses its natural sounds. The loss of natural sounds is compounded by the growing intrusions of motorized noise. Noise pollution is a ubiquitous problem in cities around the world, but the issue is spreading to more remote areas due to expanding transportation networks, motorized recreation and urban sprawl. These unwanted sounds have been the focus of regulations and frustrations over the years. Yet, the saliency of this issue has not taken hold in the U.S. as the acoustic environment continues to grow noisier. Indeed, it has been argued that we ought to focus our efforts on preserving the unique and natural sounds of an area. The soundscape, or entire acoustic environment of a given area, is a resource just as air and water are resources. Soundscape conservation moves beyond a reductionistic approach of dealing with noise on a source by source basis to approaching the soundscape as a holistic resource that (1) indicates a healthy environment and (2) provides many benefits to humans. Here we review soundscape conservation policy implementation by the U.S. National Park Service. This case study serves as an example of the shortcomings and successes

of soundscape conservation. We present the results of soundscape management efforts in national parks and reflect on the ability of soundscapes to be a lasting management paradigm.
Keywords: natural resource, resource management, soundscape, U.S. National Park Service

60. Protecting Our Acoustic Heritage: An Analysis of a Survey of U.S. National Park Service Managers
Authors: **DUMYAHN**, Sarah, Purdue University; Lelaina Marin, National Park Service, Natural Sounds Program; Bryan Pijanowski, Purdue University
Invited Symposium: Soundscape Ecology: The Complexity of Acoustical Patterns in Landscapes - Tuesday, April 6: 4:20-4:40 - Q

Abstract: The U.S. National Park Service (NPS) is charged with the management and protection of millions of acres of public lands. However, the sustainability of the natural, historical and cultural resources on these lands are challenged by many complex socio-ecological issues, such as climate change, loss of biodiversity, overuse and increased motorized recreation. An indicator of these issues is the continued loss of natural sounds. NPS recognizes that park soundscapes, or the unique natural, cultural, and historical sounds within the park, are resources worthy of protection. The NPS Natural Sounds Program was established in 2000 to address soundscape conservation in parks. To better understand the acoustic resources and noise issues in parks, the Natural Sounds Program sent a survey to each of the park units (n=391) in 2009. There were 150 respondents representing 141 different park units. Data were analyzed qualitatively to identify the common themes in responses. A quantitative analysis also was conducted to determine significant differences in responses based on respondents' position, park unit designation, park size, annual visitation and proximity to urban areas. The research findings from this study will help guide future soundscape conservation efforts by NPS. It is requested that this presentation be part of the Soundscape Ecology Symposium with Dr. Bryan C. Pijanowski
Keywords: acoustic environment, National Park Service, resource managers, soundscapes

61. Assessing watershed benefits of bioenergy crops: Recreational and subsistence value of fishes
Authors: **EATON**, Laurence, Oak Ridge National Laboratory; Peter Schweizer, Oak Ridge National Laboratory; Rebecca Efroymson, Oak Ridge National Laboratory; Yetta Jager, Oak Ridge National Laboratory
Invited Symposium: Reshaping Landscapes: Bioenergy and Biodiversity - Thursday, April 8: 11:00-11:20 - K-L

Abstract: A suite of economic benefits are derived from freshwater ecological resources. In the United States, a large part of these benefits stem from recreational and subsistence angling and from non-use values. Valuing these benefits can be undertaken through market-based or non-market-based methods to gauge preferences for environmental quality attributes. At the scale of a river reach or lake, fish valuation techniques often involve the collection of primary survey data on expenditure, frequency, and duration of fishing trips reported from resource users. However, challenges exist to measuring direct use over a larger spatial extent. We addressed this challenge by conducting a study of market-based, revealed preferences over a large watershed. We assembled a dataset composed of fishing privilege and species richness to estimate a spatially-oriented, welfare-relevant measure of use for the Arkansas-White-Red River Basin that covers eight states. Geographic Information Systems-based analysis is used to explain the role of biodiversity in determining use values across the Arkansas-White River basin. Our goal is to

apply the relationship between biodiversity and value to anglers to project future changes in value associated with changes in land-use resulting from a large scale expansion of lignocellulosic feedstock cultivation. Recommendations on incorporating species richness into future economic and agricultural systems will be provided with regards to angling privilege.
Keywords: biodiversity, bioenergy, fisheries, GIS, valuation

62. Assessing the Effectiveness of Agro-Environmental Conservation Programs in Maintaining High Alp Meadow
Authors: **EDWARDS**, Thomas, US Geological Survey / Utah State University; Felix Kienast, Swiss Federal Research Insititute; Janine Bolliger, SWiss Federal Research Institute
Offered Presentations: Restorative Ecology - Thursday, April 8: 10:00-10:20 - Y-Z
Abstract: We evaluated the effectiveness of conservation programs in halting or otherwise ameliorating reforestation transition likelihoods on dry grassland meadows of conservation importance in Switzerland. These meadows contain up to 65% of the rare and endangered flora and fauna of Switzerland, and their importance to overall European biodiversity cannot be underestimated. We first constructed reforestation likelihoods for 1,472 Swiss meadows using a logistic GLM. These represent simple successional models in the absence of any human-related management or conservation actions. Model accuracies estimated from both internal 10-fold cross-validation and an additional 149 independent meadows, respectively, were quite good (PCC: 79%-89%; Sensitivity: 75%-70%; AUC: 0.74-0.75), indicating our successional model accurately predicted reforestation likelihoods for the meadows. Using an independent data set of an additional 3,609 meadows, we next used logit models to evaluate the effectiveness of 3 different agro-environmental programs (here, labeled as H, S, E) linked to dry meadow protection in halting or reducing reforestation likelihoods. This analysis models the effectiveness of programs in halting or otherwise ameliorating the effects of reforestation. With the successional models defined as the baseline, the three agro-environmental programs were 2 (Program H) to 6 (Programs HSE, combined) times more effective at reducing reforestation likelihoods (χ^2=468.1, df=8, p<0.001), indicating their application to Swiss meadows was effective in reducing or halting reforestation. Last, we used these program results to re-conditioned the successional models, thereby providing a means of determining where application of specific programs would be most effective. Overall, application of the 3 programs would reduce reforestation in approximately 45%-60% of the meadows. Higher elevation meadows were more likely to respond favorably to application of the conservation programs than lowland meadows. In addition, meadows located Swiss plateau and Juras were more likely to benefit from program application than meadows in southern Switzerland.
Keywords: biodiversity, Conservation, endangered flora

63. Forecasting Climate-Induced Distribution Shifts for The Pinyon- Juniper Complex of the Western U.S.
Authors: **EDWARDS**, Thomas, US Geological Survey / Utah State University; Jacob Gibson, Utah State University; Gretchen Moisen, US Forest Service / Rocky Mountain Research Station
Offered Presentations: Climatic Influences I - Tuesday, April 6: 1:20-1:40 - R
Abstract: Pinyon and juniper vegetation types cover over 30% of the Colorado Plateau. Two species and one variety of pinyon pine (Pinus monophylla, P. edulis, P. monophylla var. fallax) and four species of juniper (Juniperus osteosperma, J. monosperma, J. deppeana, J. arizonica) are dominant in the Colorado Plateau, and comprise a mosaic of overlapping distributions arranged

primarily across a gradient of precipitation seasonality. Individual species have been found to respond uniquely to climate changes, causing shifts in the co-occurrence of species. This is reflected in the differential mortality among species caused by recent droughts, which appear to indicate long-term distribution shifts have already begun. We developed bioclimatic distribution models and applied climate change scenarios to gauge potential shifts in the distributions of individual species and their co-occurrence. In order to capture the full breadth of bioclimatic conditions inhabited by each species we developed distribution models for each species across the entirety of their geographic distribution. The application of climate change scenarios resulted in, for each species / variety, the spatial depiction of currently inhabited areas no longer suitable for regeneration as well as currently uninhabited areas becoming suitable for colonization. Collectively, the distribution shifts of each species were overlaid to gauge shifts in their co-occurrence. Our results suggest individualistic responses of species to climate change will likely cause shifts in their spatial co-occurrence. For example, J. osteosperma is predicted move northwest whereas J. monosperma is predicted to move northeast resulting in a decrease of co-occurrence. P. edulis is predicted to increasingly co-occur with J. osteosperma while P. monophylla is predicted to decrease or increase depending on the climate change scenario. The character of individual species distributions shifts and their resulting changes in co-occurrence will be largely determined by changes in the summer monsoon rains and in the minimum winter temperatures.
Keywords: climate effects, community shifts, junipers

64. The spatial framework and results of the initial National Assessment of the Status of Fish Habitat

Authors: **ESSELMAN**, Peter, Michigan State University; Dana Infante, Michigan State University; Lizhu Wang, Insitute for Fisheries Research; Arthur Cooper, Michigan State University; William Taylor, Michigan State University
Offered Presentations: Resource Management I - Tuesday, April 6: 1:40-2:00 - K-L
Abstract: The National Fish Habitat Action Plan recognizes that wide-spread degradation of habitat from human activities limits the health and productivity of the Nation's fisheries. To manage for impacts, a national accounting of habitat status is needed. However, the U.S. currently lacks a comprehensive and objective synthesis of the factors causing habitat degradation, undermining abilities to protect healthy systems and compromising development of restoration strategies. Our project, the National Assessment of the Status of Fish Habitat, begins to address these needs for the Nation's rivers. Using a landscape-scale approach, we developed a hierarchical assessment framework applicable to aquatic systems at multiple spatial extents which facilitates data summaries at various scales. We have data about landscape sources of habitat impairment for the conterminous U.S. including 1) human land use, 2) stream reach disturbances like dams and point source discharges, and 3) disturbance proxies such as human population densities. Multivariate statistical methods were used to summarize major landscape disturbance gradients, to determine the strength of influence of different disturbance types on fish assemblage variation, and to infer the relative influence of factors in network and local catchments on local fishes. The results of these analyses were used to derive an index of relative landscape disturbance to assign disturbance scores to each of the 2.25 million river reaches in the conterminous U.S. Index results are discussed and future directions identified.
Keywords: Assessment, fishes, Habitat, rivers

65. Connectivity in Riverine Landscapes and its Implications for Ecology and Biogeography
Authors: **FAGAN**, William, University of Maryland
Invited Symposium: Graph, Network, and Circuit Models of Landscape Connectivity - Thursday, April 8: 11:00-11:20 - Q

Abstract: Riverine landscapes differ in fundamental ways from terrestrial ones. In particular, the branching hierarchical geometry and downstream flow of river networks lead to inherently asymmetrical opportunities for connections among parts of a landscape. This ◄ alternative geometry↕ of riverine networks provides excellent opportunities to explore how network connectivity shapes habitat occupancy, metacommunity dynamics, and biogeographic patterns. Over the last few years, my colleagues and I have been exploring what happens when spatial ecological processes such as dispersal play out in riverine systems, with a particular emphasis on understanding how these processes influence species' biogeography and extinction risks. Using examples involving fish communities inhabiting the river networks of North America and India, I will discuss here how spatial features of river systems, such as habitat fragmentation and interbasin water transfer projects, influence ecological dynamics and biogeographic patterns.
Keywords: biodiversity, freshwater fish, hierarchical system, metacommunity, river network

66. Habitat suitability for the medicinal plant black cohosh (Actaea racemosa, L.) in western Maryland- a baseline study for management of non-timber forest resources
Authors: **FERRARI**, Joseph, University of Maryland Center for Environmental Science; Sunshine Brosi, Frostburg State University; Jim Howell, Allegany College of Maryland
Offered Presentations: Landscape Aesthetics II - Thursday, April 8: 2:20-2:40 - F-G

Abstract: The Appalachian mountain range has a long and rich tradition in herbal medicine, and is home to many native medicinal plants including well-known species such as American ginseng (Panax quinquefolius L.) and black cohosh (Actaea racemosa L.). Black cohosh is gaining popularity in Europe and the United States as an alternative to hormone therapy for menopausal women. Because this plant is primarily collected from the wild rather than cultivated, as demand has grown concerns have been raised regarding overharvest. Baseline data is needed on the abundance, health, and reproduction of populations to insure continued harvest is sustainable. Extensive field sampling was used to quantify existing populations on public lands in western Maryland, and a Mahalanobis distance measure was used to predict the location of potential populations on both public and private lands throughout this region. Conditions most likely to predict presence or absence were determined using GIS data layers related to elevation, etc., as well as field data related to soils and vegetative associations. A threshold Mahalanobis distance was determined to differentiate between ideal and non-ideal sites at 30m pixel resolution, and validation surveys were completed on a range of values above and below the threshold, with only 4 new populations found. Several forested areas predicted to be ideal were recently clearcut, reflecting current management goals. We suggest incorporating stand age information to eliminate surveying in recently harvested areas and to assist in providing baseline data for use in broader management plans that take into account economically valuable non-timber resources. Habitat variables significant in predicting locations for black cohosh could also be expanded to other related species which are rare and endangered in parts of their native range including mountain bugbane (Actaea podocarpa DC.) and Appalachian bugbane (Actaea rubifolia (Kearney) Kartesz).
Keywords: black cohosh, habitat suitability, herbal medicine, mahalanobis distance, Management

67. Vector mediated plant-pathogen interactions across the agricultural-wild ecotone.

Authors: **FERRARI**, Matthew, Center for Infectious Disease Dynamics,Penn State University

Invited Symposium: Pathogens in Heterogeneous Landscapes - Wednesday, April 7: 11:40-12:00 - Masters Hall

Abstract: Pathogens play a role in a host of interactions at the interface between the agricultural and wild landscapes. Pathogen import from wild species has long been a concern in agriculture. There is increasing concern about the reciprocal issue of escape of cultivar resistance genes into wild species. Understanding, and thus managing, these processes requires knowledge of the full set of ecological and evolutionary interactions that govern pathogen dispersal and transmission, the fitness of wild-type and cultivar genes, and interactions with other natural enemies on both sides of the agricultural-native ecotone. Establishment and spread of a resistance gene in wild populations depends on both the fitness costs associated with resistance and the ecological context that mediates those costs. We study the introgression of a viral resistance transgene from cultivated squash to their wild con-specific, Cucurbita pepo ssp texana in the presence of a non-target pathogen. C. pepo is affected by two major classes of vector-transmitted pathogens: viruses transmitted by generalist aphids and the bacterium, Erwinia tracheiphila, transmitted by specialist cucumber beetles. The beetle vectors of Erwinia selectively forage on large plants, resulting in an increased mortality risk due to bacterial infection. Viral infection, though rarely fatal, results in reduced growth and fecundity, which reduces visitation by the vectors of Erwinia. Thus, in the presence of both pathogens, virus resistant transgenics have an increased risk of a fatal bacterial infection. From common garden experiments with mixed fields of wild-type C. pepo and transgenic hybrids, we show that selective foraging by vectors results in a counter-intuitive cost to viral resistance in the context of the full pathogen community.
Keywords: Agriculture, cucurbita, erwinia, transgenic resistance, vector-borne

68. Signal detection, perceptual range, and landscape connectivity

Authors: **FLETCHER**, Robert, University of Florida; John Andrews, University of Florida; Christopher Maxwell, University of Florida

Offered Presentations: Simulated Environments I - Thursday, April 8: 10:20-10:40 - T-U

Abstract: Understanding functional connectivity is critical for numerous issues in ecology and conservation. When animals actively search for habitat across landscapes, variation in the perceptual range of habitats by organisms can profoundly influence connectivity. Nonetheless, conceptual development and estimation of perceptual ranges and their influence on connectivity have been limited. Signal detection theory has a long tradition in numerous disciplines to address the problem of detecting stimuli in noisy and uncertain environments, which may prove useful for interpreting perceptual ranges and connectivity. Here we extend signal detection theory to the concept of perceptual ranges, provide analytical approaches for estimating the perceptual range, and apply this framework to interpreting the perceptual range and functional connectivity of cactus bugs Chelinedea vitteger on cactus networks. Signal detection theory is particularly useful for interpreting the perceptual range because it distinguishes between two key parameters that have previously been absent in interpreting the perceptual range of animals: signal detectability and the response bias of individuals. Previous studies on C. vitteger suggested that cactus bugs exhibit significant response bias by directing movements into the wind, thereby complicating interpretation of the perceptual range. We find that signal detectability of habitat, and thus the perceptual range, by cactus bugs is 1 m, based on generalized linear models aimed at estimating signal detection parameters. We further illustrate the role of response bias versus signal

detectability in connectivity via simulations on cactus spatial networks. Our simulations emphasize that landscape connectivity differs markedly with response bias of individuals, independent of signal detectability. Signal detection theory thus provides new insights into perceptual ranges and functional connectivity in heterogeneous landscapes.
Keywords: Behavioral landscape ecology, Functional connectivity, movement, Network theory, perceptual range

69. How to compare graphs
Authors: **FORTIN**, Marie-Josee, Ecology & Evolutionary Biology, University of Toronto; Andrew Fall, Gowlland Technologies Ltd
Invited Symposium: Graph, Network, and Circuit Models of Landscape Connectivity - Thursday, April 8: 10:40-11:00 - Q
Abstract: In conservation and reserve network selection studies, there is a lot of interest in maintaining landscape connectivity such that individuals can move through fragmented landscapes. Over the last decade, different graph-theoretical methods have been proposed to determine potential corridors and reserve networks. The question is however which of these networks is the most appropriate. We need therefore to be having a framework to compare different types of networks based either on the nodes, the links or the network as a whole. First, we present the most common network methods to compare graphs. Then, we propose using spatial graphs and Voronoi polygons to determine the degree of spatial overlap between networks based on different sets of variables. The potential of these new metrics is illustrated using caribou habitat networks. We show that the Voronoi polygon approach offers several advantages when comparing two graphs that do not have the same number of nodes.
Keywords: connectivity, fragmentation, graph theory, network, spatial overlap

70. Forest insect defoliation and carbon dynamics: simulating multiple defoliator outbreaks in mixed deciduous landscapes with Landis-II
Authors: **FOSTER**, Jane, University of Wisconsin - Madison; Robert Scheller, Portland State University; Brian Sturtevant, US Forest Service - Northern Research Station; Philip Townsend, University of Wisconsin - Madison; David Mladenoff, University of Wisconsin - Madison
Offered Presentations: Simulated Environments II - Thursday, April 8: 1:20-1:40 - Y-Z
Abstract: Defoliation outbreaks are dynamic forest disturbances with unique spatial and temporal characteristics that produce distinct changes in forest composition and carbon (C) balance. We simulated defoliation outbreaks using a new module for the forest disturbance and succession model, Landis-II, to better understand the long-term consequences of defoliation on forest C. Our disturbance module recreates defoliation spatial dynamics with parameters derived from Landsat maps and captures species-specific growth and mortality responses to accumulated stress. We demonstrate how simulated defoliation events mimic spatial and temporal patterns of gypsy moth (GM, Lymantria dispar L.) outbreaks and their effects in the central Appalachian mountains of western Maryland, U.S.A. We simulated forest dynamics over 400 years with and without GM defoliation to compare aboveground C dynamics expected in the absence of GM with those following introduction. Simulations were also run with forest tent caterpillar (Malacosoma disstria Hbn.) defoliation, individually and with GM, to examine how multiple defoliators with shared hosts alter disturbance response. Results show that the introduction of GM disturbance changes the trajectory of forest species composition, facilitating increases in non-host species that would not otherwise occur. Forest C is temporarily reduced following individual outbreaks,

as are long-term means, once GM enters the landscape. Changes in forest C storage are even more pronounced when a native defoliator has periodic outbreaks in the same landscape, particularly when outbreaks synchronize. Interacting insect disturbances have significant consequences for forest C storage and should be incorporated into our growing understanding of C dynamics at landscape scales.
Keywords: carbon, defoliation, Disturbance, Forests, gypsy moth

71. Stream Classification for Modeling Ecological Reponses to Hydrologic Alteration
Authors: **FREEMAN**, Mary, U.S. Geological Survey; Robert Jacobson, U.S. Geological Survey; John Jones, U.S. Geological Survey; Colin Shea, University of Georgia; James Peterson, U.S. Geological Survey
Invited Symposium: Linkages Among Landscape, Flow, and Aquatic Habitat: The Upper Flint River Water Availability Study - Tuesday, April 6: 1:20-1:40 - Q
Abstract: Stream classification is commonly used to improve predictive models of physical and biological properties. Classification is often based on general differences in hydrologic patterns, such as degree of flow intermittency or seasonal flow predictability. Geomorphic variation across the landscapes that encompass stream systems is also expected to influence a variety of ecologically-relevant processes, but generalized bases for geomorphic classification have not been widely applied or tested. This is particularly the case for low-relief landscapes such as those that characterize the eastern U.S. Piedmont. We are developing a simple stream classification to support an interdisciplinary effort to model effects of watershed dynamics, water management and climate change on aquatic biodiversity in the upper Flint River system, Georgia. Initially, we have evaluated the usefulness of field, map and airborne LiDAR (Light Detecting And Ranging) data for classifying stream reaches based on variation in channel confinement and bed sediment characteristics. Additional field research will be required to test the hypothesized relevance of geomorphic variation to ecological processes, including the spatial scales at which geomorphic features carry the most useful information for predicting how stream biota respond to hydrologic change.
Keywords: Geomorphology, Hydrologic change, Stream biota

72. Multiscale Analysis of Phenology Data Sets - Implications for Remote Sensing Methods
Authors: **FRIEDL**, Mark, Boston University; Koen Hufkens, Boston University; Andrew Richardson, Harvard University
Invited Symposium: A Land-surface Phenology: A View Through the Lens of Vegetation - Thursday, April 8: 11:00-11:20 - R
Abstract: Satellite-based phenology products are becoming increasingly widespread. Current sensors used to generate these products include the AVHRR, SPOT-Vegetation, MODIS, and MERIS. These instruments provide data that vary in spatial resolution from 300-m to 1 km. Further, each sensor has different radiometric properties and effective temporal resolution. Algorithms used to estimate phenological transitions from these data sources vary widely. As a result, satellite-based measures of phenology show substantial variability across data sets and algorithms. In this paper we provide an overview of ongoing efforts to assess satellite-derived measures of phenology from MODIS based on the MODIS Land Cover Dynamics Product. This product is designed to estimate cardinal dates in the growing season based on time series of vegetation indices. Here we describe results from two assessment activities. First, we compare MODIS-based estimates of phenology against ground-based observations of phenology and light

interception data at several sites in the northeastern United States. Second, we present results comparing MODIS-based estimates of phenology with time series observations from webcam data collected at roughly 30 sites in the United States and Canada. Results show general agreement between MODIS data and in-situ measurements, but also that substantial uncertainty is inherent to satellite-derived measures and more work is needed to develop methods and metrics to characterize errors in satellite-based estimates of phenology.
Keywords: MODIS, phenology

73. Modeling vegetation succession dynamics to evaluate landscape-level responses to Everglades restoration scenarios

Authors: **FRIEDMAN**, Steve, Everglades National Park; Leonard Pearlstine, Everglades National Park; Matthew Supernaw, Everglades National Park

Offered Presentations: Simulated Environments II - Thursday, April 8: 2:20-2:40 - Y-Z

Abstract: The Comprehensive Everglades Restoration Plan (CERP) is the largest wetland restoration project in the world whose objectives include improving the quantity, quality, and timing of water deliveries to the Everglades. The Everglades Landscape Vegetation Succession Model predicts estimated shifts in vegetation communities in ecosystems including the coastal saline, freshwater marsh, hammocks and pineland communities. Ecological drivers of succession in the model integrate hydrology (hydroperiod, wet and dry season water depths, frequency and duration of dry downs), nutrients, salinity, and large-scale dynamics including fire, hurricanes and climate change. Model rules defining niche spaces for vegetation communities are derived primarily from the literature and expert opinions of plant community responses to ecological drivers. Transitions between community states are defined with conditional probabilities weighted by spatial neighborhood community abundance and temporal lag periods specific to each respective plant community. Vegetation dynamics are influenced by current and past water management actions that have altered flow dynamics which changed the timing and quantity of water resulting in varying water depths and hydropatterns. The model is designed to address ecological dynamics in vegetation communities ranging from sea grass communities, mangroves, saline and freshwater marsh and prairies, hammocks and pineland forests. These communities are positioned along a numerous stress and competition gradients where species and community spatial dynamics are represented by a balance between freshwater, nutrients, soil salinity and sea level as well as fire and hurricanes which also influence Everglades vegetation communities. The ELVSM's modular construction facilitates model expansion, improvement and flexibility to promote open source computing. As system knowledge improves over time, new relationships can be integrated into new model components or replace previous framework. Preliminary simulation results demonstrate the application of vegetation succession modeling for evaluating CERP restoration scenarios. Future plans include the integration of the model with higher trophic level habitat suitability models.
Keywords: Everglades, restoration, simulation model, succession, vegetation

74. Natural and anthropocentric river fragmentations analysis, an its implications

Authors: **GAMA**, Lilly, Universidad Juarez Autonoma de Tabasco; Ricardo Collado-Torres, Universidad Juarez Autonoma de Tabasco; Claudia Villanueva-Garcia, Universidad Juarez Autonoma de Tabasco; Hilda Diaz-Lopez, Universidad Juarez Autonoma de Tabasco; Mario Ortiz-Perez, Universidad Nacional Autonoma de Mexico; Eduardo Moguel-Ordoñez, Universidad Juarez Autonoma de Tabasco

Offered Presentations: Disturbance II - Wednesday, April 7: 10:20-10:40 - Z

Abstract: The Grijalva-Usumacinta basins in the South-east part of Mexico are together the biggest most dynamic ones. They have an extension of 91,345 km2 that represent 4.7% of the Mexican territory. The basins have a population of 4, 919,793 habitants that correspond to 5% of the Mexican population. One third of all the fresh water reservoirs of the country pass through the basins. Five of the biggest dams of the country for electricity generation were constructed on the upstream area of the Grijalva River. An historical review of the basins in the Golf of Mexico reveals that they have had a high degree of fragmentation and that the natural floods had increase in extension, duration and magnitude. The objective of this research was to find out the implications of this fragmentation on recent floods. A geographical information system was use to configure a cartographic data base of the actual and historical hydrological maps to find out changes on them. A review was done to gather information on the hydrological infrastructure constructed in these basins. An analysis of a set of landscape components was done to relate them to natural changes on the hydrodynamic of the basins and their probable impacts on the territory. Results show that the hydrology of the area had change drastically since prehispanic times. These changes and fragmentation of the local streams affect the natural flooding characteristics that had increase the vulnerability of the territory. Each time there is a change or fragmentation on the hydrodynamic on the basin especially on the last century or a construction of hydrological infrastructure there is a drastically increase in the vulnerability of the localities located here.
Keywords: Basin, dams, floods, fragmentation, vulnerability

75. A multi-scalar and multi-platform approach to evaluating ecological status of African savannas

Authors: **GIBBES**, Cerian, University of Florida; Sanchayeeta Adhikari, University of Florida; Jane Southworth, University of Florida
Poster #30: Scale - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria

Abstract: Human influence on and intertwinement with ecosystems is evident in land transformation and biotic change trends. The lack of human-free ecosystems suggests that separation of humans and the environment is not a realistic conceptualization of the Earth's system and that human dimensions are an integral part of the system. The research presented here recognizes human actions and decisions as fundamental components of the global system and explores the effects of variations in human land use and land management on vegetation composition. We utilize a multi-scale and cross platform approach to examine vegetation composition and associated land cover patterns. The study site contrasts an area in which direct human land use is permitted with an area in which human influence on the landscape is realized solely through land management policies. Recognition that ecological processes occur at multiple and interacting scales, drives current research to explore ecological status and change at many scales. In addition to comparing direct and indirect human influence on the landscape, this study explores the utility of subpixel, and object oriented classifications combined with multi-sensor analyzes in order to improve the characterization of savanna landscapes. We rely on a hybrid remote sensing approach to characterize the landscape and examine the patterns of vegetation and land cover associated with varied human actions and land management decisions. The results from this research contribute to methodological advances in characterizing semiarid regions and to the understanding of how land management decisions affect land cover.
Keywords: land cover, multiscale, remote sensing, savannas, semiarid

76. Conservation incentives in the context of other influences on land managers' decisions

Authors: **GIMONA**, Alessandro, The Macaulay Land Use Research Institute; Gary Polhill, The Macaulay Land Use Research Institute

Offered Presentations: Landscape Aesthetics II - Thursday, April 8: 2:40-3:00 - F-G

Abstract: We used a coupled agent-based model of land use change and a species metacommunity model to investigate the effects of conservation incentives on landscape structure and species diversity. Incentives are studied in the context of other influences on land managers' decision making, namely input costs, market price variability and aspirations. We investigated activity-versus-outcome-based incentives, and individual-versus-collective incentives. The results show that there are critical thresholds in the amount of incentive schemes provided, where a sudden increase in delivery of environmental benefit occurs for a relatively small increase in incentive (and vice versa). Landscape structure and its space-time pattern mediate the effect on metacommunities, and are affected by the interaction between incentives and market price volatility. The context affects the level of incentive at which tipping points occur, and the degree of the effect.

Keywords: conservation incentives, land use change, metapopulation, simulation

77. Landscape Ecosystems Classification, National Soil Survey, and the Alaskan Wilderness: a Study in Applied Ecological Site Mapping.

Authors: **GLASS**, Dallas, Natural Resources Conservation Service; Tracy Christopherson, Natural Resources Conservation Service; Mark Clark, Natural Resources Conservation Service; Michelle Schuman, Natural Resources Conservation Service

Offered Presentations: Resource Management II - Tuesday, April 6: 4:40-5:00 - F-G

Abstract: It's no surprise that Alaska provides a unique set of challenges when working in natural resource fields. If the difficulty of working in remote roadless areas with study areas the size of small states is not enough, a lack of local ecological literature only compounds the problem. During the winter of 2008, an initial Soil Survey was undertaken by the Natural Resources Conservation Service in cooperation with the National Park Service to develop a soil and ecological site map of the Yukon-Charley Rivers National Preserve. Yukon-Charley is a 2.5 million acre national preserve located in interior Alaska along the Canadian boarder. The park ranges from rugged alpine peaks to large flat peat lowlands, covering numerous ecological communities. Due to the largely unglaciated nature of the preserve, scientists believe this area was a refuge for vegetation. Remnants of this vegetation are thought to still exist on steep south facing slopes. Mapping began by delineating landtype associations based on geomorphic properties and vegetative photo signatures using Alaska High-Altitude Photography. The composition of each landtype association was determined by literature review and ground data from the 2008 and 2009 field seasons. Traditional soil components were paired with an associated vegetation community and its historic climax plant community. Each ecological site described is composed of all communities within the seral progression to the historic climax community and is akin to Bailey's landtype and landtype phases (1980). Data from the field was placed in databases for management and analysis. To date over 550 plant species have be found in 200 distinct plant communities arranged in 70 ecological sites. Presented here are two examples of these ecological sites and their interpretations. The ecological site classification combined with traditional soil survey provides a practical tool for a wider range of users in the remote wilds of Alaska.

Keywords: Alaska, Mapping, Soils, Vegetation Community

78. Butterfly responses to agricultural buffer management at two spatial scales

Authors: **GOLDENETZ-DOLLAR**, Jolie, Mississippi State University; Samuel Riffell, Mississippi State University; L. Wes Burger, Jr., Mississippi State University

Offered Presentations: Agrarianism I - Tuesday, April 6: 11:00-11:20 - Q

Abstract: Agricultural field buffers comprised of native warm-season grasses and native forbs provide habitat for many butterflies. We measured responses of butterflies to mid-contract management of buffers enrolled in the USDA's Conservation Reserve Program (conservation practice CP33 – Habitat Buffers for Upland Birds) within an agricultural landscape in northeast Mississippi. Fields were randomly assigned to burning, disking, or control (undisturbed), and 1/4th of each experimental field was burned or disked each year (2007 – 2009). We counted butterflies in each buffer six times each summer using 50-meter transects. We examined the effects of disturbance (mid-contract management) at both buffer and field scales for disturbance-tolerant and grassland-specialist guilds. Prior to disturbance (2007), butterfly communities, plant communities, and vegetative structure did not differ among treatments. In 2008, disturbance-tolerant butterflies responded positively to disking at the buffer scale. In 2009, this same guild responded positively to disking at the field scale. Disking increased forb cover, thus providing greater nectar resources for butterflies. No statistical differences existed between treatments for grassland-specialists for both years and at both scales, though abundance and richness was lowest on disturbed (i.e., burned and disked buffers) at the buffer scale analysis in 2008. At the field scale of analysis, grassland-specialists were not negatively affected by disturbance, suggesting that providing refugia (undisturbed buffers) adjacent to disturbed buffers by using a rotational disturbance schedule could maintain diverse butterfly communities at larger scales. Current and future USDA practice standards should continue to restrict disturbance to only 1/3rd or 1/4th of buffer area in a given year. This rotational management regime promotes early-successional habitat for numerous wildlife species and provides refugia for beneficial insects, including butterfly species. Butterflies serve important ecological and economic functions in agricultural ecosystems, including pollination, food for wildlife, indication of environmental health, and wildlife-viewing opportunities.
Keywords: Disturbance, refugia, semi-natural habitat

79. Valuation of ecosystem services in reservoir systems: a case study of the Hongyashan Reservoir in arid Northwest China

Authors: **GONG**, Jie, Key Laboratory of West China's Environmental Systems (MOE),; Tongchang Jiang, ; Yuchuan Wang,

Poster #28: Sustaining Systems - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: Valuing ecosystem services is an increasingly popular approach in ecosystem management, particularly due to its capacity to link human and natural systems. Reservoirs are excellent systems to study ecosystem services in arid areas because they provide critical water resources that support both biodiversity and humans development. We conducted a case study to evaluate ecosystem services provided by the Hongyashan Reservoir, the largest reservoir in the desert area in Asia. Based on a revision of valuation methods of Costanza et al (1997) and Xie et al (2003) and government archival, we determined the total economic value of Hongyashan Reservoir was 453 million yuan per year (1 Yuan=0.13 USD in 2007). The economic value was derived from water conservation (145 million yuan per year, 32.1%), sediments and waste assimilation (130 million yuan per year, 28.7%), grain production services (125 million yuan per year, 27.7%) and other services including biodiversity conservation, entertainment and culture

(53 million yuan per year, 11.5%). This study serves as a basis for stakeholders (e.g., local residents) to understand various services that this reservoir provided. In addition, this study provides a benchmark for policy makers on ecosystem services from reservoirs in arid systems, and highlights the need for new policy frameworks that integrate human and natural systems. Keywords: arid area of Northwest China, Ecosystem Services, Hongyashan Reservoir, reservoir, valuation

80. Landscape context and plant community composition in grazed agricultural systems
Authors: **GOSLEE**, Sarah, USDA-ARS; Matt Sanderson, USDA-ARS
Offered Presentations: Agrarianism I - Tuesday, April 6: 10:00-10:20 - Q
Abstract: Temperate humid grazinglands are an important component of the landscape of the northeastern Unites States. Grass-based agriculture is a major contributor to the economy of this region, but little is known about the basic ecology of these grazinglands. During an eight-year survey of 28 farms across the northeastern United States, we sampled the vegetation on 95 modified Whittaker plots in grazed pastures, and collected data on topography, climate and soils at each site. Surrounding land use and landscape metrics were calculated from the NLCD 2001 within circles of six radii (250 - 2000 m) surrounding each sampling site. Plant species diversity was divided into planned (forage) species and associated (nonforage) species. Composition of forage species was not strongly related to environmental factors or landscape context, while composition of nonforage species was influenced by elements from all classes of explanatory variables, particularly the presence of species in 1000-m2 plots. The lower variability in the forage species pool and the management applied to forage species and only incidentally to nonforage species probably explains the differences in responses of the two groups of species. Seed dispersal pathways may contribute to differences between the two groups. Site management for forage species overwhelms the role of landscape context for this group, but site management alone does not explain all variability in plant species composition. Landscape management, biodiversity management and land use planning must consider pastures as functional plant communities, part of the interconnected regional landscape.
Keywords: Agriculture, Grazing, land use, Management, Plant communities

81. An overview of circuit theory applications in landscape ecology, landscape genetics, and conservation planning
Authors: **GRAVES**, Tabitha, Northern Arizona University; Brad McRae, The Nature Conservancy; Brett Dickson, Northern Arizona University; Paul Beier, Northern Arizona University
Invited Symposium: Graph, Network, and Circuit Models of Landscape Connectivity - Thursday, April 8: 11:40-12:00 - Q
Abstract: Circuit theory is an emerging tool for modeling connectivity in the fields of conservation planning, landscape genetics, and movement ecology, and is being applied to prioritize habitats for conservation using carnivores. Circuit models represent raster landscapes as conductive surfaces, with resistance levels corresponding to movement probabilities or costs in different habitat types. Resistance and current calculated across the grids can then be related to ecological processes, like individual movement and gene flow, across landscapes. For conservation planning, circuit theory is particularly useful in quantifying the conservation value of multiple movement pathways, and identifying "pinch points," or areas that are critical for connectivity conservation because of a lack of redundant pathways. We'll review basic circuit

theory, discuss relationships between circuit and random walk theories, and describe software (circuitscape.org) that implements circuit theory for conservation planning, landscape genetics, and movement modeling. We'll describe how circuit models are being applied to identify barrier effects,parameterize movement models using genetic data, and to prioritize important connective habitats for conservation. We will discuss the use of circuit theory in quantifying the resistance of landscape features.
Keywords: circuit theory, connectivity, landscape genetics, movement, resistance

82. Community Garden Site Selection in Madison, Wisconsin: Social and Spatial Analysis in a Changing Urban Landscape
Authors: **GREENE**, Robert, University of Wisconsin-Madison, Landscape Architecture Dept; Janet Silbernagel, University of Wisconsin-Madison, Landscape Architecture Dept
Offered Presentations: Landscape Aesthetics I - Tuesday, April 6: 3:40-4:00 - K-L
Abstract: In the last century urban agriculture has occupied a marginal and transient space in regard to land use in U.S. cities. Over the past decade, however, there has been a renewed interest in urban agriculture as a land use mechanism to engage themes of environmental health, community food security, and social justice. Community gardens, as a subset of urban agriculture, provide an opportunity to convert unoccupied or underutilized land in urban environments into a community asset, yet few cities have developed cohesive frameworks for the selection of land for these gardens. The purpose of my study is to identify the social and spatial characteristics that influence such a framework in the context of Madison, Wisconsin. As vacant and underutilized land in Madison becomes increasingly scarce, community garden sites do not necessarily correspond with optimal social and physical settings. The study is designed in the context of this changing urban landscape, and provides unique insight into the correlations between garden site selection criteria and the spatial distribution of community gardens. I use Interviews and archival investigation of a local, collaborative decision making process to identify the most influential factors in the approval of new community garden site proposals. These factors are then represented spatially using geographic information systems, and analyses are performed comparing spaces occupied by existing community garden sites and attributes of site selection criteria on the landscape. Initial results suggest that population centers and demographics have an equal, and in some cases greater impact on site selection than biophysical factors that are more commonly measured in land suitability analyses. Rejections or approvals of new community garden proposals by a garden funding panel in January, 2010 will offer an opportunity to assess the validity of the site selection factors identified in the study.
Keywords: Community Gardens, geographic information systems, land use, Public Space, Urban Agriculture

83. US-IALE Presidency: the Gustafson administration, 2002-2004
Authors: **GUSTAFSON**, Eric, Institute for Applied Ecosystem Studies
Invited Symposium: US-IALE Presidents' Symposium II - Tuesday, April 6: 1:40-2:00 - Masters Hall
Abstract: The focus of the Gustafson administration was 1) advancing the Society into the digital age, 2) improving the administration and organization of our annual meetings and 3) strategic and tactical planning and implementation. We hired a webmaster and made substantive improvements to our web presence, including online membership registration and dues payment, revising the by-laws to allow online voting, member networking services (including job

postings) and enhanced website content (including course syllabi and photo gallery). The primary enhancements to the way we organize meetings were to begin using the services of meeting organizer (Virginia Dale's idea) and to develop an MOU template to use with annual meeting host organizations to specify responsibilities and fiscal arrangements. We charged the Chair-elect (Pete August) to review and revise the 1998 Strategic plan, to provide his administration with ready-made blueprint for action. We also focused a great deal of time and energy on brainstorming and implementing tactical plans for increasing membership, improving services to our members, advancing the relevance of the Society to the landscape ecology scientific enterprise, and improving the administration of the Society. I see three challenges for the future, all related to the fundamental and rapid changes occurring in how people communicate and interact. 1) Sustain and improve our core strength – our annual meeting. 2) Fully exploit the internet as the primary medium for people to get information, network, and create knowledge. If we are not relevant on the web, will we be relevant anywhere? 3) How do we maintain the relevance of our scientific society in the face of instant global access to information and people? To what extent should we embrace electronic media, and how can we create an essential niche to enhance the interpersonal networking that makes our Society critical for the advancement of our science?
Keywords: US-IALE

84. Modeling effects of species diversity on disease risk in an invading forest pathogen system with spatially-autocorrelated observation data

Authors: **HAAS**, Sarah, University of North Carolina-Charlotte; David Rizzo, University of California-Davis; Ross Meentemeyer, University of North Carolina-Charlotte

Poster #20: Invasion - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: Epidemiological theory predicts that species diversity of ecological communities affects the prevalence and transmission dynamics of infectious diseases by either dilution or amplification effects. Despite its importance, little has been done to incorporate effects of landscape heterogeneity into models of diversity-disease risk interactions, and most studies have focused on animal or agricultural systems, with less attention on plant pathogens in natural ecosystems. Here, we analyze diversity-disease risk in sudden oak death, an emerging infectious forest disease caused by the generalist plant pathogen Phytophthora ramorum. This pathogen is an ideal organism for studying diversity-disease risk because it infects dozens of plant species throughout forest ecosystems in California. We hypothesize that increased plant species richness decreases disease incidence due to asymmetric transmission and susceptibility between host species. We measured forest structure and disease status of all host individuals in 279 randomly located plots in Big Sur, CA across a heterogeneous range of host and abiotic conditions along a gradient of infection exposure. We modeled diversity-disease risk using two approaches: (1) standard logistic regression, and (2) autologistic regression (using the 'spdep' R package), which includes an additional explanatory variable, the autocovariate, used to correct the effect of spatial autocorrelation among observations. We found significant spatial autocorrelation remaining in the logistic regression residuals (Moran's I: 0.234, p=8.35e-10), but not in the autologistic residuals (Moran's I: 0.057, p=0.062). Both models revealed a negative relationship between species richness and disease incidence, suggesting that forest areas with higher species diversity may have lower disease incidence in this generalist host-pathogen system. This relationship may be occurring in the P. ramorum pathosystem through two dilution mechanisms—'encounter reduction' (reduced encounters between susceptible and infected hosts as non-optimal host

species are included) and 'susceptible host regulation' (a reduction in the number of susceptible hosts as diversity increases).
Keywords: autocorrelation, autologisitic, disease, diversity, sudden oak death

85. Scaling of fire regimes across a gradient in wilderness management

Authors: **HAIRE**, Sandra, University of Massachusetts; Carol Miller, Aldo Leopold Institute, USFS; Kevin McGarigal, University of Massachusetts
Offered Presentations: Fire - Wednesday, April 7: 10:20-10:40 - F-G
Abstract: Within many wilderness areas, naturally ignited fires are selectively allowed to burn with the recognition that natural disturbances can meet management goals. Because this practice has occurred since the 1970's in some areas, the allowance of natural burning in those areas may have changed the characteristics of local fire events and their contribution to broader-scale fire regimes. The current study is based on the theory that scales at which fire characteristics vary correspond with thresholds in key structuring processes. We hypothesized that fire use management practices affect scaling of fire characteristics via their influence on fuel dynamics, even in large fire years. We focused on Sierra Nevada wilderness areas (California, USA) where management practices are well documented. To test our hypothesis, we quantified changes in fire frequency-area relationships for randomly chosen fire locations across a fire use management gradient. The gradient was developed using a kernel surface weighted by an index that reflects differences in policies among management units. The relationship between rate of change in frequency-area and the kernel value at each fire location was analyzed using linear regression. Results indicated that fire use management did not influence the scaling of fire frequency when the analysis focused on point of ignition patterns alone. However, when data reflected fire size distributions, variations in management became important to scaling relationships. Findings suggested that fire sizes are limited by policies that have allowed more fires to burn over a longer term. In a temporal analysis that considered scaling of fire frequency by year, differences were less pronounced, illustrating potential links with variability in climate. Is human management of wilderness fires natural? A long history of interactions between people and fire have shaped the fire regimes of today, making human culture inseparable from fire as a natural process.
Keywords: cross scale analysis, fire management, Sierra Nevada, wilderness

86. Ensemble modeling of persistence and turnover: Ecological forecasting for conservation planning

Authors: **HAMILTON**, Healy, California Academy of Sciences; Miguel Fernandez, University of California, Merced
Invited Symposium: Climate Change and Landscape Connectivity: From Theory to Practice - Thursday, April 8: 10:40-11:00 - Masters Hall
Abstract: Although connectivity conservation is firmly grounded in the principles of conservation biology, recent expanded interest emphasizes the role of connectivity conservation in supporting biodiversity adaptation to climate change. As species attempt to track their shifting climate envelopes, design and implementation of corridors among existing protected areas could facilitate these range shifts. Many studies attempt to model the future geographic ranges of conservation target species, and conservationists seek these results to design for connectivity that accommodates species shifting geographic ranges. However, methods for forecasting range shifts are encumbered with significant uncertainties, and most forecasts of species future ranges cannot yet be translated into actionable conservation planning. One approach to increase confidence in

ecological forecasts is the use of an ensemble of global climate models to forecast the most extreme ends of the spectrum of geographic response: persistence, defined as regions where consensus among climate models suggests continued residence of a current climate envelope, and turnover, in which an ensemble of climate models consistently projects elimination of the current climate envelope. Persistence and turnover can be calculated for a geographic region using global climate model outputs directly, or for a target taxon, using species distribution modeling algorithms. We describe a large dataset of downscaled climate parameters generated from an ensemble of 17 global climate models that supports analysis of persistence and turnover. With a focus on North America, several examples demonstrate analyses of climate persistence and climate turnover for ecoregions as well as for conservation target species. This approach to ecological forecasting can be applied to connectivity conservation strategies to support biodiversity resilience to climate change.
Keywords: biodiversity, climate change, connectivity, Conservation

87. High-Resolution National Phenological Ecoregions and Their Utility for Forest Monitoring
Authors: **HARGROVE**, William, Eastern Forest Threat Assessment Center, USDA Forest Service; Forrest Hoffman, Oak Ridge National Laboratory
Invited Symposium: C - Thursday, April 8: 4:00-4:20 - R
Abstract: Deviations from "normal" land surface phenological development can be the first indications of important changes in landscape status, including disturbance and recovery. For use as part of an early warning system, however, an assessment must be made as to whether the current temporal trajectory of a location falls within the normal, expected range of variation, or whether it has deviated beyond this range due to some kind of forest disturbance. The ability to define a spatially explicit normal baseline expectation of phenological behavior is thus crucial to the utility of phenological data for vegetation health. Many such phenology-based definitions of normal are possible – which of these will provide the most reliable reference for the earliest possible discrimination of vegetation disturbance? In an effort to bracket normal phenological behavior, we have explored spatial and inter-annual variability in length of growing season, duration of spring and fall across the conterminous United States. We have also delineated national phenological ecoregions, or phenoregions, areas which have similar timing of spring green-up and fall senescence. A multivariate clustering algorithm, scaled up to very large datasets using a parallel supercomputer, forms the basis of this statistical approach. Like ecoregions, quantitative, statistically defined phenoregions are useful for sampling stratification, and provide insights into vegetation patterns. The constancy of classification of a particular location ino phenological ecoregions over a multiple-year period is another measure of phenological variability. Deviations in land surface phenology beyond the characteristics of the containing phenoregion can be used as one indicator of a change in vegetation health status. Results can be seen in Google Earth at http://data.forestthreats.org/phenology
Keywords: Disturbance, ecoregions, monitoring, vegetation health, warning

88. Generating Spatially Distributed Streamflow for Aquatic Habitat and Population Modeling
Authors: **HAY**, Lauren, US Geological Survey; Steve Markstrom, US Geological Survey; Roland Viger, US Geological Survey
Invited Symposium: Linkages Among Landscape, Flow, and Aquatic Habitat: The Upper Flint River Water Availability Study - Tuesday, April 6: 2:00-2:20 - Q
Abstract: The sensitivity and potential effects of long-term climate change and urbanization on

the freshwater resources of the upper Flint River basin were examined using the Precipitation Runoff Modeling System (PRMS). PRMS is a distributed-parameter watershed model developed to evaluate the effects of climate and land use on general basin hydrology. Simulations of precipitation and temperature from 5 GCMs and for one current and three future carbon emission scenarios were statistically downscaled for input into PRMS. Projections of urbanization for PRMS were derived using the FORecasting SCEnarios of future land-cover (FORE-SCE) model through 2050. PRMS was used to generate spatially distributed streamflow for river locations which are important for aquatic habitat and population modeling using each climate scenario with and without urbanization projections. The hydrologic effects and sensitivity of the Flint basin to climate and urbanization change was evaluated by comparison of PRMS simulations for current climate conditions to the ensemble of results produced using the GCM climate and FORE-SCE urbanization projections. All future GCM scenarios project a steady increase in temperature. Unlike temperature, projected changes in precipitation show both increases and decreases, indicating a high degree of uncertainty associated with future precipitation projections in the upper Flint River basin. PRMS simulates spatially-distributed estimates of streamflow, components of flow (surface, subsurface, and groundwater), and multiple intermediate hydrologic states of interest. The central tendency of the 5 GCMs for each of the three scenarios shows a slight decrease of all streamflow components over time, with the surface and groundwater components of flow having the most influence on the corresponding changes in total streamflow. When combined with the projected increases in urbanization from the FORE-SCE model, potential decreases in basin mean streamflow resulting from climate change are mitigated by increases in the surface water flow component resulting from projected increases in urbanization.
Keywords: FORE-SCE, GCM, Hydrology, PRMS, streamflow

89. The Relative Effects of Habitat Loss, Fragmentation, and Degradation on Population Extinction

Authors: **HEINRICHS**, Julie, University of Calgary; Darren Bender, University of Calgary; Nathan Schumaker, Western Ecology Division, U.S. EPA
Offered Presentations: Disturbance I - Tuesday, April 6: 2:40-3:00 - F-G
Abstract: It is currently unclear which process of landscape change has the greatest effect on population extinction. While the most prominent conservation concerns are habitat destruction by loss and fragmentation, the role of habitat degradation has received comparatively little attention. Previous research has demonstrated that the quality of habitat patches can significantly influence population dynamics. This suggests that habitat degradation may be a key variable explaining population responses to landscape change and disturbance. To determine the relative influence of landscape-level habitat quantity, quality and configuration on regional population persistence, a spatially-explicit individual-based population model was generalized to produce ecological profiles, representing a spectrum of dispersal abilities, resource requirements, and life strategies. Population dynamics were simulated in landscapes that varied in their degree of habitat loss, fragmentation, and habitat degradation according to a factorial design. Landscapes were composed of a range of habitat amounts (10-50%), and proportions of high to low quality habitat. Landscape configurations varied from contiguous to highly fragmented habitat embedded in uninhabitable matrix. The probability of regional population extinction was measured and the relative importance of habitat quantity, quality and configuration was assessed using generalized linear models. In general, habitat amount and quality outweighed the influence

of habitat configuration. Dramatic extinction thresholds were observed in scenarios of combined habitat loss and degradation, indicating that the interactive effects of these variables may greatly affect population persistence. The results also suggest that in some circumstances it might be effective to mitigate the population viability consequences of habitat loss by improving habitat quality. While the current paradigm for conservation emphasizes the role of habitat fragmentation and neglects habitat degradation, our results demonstrate that habitat quality may be of greater importance. Habitat degradation, along with its associated interactive effects should be explicitly considered when assessing the implications of landscape change on population viability.
Keywords: fragmentation, habitat loss, habitat quality, individual-based model, population viability

90. Exploring senescent trajectories using the 2008 Web-Enabled Landsat Data (WELD) composites for CONUS
Authors: **HENEBRY**, Geoffrey, South Dakota State University; David Roy, South Dakota State University; Junchang Ju, South Dakota State University; Valeriy Kovalskyy, South Dakota State University; Landsat Phenology Study collaborators, at various institutions
Invited Symposium: A Land-surface Phenology: A View Through the Lens of Vegetation - Thursday, April 8: 11:20-11:40 - R
Abstract: Most studies of land surface phenology (LSP) have used time series derived from moderate spatial resolution satellite sensor data because these data are freely available and they provide an acceptable trade-off between higher, near daily, temporal frequency of observation needed to reduce cloud contamination against lower (500m-5km) spatial resolution. The opening of the USGS Landsat archive to web-enabled access presents the opportunity to explore how well Landsat time series can portray LSPs at high spatial resolution. The NASA Web-Enabled Landsat data (WELD) project has produced 30m composited mosaics for all the conterminous US (CONUS) from Landsat 7 ETM+ data. These mosaics are generated as monthly, seasonal, and annual composites and include spectral reflectance, normalized difference vegetation index (NDVI), and the acquisition date of each composited pixel. The WELD compositing approach is designed to select valid land surface observations with minimal cloud, snow, and atmospheric contamination. We extracted 30m pixel time series from the monthly composited mosaics for 2008 at 320 locations across the CONUS at sites with phenological observations. These sites are heterogeneous with respect to the types of plants observed, the phenophases recorded and the ground sampling protocols used. These data came from several sources, including the cloned lilac/honeysuckle network, the Phenocam network, five LTER sites (H.J. Andrews, Harvard Forest, Jornada, Konza Prairie, and Sevilleta), and a private woodlot in Maine. We screened the WELD composited reflectances for cloud and quality flags and calculated the NDII and the GNDVI from the remaining reflectance data. We compared the temporal profiles of NDVI, NDII, and GNDVI with the ground observations. Of particular concern was how the three indices could work together to characterize senescent trajectories in woody and herbaceous communities. Success of identifying leaf coloring was a function of vegetation community and the temporal density of both ground and spaceborne observations.
Keywords: brown-down, dry-down, Landsat, leaf coloring, phenology

91. Modeling avian responses to multiscale landscape characteristics across a rural-urban gradient

Authors: **HEPINSTALL-CYMERMAN**, Jeffrey, University of Georgia; Michael Parrish, University of Georgia
Offered Presentations: Scale I - Tuesday, April 6: 10:40-11:00 - F-G
Abstract: Human population growth has substantially altered and continues to alter landscapes on a global scale. Urbanization in the southeastern United States, especially the state of Georgia, has been rapid in the past 20 years and has caused extensive restructuring of the natural landscape. Birds are known to respond to urbanization-related landscape changes in a variety of ways. We designed a study to explore the influence on bird communities of landscape composition and configuration measured at three spatial scales (local: 0.1 km2; landscape: 1 km2; and regional: 5 km2). We sampled birds at 36 previously-forested residential sites across a gradient of local and regional development intensity defined by land use, housing density, and road density. Eight six-minute point counts were conducted twice in 2007 and twice in 2008 at each site. We developed a series of linear regression models of avian community and population response to 15 urbanization-related landscape characteristics measured at each scale. Seven community models had strong explanatory value (R-squared >= 0.5). The most frequently included characteristics were (at each scale): percentage of forested land cover (local); housing density (landscape); and amount of agricultural land cover (regional). Residential development age was also included in many models. Our results support the findings of other studies that suggest measures of landscape composition, pattern, human alteration, and development age explains variation in breeding bird community dynamics. Our results also show that landscape metrics we included varied in their relative importance based on the spatial scale at which they were considered. Local-scale percent forested land cover the most commonly selected variable. During the breeding season, smaller spatial scales may be of particularly high importance; however, many explanatory variables were included at the landscape and regional scale as well, indicating that avian diversity also is related to larger scale patterns.
Keywords: avian diversity, land use, multi-scalar, regression, urbanization

92. Empirical evidence for fractal vegetative patterns in fire-prone systems of the interior Pacific Northwest
Authors: **HESSBURG**, Paul, USDA-FS, PNW Research Station; Nicholas Povak, USDA-FS, PNW Research Station
Invited Symposium: Landscape Ecology of Wildfires: Theory, Modeling, and Application - Tuesday, April 6: 10:20-10:40 - R
Abstract: In this study, we examine the power law behavior of pre-settlement era vegetation features, fire severity patches, and topographies of eastern Cascade Mountain, USA, forest landscapes of four ecoregions. Our objectives were to: (1) objectively fit statistical distributions to vegetation, topography, and fire severity patch-size distributions (PSDs) of landscapes, (2) evaluate power-law behavior of the best fitting distributions using Monte Carlo goodness-of-fit tests, broken-stick regression, and neutral-modeling techniques, (3) evaluate statistical concordance between the respective PSDs, and (4) evaluate evidence for exogenous and endogenous controls on the distributions of physiognomic, cover type, structural class, canopy cover class, and fire severity patch sizes. Pareto and Generalized Beta II (GBII) distributions consistently fit the empirical inverse cumulative distribution functions (CDFs) of vegetation, topography, and fire severity patches, and Pareto 1 and truncated Pareto 1 models consistently fit a middle region of each distribution. K-S boot strap and log-likelihood ratio tests revealed that when compared with pooled results, models fit to individual subregions provided improved fits,

suggesting that ecoregions did well to partition variation among the CDFs. Among all topographies tested, the frequency-size distributions of N and S aspect patches followed a power-law distribution for most ecoregions. Neutral models developed for vegetation, topography, and fire severity classes showed conclusive evidence that the PSDs were not the result of random influences. We show that vegetation and aspect PSDs partially drive fire severity PSDs via mosaics whose patches provide variable resistance to fires due to their time since disturbance, prior disturbance severity, and recovery regime. We show topography is a likely endogenous driver of vegetation and fire severity PSDs, and that ecoregions (via biogeoclimatic inputs) are likely exogenous drivers of vegetation and fire severity PSDs. This information is useful to creating more resilient landscapes in an uncertain climatic, management, and development future.

Keywords

93. Effects of forest fragmentation on bonobo (Pan paniscus) habitat suitability

Authors: **HICKEY**, Jena, University of Georgia; Nathan Nibbelink, University of Georgia
Offered Presentations: Fragmentation - Wednesday, April 7: 11:00-11:20 - Y

Abstract: The bonobo (Pan paniscus) is a globally endangered great ape endemic to Democratic Republic of Congo (DRC), yet little is known about its distribution. Bonobos may be threatened by habitat fragmentation through slash-and-burn agriculture and timber harvest, as well as bushmeat hunting. Therefore, we were interested in predicting relative bonobo-habitat suitability based on limited available spatial data for the Maringa-Lopori-Wamba (MLW) landscape. Determining effects of these activities on current bonobo distribution can guide future research and aid landscape planning efforts. Due to the dearth of spatial data for this region of the world, we identified indirect environmental variables in the Maringa-Lopori-Wamba (MLW) Landscape that may serve as surrogates for measuring habitat fragmentation and accessibility of areas to hunting. Moving-window analyses were conducted across the entire MLW for edge density (fragmentation), and for 2 measures of human accessibility; distance-from-fire and distance-from-river. Fires are highly correlated with human presence and rivers serve as primary transportation corridors since road infrastructure is limited. Moving windows were approximately the size of bonobo homeranges (2.5-km radius, Hashimoto et al. 1998) and mean values for each variable were assigned to the centroid of each window. Then with presence-only data of bonobo nest sites collected on random stratified transects in 2009, we used program MaxEnt (3.3.1) to generate relative habitat suitability models. Model results indicate that edge density and distance from river were both important components, contributing 46.7% and 43.5%, respectively, to the model. The Area Under the Curve (AUC) for training data was 0.96 and for test data was 0.94, whereas random prediction would be 0.5, suggesting we identified a plausible model with low error rates and high prediction success. Identification of highly suitable habitats will aid in planning arrangement of conservation and exploitation zones.
Keywords: bonobo, congo, fragmentation, habitat suitability

94. EARLY DETECTION OF PHYTHOPHTHORA RAMORUM IN CALIFORNIA WATERSHEDS AND RISK MAPPING OF DISEASE SPREAD

Authors: **HOHL**, Alexander, University of North Carolina - Charlotte; David Rizzo, University of California - Davis; Ross Meentemeyer, University of North Carolina - Charlotte
Poster #19: Invasion - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: The rapid discovery of a disease is essential for the prediction and early detection of its

prevalence. The initial recognition of Sudden Oak Death exposure in forest populations only transpire when host species demonstrate symptoms. Thus, early detection studies via stream monitoring of California watersheds have facilitated the identification of P. ramorum infestations even before its manifestation in areas where no sign or symptom is apparent. To address the instigation of spread, we monitored watercourses throughout California to track the distribution of Phytophthora ramorum and predict future infestations. We established 178 stream baiting sites from 2004-2008 of varying habitat and environmental constraints. Climate variables, watershed characteristics, and habitat attributes were spatially analyzed in a GIS. A spread risk map was developed using logistic regression modeling to analyze the probability of invasion. Among the observed watersheds, 44 sites confirmed the presence of the pathogen and most positives are without a priori knowledge of adjacent forest infestation. Preliminary results predict the spatial variability and spread risk of P. ramorum associated with the combined influence of precipitation, minimum temperature and distance to known infection. Based from our model criteria, there are a disconcerting number of uninfected forest ecosystems in California with a substantial risk of infection. The geographic pattern of spread risk illustrates a broad band of high disease threat on the northern and central California. The model was validated by an assessment of the predicted spread with the field observations of P. ramorum positives. Modeling the variables that have significant effects on the manifestation of P. ramorum can provide prospective approaches to forest management. Recognizing the presence of the pathogen before it can inflict plant populations will be economically constructive because major losses will be avoided as well as the consequences on the loss of biodiversity and forest structure.
Keywords: detection, disease, landscape epidemiology, species distribution modeling, Watershed

95. Linking landscapes to ecosystem services: Landscape structure as an indicator and predictor of water clarity in New England lakes
Authors: **HOLLISTER**, Jeffrey, US EPA, Atlantic Ecology Division; W. Milstead, US EPA, Atlantic Ecology Division
Poster #25: Sustaining Systems - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Lakes provide ecosystem services such as recreation, clean water, aesthetics, wildlife habitat, and nutrient attenuation. While numerous methods exist to monitor these services (e.g. visitor counts, opinion surveys, water quality monitoring, etc.) they are labor intensive to collect and difficult to implement in broad-scale monitoring programs. An alternative is to use linkages between landscapes and ecosystem services to monitor services over large areas. In our research, we are exploring the feasibility of this approach with relationships between water clarity and landscape structure. Water clarity, measured simply by Secchi depth, is an excellent predictor of recreational and aesthetic quality of lakes as well as habitat suitability for charismatic species (e.g. Common Loon, Gavia immer) whose presence can be shown to increase lakeshore property values. Furthermore, water clarity is related, in part, to nutrient loads derived from the surrounding landscape. To begin our work on landscape structure and water clarity, we have compiled data on lakes in New England collected as part of the US EPA's National Lakes Survey and the New England Lakes and Ponds Survey. For each lake catchment, we measure landscape structure of sinks and sources of nutrients and calculate proportion, inverse distance weighted proportion (a measure of proximity), and weighted flow accumulation (a measure of connectivity). We compare these to measured Secchi depth to determine if source composition, proximity and/or connectivity is related to water clarity. Results of this research will inform future efforts to identify source patches that due to their configuration on the landscape

contribute nutrients in amounts disproportionate to their size. This information will likely improve conservation, restoration and other landscape level management decisions.
Keywords: connectivity, Ecosystem Services, National Lake Assessment, water clarity

97. Interactive chain of "women, will and water" in severely-degraded Minqin oasis of arid northwest China: A woman-led CHANS

Authors: **HU**, Xiao-Jun, Lanzhou University, P.R. China; You-Cai Xiong, MOE Key Laboratory of Arid and Grassland Ecology, Lanzhou Un; Xu-Zhe Zhao, MOE Key Laboratory of Arid and Grassland Ecology, Lanzhou Un; Zheng Zheng, MOE Key Laboratory of Arid and Grassland Ecology, Lanzhou Un; Qing-Feng Han, MOE Key Laboratory of Arid and Grassland Ecology, Lanzhou Un; Wan-Fang Xiong, MOE Key Laboratory of Arid and Grassland Ecology, Lanzhou Un; Feng-Min Li, MOE Key Laboratory of Arid and Grassland Ecology, Lanzhou Un
Offered Presentations: Landscape Aesthetics I - Tuesday, April 6: 4:00-4:20 - K-L
Abstract: Studies on coupled human and natural system (CHANS) have recently received increasing interests around the world, but more and systematic efforts from the gender perspective are needed. This study focuses on a woman-led severely-degraded Minqin oasis of arid northwest China (102°03´-104°03´E-38°05´-39°06´N). Over last two decades, this oasis was facing with the similar fate to the vanished Lop Nur oasis, and the Chinese government had initiated a series of water conservation programs to prevent and control local desertification expansion. From January to April of 2009, we conducted an extensive questionnaire survey with 392 villagers from 27 villages in Minqin. The results indicated that women accounted for over 70% of local agricultural workforce because the majority of the masculine population had migrated to urban areas to make livelihood. The data showed that the willingness and participation of women played a critical role during the implementation and adoption of water-saving policies and techniques. Over 38% of women and 26% of men were able to conscientiously abide by the restrictions on water utilization; and 61% of women and 43% of mean were willing to transfer to other industries when the farming income was low enough not to make their livelihood. However, the cognitive level, responsive degree and psychosocial adaptation to irrigation water management policies and techniques for women were significantly lower than those for men. Furthermore, the women's participatory frequency to join the Village-level Farmer Society for Water Use and the activeness and willingness to receive agricultural water-saving technical training were also obviously inferior to those of men. The will of women participating in water management practice is a dominant factor when making policy and relevant conducting theoretical research. This study will help raise some strategies to manage water-deficit areas on the basis of "triple W" of "women, will and water" in woman-led CHANS.
Keywords: CHANS, Minqin of China, water-saving, will, women

98. Incorporating landscape connectivity principles into planning at multiple spatial scales in an intensive agricultural region

Authors: **HUBER**, Patrick, University of California, Davis; Fraser Shilling, University of California, Davis; James Thorne, University of California, Davis; Steven Greco, University of California, Davis; James Quinn, University of California, Davis; Nathaniel Roth, University of California, Davis; J Hightower, City of Riverbank; Laura Podolsky, Local Government Commission
Offered Presentations: Scale II - Thursday, April 8: 3:40-4:00 - T-U
Abstract: Incorporation of landscape connectivity is critical to conservation planning in working

landscapes. Safe Passages is a 3-phase partnership among land use planners, conservation non-profits, and UC Davis to develop and demonstrate a framework to promote landscape connectivity and facilitate the movement of species in one of the most intensively managed agricultural landscapes in the USA, the San Joaquin Valley (SJV) of California. The first phase identified opportunities and constraints encountered in previous connectivity planning and implementation efforts through workgroups and a statewide forum. The next step focused on the ecoregional scale, and presented concepts, benefits and approaches to connectivity implementation to a multi-jurisdictional, land-use and transportation planning group in the San Joaquin Valley. The third step is a local pilot implementation project with one of several willing participants from the regional group, the City of Riverbank. The partners in the pilot selected four focal species to represent a cross-section of ecological needs in local modeling. We used multiple, overlapping GIS-based least cost corridor analyses to create species-specific connectivity surfaces. These analyses were conducted at 5, 10, and 20 kilometer radii centered on the City of Riverbank and used raster cells of 10, 30, and 100 meter size in order to test the effects of spatial grain and extent on connectivity modeling. We found that the 100 meter cell size failed to adequately capture the remaining natural vegetation in this highly fragmented working landscape. Further, we found that change of analysis extent affected the relative importance to overall study area connectivity of the Stanislaus River riparian corridor. Results gleaned from both the forum and connectivity analyses will serve to inform the ongoing collaborative planning process in Riverbank, which has passed a resolution to include Safe Passages findings in its collaborative planning process.
Keywords: California, connectivity, linkage, planning, spatial scale

99. Linking an increase of the Global Human Footprint with the promotion of Economic Growth and GDP: Evidence, causes and reforms for 5 globally relevant landscapes before the "Triple Whammy" hits.
Authors: **HUETTMANN**, Falk, EWHALE lab
Offered Presentations: Sustaining Systems - Thursday, April 8: 1:20-1:40 - T-U
Abstract: Considering that Earth is a finite space, the growth of the human economy is only possible on the cost of the wildlife economy. Growing the GDP (Gross Domestic Product) through a one-sided 'modern' Economic Growth policy results in an increase of the human footprint: habitats and species are getting lost. In times of globalization, these impacts are recognized globally, and they can easily be seen on land, in the ocean and in the atmosphere for instance. Here, I show results over time (1850 onwards) from a global GIS analysis and public online data mining project that deals with five major landscapes: Selected Mountains, Polar regions (Arctic, Antarctic, Tibetan Plateau), Oceans, Tropical and Boreal Forests. The loss of wilderness coverage, reduction of Ecological Services, and increased fragmentation levels are related to Economic Growth statistics for these regions. In addition, social metrics are shown that indicate for these regions that through a 'traditionally western' style of development the established social fabrics get disrupted, and which subsequently modify landscapes and their biotic components even further. In addition, the role of diseases and invasive species gets briefly discussed. The initial critique of 'causation vs correlation' in these relationships is addressed through a Metaanalysis (literature review) and through theoretical support (laws of thermodynamics). Considering that the Earth will carry ~ 9 billion people in 50 years from now, and for reasons of global sustainability, I present how Macro Reforms, better policies, Adaptive Management and Strategic Conservation Planning could look like to mitigate and even stop

impacts of the "Triple Whammy" (Wilderness Destruction, Rebound Effect & Population Increase).

Keywords: Economic Growth, Global Landscapes, Human Footprint, Strategic Conservation Plannin, Wilderness Fragmentation

100. Habitat monitoring and management of a heathland site: posterior classification probabilities as additional information, a case study.

Authors: **HUFKENS**, Koen, University of Boston; Guy Thoonen, University of Antwerp; Jeroen Vanden Borre, Research Institute for Nature and Forest, Belgium; Paul Scheunders, University of Antwerp; Reinhart Ceulemans, University of Antwerp

Offered Presentations: Remote Sensing - Thursday, April 8: 11:40-12:00 - F-G

Abstract: Heathlands are man-made habitats and their decline during the last century can be contributed to shifts in both agricultural and management practices as well as to hydrological and atmospheric changes. As a result, many heathland sites, including the Kalmthoutse Heide in Belgium, were included in the European Natura 2000 program, a network of protected areas across the European Union (EU). To assure an accurate mapping of the Kalmthoutse Heide and other Natura 2000 sites in Belgium a classification framework for habitat status reporting with remote sensing data and in particular high resolution hyperspectral imagery was started. We propose a simple context based GIS method for mapping heathland heterogeneity using the intermediate, otherwise redundant, posterior classification probabilities as generated by a hard classification algorithm. In general, the variation in posterior classification probabilities can be summarized in three groups of parameters: (1) the image quality, which is influenced by the optical system, the spatial resolution and the atmospheric conditions at the time of the acquisition; (2) the training data used by the classification algorithm; (3) and last but not the least, the heterogeneity of the vegetation in the field. Therefore we hypothesize that given nearly optimal acquisition circumstances and an optimized classifier (and ground truth data), the majority of the variation of the posterior classification probabilities would be attributed to the intrinsic vegetation heterogeneity. Our study proved to be successful in using the posterior classification probabilities as a valuable source of ecological information. The delineated areas have been shown to be statistically sound and robust compared to a neutral model. The technique is not limited to a particular hard classification technique and can therefore easily be adopted into current vegetation monitoring efforts. Our results provided accessible maps which can support ecosystem management of the protected site and enhances the accuracy of (EU) habitat reportage.

Keywords: hyperspectral, patch based, remote sensing, uncertainty, vegetation heterogeneity

101. Plant-soil feedback effects on tree species tracking global warming

Authors: **IBANEZ**, Ines, University of Michigan; Sarah McCarthy-Neumann, University of Michigan

Offered Presentations: Climatic Influences II - Tuesday, April 6: 4:00-4:20 - R

Abstract: Many species will likely shift their distributions in response to current trends in climate. The ecological consequences of such shifts could be enormous, have serious implications for conservation of local biodiversity and also for preservation of relevant ecosystem functions. In particular, interactions between trophic levels such as microbial mediated plant-soil feedbacks, which have been shown to affect plant performance and thus influence community dynamics, could have large impacts on colonization success for migrant

species and ultimately distribution patterns. To investigate the role of soil pathogens on colonization potential of tree species tacking global warming we conducted a seedling transplant of several tree species. Temperate deciduous species (two species of Carya and Quercus, and Nyssa sylvatica) were planted beyond the northern limit of their distributional ranges. Control and fungicide treated plots were setup under a gradient of environmental conditions. Survival survival data were analyzed using a frailty or risk model (parametric survival with individual random effects) within a multilevel framework. Results for the two Carya species show a benefit from the fungicide treatment, indicating that they could be released of some of their soil pathogens during the colonization process. On the other hand, Nyssa and Quercus had higher survival rates in control plot, which led us to think that the treatment might have affected beneficial fungi. Results show that the response to the fungicide treatment varied among species, and indicates the need to evaluate species-specific responses to global warming.
Keywords: climate change, distributional range, multilevel model, plant-soil feedbacks, seedlings

102. Content and context: Predicting occupancy for avian species in the southeastern United States
Authors: **IGLECIA**, Monica, North Carolina State University; Jaime Collazo, North Carolina State University
Offered Presentations: Fragmentation - Wednesday, April 7: 10:00-10:20 - Y
Abstract: Ecologists seek to understand the mechanisms underlying species' associations with their environment, while planners need to address species' needs in a changing landscape. These efforts often do not include estimates of species-habitat dynamics at a landscape scale. We asked how landscape configuration and context affect a species' occupancy at local and regional scales. We piloted this research in the southeastern coastal plain of the United States by integrating data from the North American Breeding Bird Survey (BBS) and satellite derived land cover from the Gap Analysis Program. Single season models were used to test expert-opinion hypotheses regarding habitat quality, as well as knowledge-driven assumptions (e.g., influence of patch size, hostile matrix) commonly used to create landscape-level models in conservation design. Models were developed for three species of conservation priority in the southeast: the Brown-headed nuthatch (Sitta pusilla), the Red-headed woodpecker (Melanerpes eurythrocephalus) and the Eastern wood-peewee (Contopus virens). We divided the 50-stop BBS routes into four, eight-stop segments to reduce within-route habitat heterogeneity. We estimated the probability of occupancy after adjusting for detection probability, and spatial dependence among sampling stations when required. Model covariates were selected based on expert-knowledge and species-specific life history traits. Top models were selected using Akaike's Information Criterion. Covariates with significant influence on occupancy included the proportion of optimal habitat, composition of the landscape matrix (e.g., urban), latitude, patch size and distance, and number of patches. Results provide an explicit means to link conservation actions to objectives in a structured-decision framework via a data-driven process, and can help guide monitoring programs. Future research will incorporate multi-season models, urban development and climate variables.
Keywords: BIRD, Breeding Bird Survey, Conservation, Occupancy model

103. A look from Allerton ahead
Authors: **IVERSON**, Louis, USDA Forest Service, Northern Research Station

Invited Symposium: US-IALE Presidents' Symposium I - Tuesday, April 6: 11:20-11:40 - Masters Hall

Abstract: I was fortunate to be a 'local' at the 1983 Allerton Conference and was quickly hooked on the emerging field of Landscape Ecology, thanks to some familiar names who pounded out its initial form for North America: Forman, Risser, Barrett, Wiens, Golley, Shugart, O'Neill, Merriam, Levin, Botkin, Costanza, Parton, Sharpe, and Godron. As I was then learning ArcInfo and ERDAS, I got very excited about the potential to use these new tools to synthesize several disciplines related to pattern and process, and for applications that truly assist in wise management and restoration of natural resources. That week captivated me, and shaped the rest of my career. As evidenced by this being my 23rd symposia, I love this group! Here are some areas of emphasis within US-IALE during my tenure as president, 1996-1998: 1. Display board and brochures developed for advertising 2. Web site and list server established (August) 3. Executive Handbook expanded and put on web 4. Tax exempt status attained (Klopatek) 5. Membership Secretary and membership software established (Castro 6. Membership established with AIBS (when Barrett lead AIBS) 7. Student representatives begin on EC (Riffle) 8. Bylaws updated for continuity of leadership (Chair-Elect) 9. First Strategic Planning report produced (Crow) 10. Many Journal issues resolved (Gardener) Landscape ecology has grown to be immensely valuable and much more mainstream over the past couple of decades. As one indicator, I'm finding that a smaller percentage of folks ask me about their landscape plant after I tell them I am a landscape ecologist. Of course, the massive expansion of GIS/RS/modeling has fueled much growth. I see this growth will continue, with exciting blending of theory and practice. My advice would be to accept the challenges of our time and do what you can to make a difference, including grand challenges to help alleviate poverty, while at the same time tending to conservation.
Keywords: Conservation, landscape ecology history, poverty alleviation, US-IALE

104. Considering connectivity and species characteristics in potential tree species shifts

Authors: **IVERSON**, Louis, USDA Forest Service, Northern Research Station; Anantha Prasad, USDA Forest Service, Northern Research Station; Stephen Matthews, USDA Forest Service, Northern Research Station; Matthew Peters, USDA Forest Service, Northern Research Station

Invited Symposium: Climate Change and Landscape Connectivity: From Theory to Practice - Thursday, April 8: 10:20-10:40 - Masters Hall

Abstract: Climate change is altering species habitats and species migration is occurring: mounting evidence suggests these are likely to continue at an accelerating pace. We have been modeling potential changes in suitable habitat for 134 tree species in the eastern United States, using several scenarios of emissions and GCMs, and for three different times during this century (see www.nrs.fs.fed.us/atlas). We now also consider modifying factors, which take into account several different disturbance and biological characteristics of each species to quantify risk based on species attributes. Upon these models we can also consider some aspects of the configuration of the landscape with the SHIFT model which estimates the probability of colonization based on abundance of the species, distance from occupied cells, and suitable habitat available over the next 100 years. As future management strategies in light of climate change are now being considered, this model provides a necessary link from the broader scale habitat models to a more constrained projection of species occupancy across a heterogeneous landscape. We concentrate here on the northern third of Wisconsin, an area designated as a 'model forest' by the Forest Service, in that special consideration is being made to the potential effects of climate change in

the management of the region's forests, especially the Chequamegan-Nicolet National Forest. We are beginning to investigate the role that actual and potential corridors, and conversely the role of especially fragmented habitats, could play in adaptation strategies.
Keywords: climate change, corridors, habitat models, species characteristis, Wisconsin

105. Integrated landscape genetics of the mountain pine beetle system
Authors: **JAMES**, Patrick, University of Alberta; Felix Sperling, University of Alberta; Dave Coltman, University of Alberta; Richard Hamelin, University of British Columbia
Offered Presentations: Invasion II - Tuesday, April 6: 3:20-3:40 - Y-Z
Abstract: The unprecedented mountain pine beetle (MPB, Dendroctonus ponderasae) outbreak in western Canada has serious consequences for both ecological and economic systems. MPB outbreak dynamics are the product of interactions among an endemic bark beetle, associated pathogenic fungi, host trees (Pinus spp.), physical landscape features, and climate. Several key features of these dynamics are influenced by genomic interactions within the beetle-fungi-pine complex. As such, genetic analyses can be used to better understand outbreak dynamics. As a starting point, we compared the spatial genetic structure of two interacting taxa in the mountain pine beetle system using neutral genetic markers. Specifically, we investigated the role of spatial (landscape features) and temporal (outbreak stage) factors on patterns of gene flow and measures of neutral genetic differentiation in the mountain pine beetle and its main fungal associate, G. clavigera. A total of 44 sites were analyzed using 13 beetle microsatellites and 8 fungal markers in British Columbia and Alberta. We used canonical correspondence analysis (CCA) to model relationships among beetle genetic structure, fungal genetic structure, and landscape spatial structure quantified using effective distances among sample sites based on resistance surfaces. Genetic structure in both taxa is significantly influenced by Euclidean distance among sample sites. However, models were improved by including spatial information such as the climatic suitability index, elevation, and forest composition, although differently for each species. From these results, we constructed interpolated continuous landscape surfaces that illustrate integrated MPB-system landscape genetics and how beetles and fungi can affect each other's patterns of gene flow. This study demonstrates a novel approach to integrating genetic information from multiple species' in a spatially explicit context to better understand landscape-genetic interactions in a complex outbreak system.
Keywords: genetic interactions, landscape genetics, mountain pine beetle, resistance surfaces, Spatial analysis

106. Characterization of Upper Flint River Landscape Dynamics for Hydrologic and Aquatic Habitat Modeling
Authors: **JONES**, John, U.S. Geological Survey; Roland Viger, U.S. Geological Survey; Gary Buell, U.S. Geological Survey; Lauren Hay, U.S. Geological Survey
Invited Symposium: Linkages Among Landscape, Flow, and Aquatic Habitat: The Upper Flint River Water Availability Study - Tuesday, April 6: 1:40-2:00 - Q
Abstract: The USGS has assembled a multidisciplinary team that is linking state-of-the-art within-discipline approaches to more effectively model in-stream flow requirements and aquatic population dynamics. As part of this effort, a multi- spectral, spatial, and temporal resolution remote sensing database is being developed and evaluated to better understand and represent the spatial and temporal scales of various land cover changes and cycles in the upper Flint Watershed. The ultimate goal is to account for the affects of land use on hydrology and link

those affects to the health of aquatic populations. The Precipitation Runoff Modeling System (PRMS) is being modified to generate stream-reach scale estimates of surface water flows as inputs to new aquatic species distribution models. PRMS simulations of Flint River sub-watershed flows uncovered inconsistencies in peak flow behaviors that could only be explained by unspecified water storage. Examination of remote sensing data suggested that numerous, manmade small water bodies such as farm and mill ponds were an important component of the water balance for Flint River. Existing surface water storage databases are out-of-date and do not contain many of these small water bodies that, in total, represent significant water storage. Therefore, imagery from airborne LiDAR (Light Detecting And Ranging) and satellite radar data are being used to calibrate and evaluate Landsat-based maps of small water bodies. Procedures are being developed and applied to archived Landsat data to yield dynamic information on the numbers, sizes, spatial configuration and combined area of coverage of Flint River surface water bodies through time. PRMS has been modified to accommodate these dynamic estimates of total storage capacity over hydrologic response units and is therefore yielding more applicable simulations of streamflow characteristics. This multi-scale characterization of landscape dynamics is helping to evaluate and forecast the importance of human activity to hydrology and aquatic habitat conditions.
Keywords: Habitat, Hydrology, Modeling, Multidisciplinary, scale

107. Mapping Wormsloe: Modern Technologies for Interpreting History and Landscape
Authors: **JORDAN**, Thomas, Center for Remote Sensing and Mapping Science, UGA; Andrew Parker, Center for Remote Sensing and Mapping Science, UGA
Invited Symposium: Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History, Isle of Hope, Georgia - Tuesday, April 6: 10:20-10:40 - K-L
Abstract: This presentation will be part of the "Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History on the Isle of Hope, Georgia" Symposium. Wormsloe Plantation, on the coast of Georgia near Savannah, is a remarkable site that has been actively inhabited, but never developed, since granted to the original owner, Noble Jones, in 1734. Furthermore, the family that has owned Wormsloe for more than nine generations has kept meticulous written records that are now housed at the University of Georgia Hargrett Library. Researchers from the UGA Center for Remote Sensing and Mapping Science are using state of the art GPS and GIS mapping technologies to integrate field surveys, aerial photographs, historical maps and photographs and non-intrusive archeological methods, such as ground penetrating radar, to reveal layers of history that include Native American, colonial, American Revolution, plantation era, Civil War, reconstruction and 20th century structures and artifacts. Land use history can be interpreted by overlaying maps and photographs from different eras and linking that information to materials from the written record. Using geographic visualization techniques, it then is possible to reconstruct a view of the landscape and historical structures that has been lost to time. These data also can be made accessible to the public and to other researchers using GIS web services. In this presentation, we will discuss the mapping of Wormsloe and the online GIS database and we will demonstrate the visualization the original fortified house from 1734 using Google SketchUp.
Keywords: Environment, GIS/GPS, History, Mapping, Visualization

108. Geospatial distribution and characterization of potential habitats of mosquito larvae in Yamuna Nagar, Haryana, India

Authors: **KALSI**, Meenu, M.L.N. College, Yamuna Nagar, Haryana, India
Poster #22: Invasion - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Dengue fever, malaria and encephalitis have emerged as major public health hazards in South Asia and many other tropical regions of the world. Surveillance of potential habitats of the vector larvae is essential for cost effective application of control practices. I used a combination of global positioning system, GIS and immature sampling count method for identification of larval habitats and to determine spatial heterogeneity of different mosquito larvae. A hand held GPS unit was used to record the locations of collection sites. Aquatic habitats were sampled by the use of standard dipping technique and droppers. From collected samples, mosquito larvae of different genera i.e. Culex, Aedes and Anopheles were identified, segregated and counted. Layers of immature survey data were overlaid on sampling locations to produce distribution and density maps of mosquito larvae in the affected localities. These maps have application in determining the population densities of vector mosquito species in a particular area for effective application of control measures.
Keywords: density, distribution, GIS, Mosquito, vector ecology

109. Spatial Analysis of Human-Leopard Conflict in Himachal Pradesh, India
Authors: **KALSI**, Rajiv, Department of Zoology, M.L.N. College, Yamuna Nagar, Haryana; Randeep Rana, Wildlife Institute of India, Chandrabani, Dehra Dun
Poster #11: Disturbance - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: We studied human-leopard (Panthera pardus) conflict in four districts of the state of Himachal Pradesh (latitude 30d 22' to 33d 13' N and longitude 75d 36' to 79d 02' E), India. Data on attacks on humans were collected and verified in the field by visiting villages and interviewing the affected families in the conflict localities from 2004 to 2008. We recorded 98 incidents of conflict, in which, there were 18 human casualties, 39 cases of leopard inflicted injuries to humans, 24 incidents of leopards entering human habitations and 17 leopards were killed. Out of the four districts, maximum incidents of conflict were recorded in Mandi and Hamirpur, followed by Kangra and Bilaspur. Landuse-landcover map of the state was used for extracting information on different habitat categories. We used a spatial grid of 2 x 2 km with data on conflict and associated habitat information for extracting the geographical and percent area of forest, non-forest and other habitat characteristics in the four districts. Data on villages and protected areas was extracted from shapefiles. Spatially, 89% of the high conflict zones were located in non-forested areas (scrub and cultivation), 9.4% in densely forested habitat, and 1.6% in open forest areas. The zones of high conflict in Mandi, Bilaspur and Kangra districts had higher proximity to the nearest protected areas. Most of the high conflict zones were located near villages; 73% within a distance 4 km from the nearest village while 27% occurred within 4 – 8 km from a village. In zones with medium to no conflict, proportions of dense and open forest categories were higher as compared to scrub and agriculture.
Keywords: conflict, Conservation, GIS, Leopard, Spatial analysis

111. Evaluating impacts of climate change on fire regimes, landscape dynamics, and fire management using the FireBGCv2 simulation model
Authors: **KEANE**, Robert, US Forest Service Rocky Mountain Research Station; Rachel Loehman, US Forest Service Rocky Mountain Research Station
Invited Symposium: Landscape Ecology of Wildfires: Theory, Modeling, and Application - Tuesday, April 6: 10:00-10:20 - R

Abstract: Fire management faces some challenging issues in the future and none are more important than how to deal with effects of climate change in fire management and how to incorporate landscape dynamics into management decision-making. Fire-BGC, a mechanistic ecosystem dynamics model, was used to examine landscape ecological responses to future climates, fire regimes, and fire management within a forested landscape at Glacier National Park. We used a full factorial experimental design including climate (historical, current, and predicted future scenarios) and fire (historical fire return and varying levels of fire suppression) as factors to simulate potential effects of disturbance on wildfire dynamics, landscape composition and configuration, and ecosystem function for a 500-year simulation period. Simulation results indicate that the interactions among climate changes and disturbance processes stimulate vegetation species conversions and amplify fire dynamics, and that landscapes show increased homogeneity and contiguity and reduced leaf area index (LAI) and proportion of late seral species under future climates. The project and its results demonstrate the importance of climate and fire in structuring mountainous ecosystems, and provide a method for evaluating potential management responses for climate change mitigation and adaptation.
Keywords: disturbance dynamics, ecological interactions, fire regimes, landscape fire simulation mode, succession

112. Building spatial networks from biodiversity data: A solution to the stepping stone conundrum
Authors: **KEITT**, Tim, University of Texas at Austin; Jessie Lasky, University of Texas at Austin; Evan Economo, University of Michigan
Invited Symposium: Graph, Network, and Circuit Models of Landscape Connectivity - Thursday, April 8: 11:20-11:40 - Q
Abstract: Spatial network models hold great promise for the quantification of landscape connectivity. Most applications of spatial networks rest on expert opinion or other surrogate methods to rank connection strengths among spatial units, or simply vary parameters over all possible values. I introduce the "stepping stone conundrum" to motivate the need for rigorous statistical methods to estimate connection weights from commonly available data. Using the avifauna of Melanesia as an example, I show how a simple stochastic process model lead to a Generalized Linear Modeling solution to the edge-weight estimation problem. I then introduce a generalization of the model to account for multiple groupings in the data and show how Bayesian posterior distributions of connectivity parameters can be obtained using Markov Chain Monte Carlo simulation.
Keywords: Bayesian analysis, connectivity, generalize linear model, island biogeography, network model

113. Scaling laws and dominant controls of low-severity fire regimes
Authors: **KENNEDY**, Maureen, University of Washington, Seattle; Don McKenzie, USDA-FS, Pacific Northwest Research Station
Invited Symposium: Landscape Ecology of Wildfires: Theory, Modeling, and Application - Tuesday, April 6: 11:00-11:20 - R
Abstract: Multiple characteristics of fire regimes exhibit scaling laws, with competing theoretical explanations. We use the Sørensen's distance as a measure of fire co-occurrence between pairs of recorder trees at fire history sites in the Pacific Northwest, and we find evidence of power-law scaling in the relationship between Sørensen's distance and the Euclidean distance between pairs

of recorder trees (the Sørensen variogram). These scaling laws differ among the fire history sites of varying topographic complexity. We produce a simple raster model to replicate attributes of the fire history regimes and use a Monte Carlo goodness-of-fit inference procedure to find combinations of three parameters (probability a fire spreads, probability a recorder tree that experiences a fire is scarred, and mean fire size) that are able to adequately replicate the observed patterns in the Sørensen variogram. The fit to the observed Sørensen variogram is characterized by increasing probability of fire spread to neighboring cells as we move from sites of high topographic complexity to sites of low topographic complexity. This characterizes a shift from fires of irregular shape with the probability of fire spread near a percolation threshold and a power-law in the Sørensen variogram, to compact fires of more regular shape with the probability of spread well above the percolation threshold and deviation from power-law in the Sørensen variogram. Preliminary simulations indicate that the fire history regimes are not similarly distinguishable by their fire size distributions. We propose that the explanation for power-law behavior in the Sørensen variogram lies in the relative scale at which bottom-up controls regulate the spatial pattern of fire spread, and that the fire size distribution cannot be explained by similar bottom-up controls.
Keywords: fire history, neutral model, power-laws, scaling, Sorensen distance

114. Assessing potential tradeoffs for carbon sequestration, wildlife habitat, and fire risk mitigation with climate change and fire management on the Olympic Peninsula, Washington, USA
Authors: **KENNEDY**, Rebecca, USDA Forest Service, Pacific Northwest Research Station
Offered Presentations: Simulated Environments II - Thursday, April 8: 2:00-2:20 - Y-Z
Abstract: Forests of the maritime Pacific Northwestern USA may have high carbon sequestration potential and high potential to sustain older forest and other forest structural types for threatened and valued wildlife species, via their high productivity and moderate to infrequent fire regimes. With climate change, there may be shifts in incidence and severity of fire, especially in the drier areas of the region, via changes to forest productivity and hydrology, and consequent effects to C sequestration and forest structure. To explore this issue in an area with relatively limited alternatives for fire and fuels management, I assessed potential effects of varying approaches to fire management (no suppression/wildland fire management/highly effective fire suppression) under two climate change scenarios on future C sequestration and wildlife habitat in Olympic National Park, WA, over a 500-year simulation period. I used the simulation platform FireBGCv2, which contains a mechanistic, individual tree succession model, a spatially explicit climate-based biophysical model that uses daily weather data, and a spatially explicit fire model that incorporates ignition, spread, and effects on ecosystem components, with stochastic properties implemented in a spatial domain. C sequestration patterns varied over time and spatial and temporal patterns differed somewhat depending on the climate change scenario applied and the fire management methods employed. Under the more extreme climate change scenario with little fire suppression, fires were most frequent and severe and older forest habitat was reduced, but early successional forest important to some components of other wildlife habitat were promoted. General trends were similar under the more moderate climate change scenario but spatial patterns differed. Some areas of the landscape served as refugia for older forest under increasing frequency of high severity fire and may be promising as anchors for the maintenance of habitat in a landscape experiencing increasing frequency of disturbance with climate change.
Keywords: carbon, climate change, fire, simulation modeling, wildlife

115. Models, science and the precautionary principle: land-use change and the sustainability of biomass systems
Authors: **KLINE**, Keith, Oak Ridge National Laboratory; Virginia Dale, Oak Ridge National Laboratory; Gbadebo Oladosu, Oak Ridge National Laboratory
Invited Symposium: Reshaping Landscapes: Bioenergy and Land-use Change - Wednesday, April 7: 11:40-12:00 - K-L

Abstract: The future of biomass energy programs increasingly depends on their perceived environmental costs and benefits. Land-use change (LUC) is a predominant determinant of environmental effects but its estimation relies on modeling. Data limitations, along with specifications and assumptions that are difficult to validate, make modeling LUC a challenging and uncertain process. This presentation will focus on what can be done in the near term to address uncertainties and develop estimates of the effects on land that are scientific, equitable and facilitate more sustainable biomass supplies. The presentation will highlight points of agreement and disagreement from the prior presentations and fill any key gaps to capture current debates on biofuels and LUC. Research from Oak Ridge National Laboratory will be shared to illustrate key uncertainties in LUC modeling, recent efforts to establish indicators of sustainability for biofuels, and application of the precautionary principle. Prior speakers will be invited to respond to the following questions to enliven a discussion: How can biomass policies better address land-use change and avoid or mitigate degradation and loss of productive lands? What are priorities for future research? This presentation and panel discussion will contribute to building scientific consensus around what we know, don't know, and what we need to find out regarding biomass production and LUC. [This presentation and key question for panel discussion will be designed to complement the content of the other five presentations in this session.]
Keywords: land use, Modeling

116. Limitations of an Eco-friendly Model Urban Landscape
Authors: **KOHLI**, Ravinder, Panjab University, Chandigarh, India; Kumkum Kohli, Government College for Girls-11, Chandigarh; Harminder Singh, Panjab University, Chandigarh, India
Offered Presentations: Landscape Aesthetics I - Tuesday, April 6: 4:20-4:40 - K-L

Abstract: Chandigarh, located at the foothills of Indian Himalayas, designed by a French Architect, Le Corbusier took shape in 1950s. The area comprised beds of boulders, pebbles, gravel, sand, silt, clays etc with seasonal rivulets. A tiny Union Territory has an Urban area (78 Km2) known as the City Beautiful. It is divided into 56 rectangular sectors besides 2 industrial areas. It is the 2nd most populated state/UT and the 7th most populated city of India. Motorized vehicular density, literacy rate and per capita income are the highest in the country. Still the pollution load is sub-threshold. The credit for this goes to the planning, managed greenery, avenue trees, and vigilant media, sensitive government and the environment loving residents. Round the year some part or the other offers colorful landscape and blooming trees. Tree selection here was done very carefully, obviously because of component of longevity of character, time required for planting and acquiring maturity and relative mutual impact of the urban pressures. The roads are identified with trees. Taking into account the direction of sun, SE-NW roads have broad leaved heavy canopy deciduous trees for better shade during summers and better light during winters for fast moving traffic, while NE-SW roads are planted with trees of light foliage. Likewise, market roads and those leading to houses support short sized deciduous ornamental trees for slow traffic/pedestrians. The road dividers have evergreen ornamental

Bougainvillea to serve as bio-fence and absorb the pollutant vehicular gas emissions. The city has its own constraints of increasing population; autumn defoliation, fast pace of development and changing lifestyle. However, the urban forest character offers a strong buffering potential that helps the citizens and the administration to keep its beauty. The proposed presentation aims at discussing the eco-friendly landscape and its limitations.
Keywords: Avenue Trees, Landscape, Problems, Solutions, Urban Forest

117. Invasive Alien Plants in Urban Landscape: Ecological Threat and Management
Authors: **KOHLI**, Ravinder, Panjab University, Chandigarh; Daizy Batish, panjab University, Chandigarh; Harminder Singh, Panjab University, Chandigarh
Offered Presentations: Invasion II - Tuesday, April 6: 4:20-4:40 - Y-Z
Abstract: Invasive alien plants pose a major threat to ecology and economy of regions invaded. The major casualty is the native biodiversity, especially in the forested ecosystems. The dimensions of loss are so serious that it has invited urgent global attention. The real challenge is to control their spread for meeting the objectives of the CBD and save the local, national and global ecology from destruction. Their effective biochemical machinery giving them a competitive edge over the natives makes them better colonizers. Use of this property assumes a better strategy and potential in weed management. The proposed presentation aims at discussing the impact of three American invasive weeds – Lantana camara, Parthenium hysterophorus and Ageratum conyzoides on plant biodiversity in Lower Himalayan ranges in India. Taking examples of these invasive aliens, it shall also discuss urgent need to develop some cost-effective environmentally safe herbicide apart from adopting integrated approach to combat the most serious enviro-economical problem facing mankind.
Keywords: Ageratum, Eco-friendly model city, invasive alien plants, Lantana, Parthenium

118. DISTRIBUTION OF PICEA RUBENS AND GLOBAL WARMING – LINKING A SYSTEMS MODEL TO A SPATIAL LANDSCAPE MODEL
Authors: **KOO**, Kyung-Ah Koo, University of Georgia; Bernard Patten, University of Georgia; Marguerite Madden, University of Georgia
Offered Presentations: Climatic Influences II - Tuesday, April 6: 3:20-3:40 - R
Abstract: For half a century the commercially and ecologically important tree species Red Spruce (Picea rubens) has declined over its entire range in Eastern North America. This study used a systems model and a GIS spatial landscape model to predict spatiotemporal changes of the geographical range of red spruce linking to global warming. The study was divided into three main sections: first, construction of envirograms of the Annual Radial Increment of Red Spruce growth (ARIRS); second, creation of Annual Radial Increment simulation Models (ARIMs); and third, development of a Red Spruce Habitat Model (RSHM). ARIMs were constructed based on the envirogram of ARIRS, which represents a structured summary of all environmental factors significant to the growth of this species. The results of ARIMs showed air pollution to be the dominant cause of growth decline at high elevations. At low elevations growth was positively correlated with water availability and radiation, and negatively air pollution. ARIMs showed growth was more affected by air pollution than global warming at high elevations and more by global warming than air pollution at low elevations. These results were applied to develop RSHM. RSHM exhibited low habitat suitability at high elevations (1850 to 2028 m), most medium suitability at low elevations (1400 to 1650 m), and most high suitability for all habitats in the intermediate buffer zone (1650 to 1850 m). RSHM predicted global warming would shrink

distribution by degrading habitat suitability. Global warming effects are augmented by interactions with air pollution, especially at high-elevation habitats. In conclusion, RSHM significantly predicted spatiotemporal changes of the red spruce range, explaining ecological and physiological processes and causes. Overall, this study showed the significance and importance of comprehensive multifactorial modeling for better understanding of tree systems by linking a systems model, ARIMs, to a spatial landscape model, RSHM.
Keywords: GIS spatial landscape model, Global warming, Habitat lost, Picea rubens, Systems model

119. Like a duck to water: incorporating hydrology into waterfowl (family Anatidae) distribution modeling
Authors: **KREAKIE**, Betty, University of Texas at Austin; Timothy Keitt, University of Texas at Austin
Offered Presentations: Distribution I - Tuesday, April 6: 11:40-12:00 - Y-Z
Abstract: Migratory waterfowl are among the most difficult species for which to create accurate spatial distribution models. Their reliance on dynamic and ephemeral wetland habitat and seasonal migration contribute to the modeling difficulties. Our objectives are (1) to improve our ability to model the spatial distribution of species reliant on dynamic wetland habitat by introducing a data source, which models the water table depth, and (2) to increase the understanding about the seasonal habitat requirements of seven waterfowl species. Season-specific distribution models for seven waterfowl were created with Maxent. The USGS' Banding Bird Laboratory banding and recovery data from 1990 through 1999 was used for species locations. Temperature, precipitation, and elevation data were used as predictor variables in addition to one of two methods of measuring wetland quantity: percent area of cell classified as wetland and average model-derived water table depth for a cell. To examine the relationship between predicted probability of occurrence and depth to water table, response curves were created for each species in each season. Of the models produced with the water table data, 26 of 28 models had an AUC over 0.7; compared to 23 of 28 of the models created with the percent wetland based on land use classification. In direct comparison between the two methods of quantifying wetlands, models created with the water table depth data had higher AUC scores than models created with percent wetland in 20 out of 28 direct comparisons. The conclusion of this project is that the novel data source is a strong predictive tool in species distribution models of waterfowl. The results illustrate that all waterfowl species are affiliated with shallow water table habitat. This study illustrates that the intensity of affiliation is not constant between seasons for a species, nor is it consistent between species.
Keywords: climate, Maxent, migratory birds, species distribution modelin, USA

120. Regionalization of National Forest Fragmentation Patterns Using Contiguity Constrained Clustering and Partitioning
Authors: **KUPFER**, John, Univ. of South Carolina; Diansheng Guo, Univ. of South Carolina; Peng Gao, Univ. of South Carolina
Offered Presentations: Fragmentation - Wednesday, April 7: 11:20-11:40 - Y
Abstract: Because of the close linkages among ecological pattern, function and process, policy makers and land managers often seek measures of landscape pattern that may be used to quantify and monitor changes in forest cover associated with forest loss and fragmentation at national or multinational scales. Typically, such broad-scale assessments involve simple descriptions of

forest pattern (e.g., extent), with values sometimes aggregated by ecoregion or other spatial units of management interest. In this study, we take the opposite approach, that is, we seek to identify regions with relatively homogeneous patterns of forest loss and fragmentation and link those patterns to potential drivers of land cover change. The goal of regionalization is to divide a large set of spatial objects into a number of spatially contiguous regions while optimizing an objective function (e.g., a homogeneity measure of the derived regions). In this study, we first used a moving windows approach to calculate five measures of landscape pattern and change for the entire continental U.S. based on the 1992 and 2001 National Land Cover Datasets. We then grouped these data using a hierarchical regionalization method based on an agglomerative clustering approach constrained with spatial contiguity. The end result was a set of regions that exhibited distinct patterns of forest extent, connectivity, fragmentation by natural and anthropogenic factors, and forest change from 1992-2001. These regions, in turn, reflect ecoregional variations in natural vegetation patterns and the superimposed effects of human activities.
Keywords: clustering, fragmentation, GIS, land change, metric

121. Defining the ecological wildland urban interface: relating fire and altered land to forest succession in the pinelands of New Jersey
Authors: **LA PUMA**, Inga, Center for Remote Sensing and Spatial Analysis, Rutgers Univ
Offered Presentations: Fire - Wednesday, April 7: 10:40-11:00 - F-G
Abstract: The purpose of this research was to assess the relationships between altered land, fire, and forest succession in the Barnegat and Mullica watersheds of the Pinelands National Reserve in New Jersey, USA. I used varying buffer distances from altered land into forest areas along with 80 years of fire perimeter records to assess the affects of human development patterns on adjacent fire suppression and forest succession. Buffer configurations changed due to forest growth and newly altered land between 1986 and 2002. A particular location within the forest may have changed in terms of its proximity to altered land, creating a 'was/is' matrix of buffer intersect fragments. Proximity to altered land is a clear factor for both fire frequency and forest succession in the Pinelands. Coniferous to deciduous composition transitions are predominant, show similar fire frequency distributions, and are most prominent in those locations closest to altered land (0-120m) in both 1986 and 2002; areas that have been closest to altered land for the longest time period. The few locations succeeding to coniferous cover tend to be at least 1km from altered land and have a fire return interval of 26-78 years. Proximity to altered land in 2002 determines fire frequency trends in locations undergoing landcover changes regardless of the relationship to altered land in 1986. Understanding the spatial extent of the affects of adjacent development on fire regimes and thus forest composition is an example of an ecologically defined wildland urban interface, or the spatial extent to which adjacent altered land can be expected to affect ecological processes due to the presence of humans.
Keywords: fire history, forest succession, landcover change, New Jersey, wildland urban interface

122. Changes in the Spatial Distribution and Entrainment Risk of Total Phosphorus in Sediments of Lake Okeechobee, Florida
Authors: **LAMSAL**, Sanjay, University of North Carolina at Charlotte; Justin Vogel, University of Florida; Matthew Cohen, University of Florida; Todd Osborne, University of Florida
Poster #9: Disturbance - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: Ongoing phosphorus (P) loading from the watershed of Lake Okeechobee has resulted in persistent eutrophic conditions and massive P accumulation in lake sediments, providing a source of internal P loading that may induce long lags between restoration efforts and lake recovery. Despite the importance of the status and trends in sediment P for understanding lake behavior, long term studies of the spatial distribution of sediment P are not available. Using data from three lake-wide sediment surveys – 170 locations sampled in 1988, 1998 and 2006 – we mapped sediment total phosphorus (TP) concentrations and its changes between sampling periods. Sediment TP maps from all periods showed elevated levels in the central and eastern parts of the lake, coincident with a broad zone of flocculent mud. There was a decline in TP concentration between 1998 and 2006, though declines in concentration were offset by increases in the extent of sediments with concentrations above 750 mg/kg; P mass in the upper sediments (0 – 10 cm) was not significantly different among any the sampling periods. Higher TP concentrations were observed in low bulk density (BD) sediments, which are more prone to wind-induced resuspension. Large decreases in TP between sampling events was found in sediments with low BD and high TP. We constructed a P entrainment risk metric based on the ratio of TP to BD, with higher values indicating greater vulnerability. Maps of this metric showed that sediment P in the central and eastern part of the lake are at higher risk of entrainment and should be prioritized for sediment management efforts.
Keywords: kriging, Lake Okeechobee, Phosphorus, Sediment Quality

123. Distribution of Sudden Oak Death host species and their biomass carbon across California and Oregon

Authors: **LAMSAL**, Sanjay, University of North Carolina at Charlotte; Qingmin Meng, University of North Carolina at Charlotte; Ross Meentemeyer, University of North Carolina at Charlotte
Poster #16: Invasion - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Sudden oak death (SOD) is an emerging forest disease that has reached epidemic levels in California and Oregon. The lethal form of the disease kills several ecologically important trees, including tanoak, coast live oak, canyon live oak and black oak. Carbon stored within tree biomass constitutes a significant component of terrestrial carbon sequestration. However, less is known about the distribution of SOD host species and carbon stored within their biomass, which is a pre-requisite to assess the potential risk of future carbon losses resulting from SOD. Our objectives were to map the distribution of SOD host species and their carbon across California and Oregon. We used biomass data of host trees collected by the Forest Inventory and Analyses program. Host species were found in 2028 plots with tanoaks found in 552 plots, coast live oaks (206 plots), canyon live oaks (927 plots), and black oak (953 plots). While the geographical distribution of individual host species followed ecoregion delineation, there were several plots within the delineation where host species were absent. We used tree expansion factors to upscale carbon stored within individual trees to plot level, and derived plot level carbon estimates expressed in tons per ha. Plot carbon estimates by host species were spatially autocorrelated and their spatial autocorrelation structure were modeled using semivariograms. We developed regression models to predict plot carbon content for each host species based on ecological and physiographic variables, and mapped carbon contents using regression and kriging. These spatial maps show regional distribution of carbon stored within SOD hosts and are useful to assess the risk of carbon losses resulting from SOD mortality. We expanded plot level carbon estimates to regional scales using plot expansion factors, which produced an estimated 205 MegaTons carbon

stored within the four host species across California and Oregon.
Keywords: biomass carbon, kriging, sudden oak death, tree mortality

124. Applied and Theoretical Landscape Ecology through Conservation Partnerships: Successes, Limitations, and Future Prospects
Authors: **LAURENT**, Edward, American Bird Conservancy; D. Todd Jones-Farrand, American Bird Conservancy; James Giocomo, American Bird Conservancy; John Tirpak, U.S. Fish and Wildlife Service; Jane Fitzgerald, American Bird Conservancy
Offered Presentations: Scale I - Tuesday, April 6: 10:20-10:40 - F-G
Abstract: Over the past few decades there have been major advances in the establishment of international, national, and regional alliances to identify, describe, and address bird conservation issues over large areas. For example, Partners in Flight has analyzed trend data and prioritized North American landbird species requiring conservation at the continental scale based on the magnitude of their decline, their vulnerability to current and imminent threats, and other factors. Likewise, the Avian Knowledge Alliance is operating at broad scales to address critical data management issues by developing standard schema, a network of data centers called the Avian Knowledge Network, and a suite of tools to compile, organize, store, integrate, and use bird monitoring data from otherwise independent efforts across the entire Western Hemisphere. Regional delivery of national and international bird conservation plans in the United States is increasingly being conducted by a wall-to-wall network of Joint Ventures. These self-directed non-regulatory partnerships of federal, state, and private agencies, organizations, and individuals rely on the theory of landscape ecology to develop conservation strategies that target the most ecologically sensitive portions of the landscape (i.e., those areas that most efficiently restore ecological function). The success of Joint Ventures and other conservation partnerships have recently provided the impetus to establish a network of Landscape Conservation Cooperatives that will address conservation needs of the United States across all taxa, with special attention provided to the development of adaptation strategies that counter the effects of climate change and other emerging threats (e.g., urbanization). In this presentation, we will highlight many of these broad-scale collaborative success stories; provide examples of where the application of theory has been limited due to issues of spatial, temporal, and thematic scale; and identify opportunities for future collaboration with the IALE community.
Keywords: Application, BIRD, Conservation, Partnership, scale

125. Spatial scale and matrix matters: effects of anthropogenic land uses on site occupancy of riparian birds in an arid region
Authors: **LEE**, Myung-Bok, University of Georgia; Rotenberry John, University of California Riverside
Offered Presentations: Urban Ecosystems - Thursday, April 8: 4:40-5:00 - K-L
Abstract: With growing urban development and intensive agriculture, riparian habitats are increasingly isolated in a human-altered landscape matrix. Although numerous studies have examined how human land-uses affect riparian birds, few studies have been performed in landscapes altered by both urban development and agriculture in semi-arid and arid regions where riparian habitat often remains intact. We examined the spatial scale (local vs. landscape) that best explained variation in site occupancy of riparian bird species and their responses to landscape features, in a landscape matrix of mixed urban developments and agriculture in Riverside, California. We conducted bird survey and vegetation sampling in 11 drainages during

2004 breeding season. We used the percent cover of each of 3 vegetation layers (tree, shrub, herb) as local-scale variables, and the percent cover of 4 land cover types (development, agriculture, shrubland, riparian habitat) and 2 configuration variables (distance to development and distance to agriculture) as landscape-scale variables. We incorporated heterogeneous detection probability between surveys into estimation of occupancy of riparian bird species. The site occupancy of most species was best explained by landscape-scale variables or both local-and landscape-scale variables. Species' responses to landscape-scale variables were species-specific; however, half of the species tended to respond positively to anthropogenic lands and amount of riparian habitat. The occupancy rate of species was higher closer to urban areas and lower closer to agriculture lands. Our results indicate that landscape features surrounding riparian habitat may be an important factor affecting distribution of riparian birds.
Keywords: Anthropogenic land uses, Detection heterogeneity, Landscape-scale, Local-scale, occupancy

126. Strategies for enhancing carbon storage in human dominated landscapes
Authors: **LESCH**, Lauren, University of Michigan; Joan Nassauer, University of Michigan; William Currie, University of Michigan
Poster #6: Climatic Influences - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Our research addresses the gap between the science investigating the carbon cycle in human dominated landscapes, and the on-the-ground decisions, made by designers and land managers, that impact carbon cycling and storage. Based on current scientific understanding of carbon cycling in vegetated, urban, and agricultural land under different management and climate regimes, we crafted strategies to help planners and designers enhance carbon storage in a way that is consistent with other potential ecosystem services, human functional requirements and cultural expectations in metropolitan landscapes. We applied these strategies to case studies of two well-known conservation subdivisions: Prairie Crossing in Grayslake, Illinois, a 678 acre development with 359 single family homes and 36 condominiums, and Coffee Creek in Chesterton, Indiana, a 700 acre development with plans for 3000 residential units and 4 million square feet of commercial space. Based on published literature describing each site and publicly available data from the developers of each site, as well as conversations with their designers, developers and land managers, we applied our strategies to assess the success of these developments in preserving and enhancing carbon sequestration. We found that many of our strategies for carbon storage overlapped with the conservation principles used in designing these subdivisions, but that shifts in construction and management practices could increase the potential for carbon storage in these developments further, especially on private residential land.
Keywords: carbon, Design, Restoration Ecology

127. The Impact of Urban Sprawl on Landscape and Environmental Change in Lianyungang, China
Authors: **LI**, Yangfan, School of the Environment, Nanjing University; Xiang Sun, School of the Environment, Nanjing University; Xiaodong Zhu, School of the Environment, Nanjing University
Offered Presentations: Urban Ecosystems - Thursday, April 8: 5:00-5:20 - K-L
Abstract: Urban sprawl is an increasingly well-entrenched phenomenon and shows few signs of abating, particularly in regions that feature rapidly growing economies. The coastal urban areas of eastern China typify these patterns. As urban planning enable and accelerate processes of

sprawl, environmental quality and large-scale ecosystem functions experience profound changes. Lianyungang has become the predominant development zone of China and the government has also indicated plans to shift development of Lianyungang eastward to the coast. The main objective of this paper is to provide a quantitative assessment of the spatial and temporal dynamics of physical urban development and landscape-environmental changes in the Lianyungang bay area and extended urban region. Environmental impacts and landscape effects of urban expansion on bay-area wetlands were assessed based on remote sensing data, spatial analyses from GIS, and methods from landscape ecology. The results show that the urban built-up area increased from 253.28 km2 of 2000 to 314.31km2 of 2004, 360.71km2 of 2006. The area of salt wetlands was significantly reduced, from 269.10km2 of 2000 to 249.56km2 of 2004, 214.72km2 of 2006. Driven by urban planning and regional development strategies, the Environmental Impact Intensity indicator distribution and dynamic are in accordance with the intensity and direction of urban sprawl. The most fragile and disturbed ecosystems are also the key regions for present and future development. The primary direct drivers of degradation and loss of Lianyungang bay-area wetlands include overexploitation, water eutrophication/pollution, urban land use change and conversion, introduction of invasive alien species and climate change. The combination of climate and land-use change may have especially profound effects on the habitability of the environment, more so than either acting alone. While urban land-use change is often a driver of environmental and climatic changes, a changing climate can, in turn, affect land use and land cover.
Keywords: China, environmental impact, landscape change, urban sprawl

128. Patterns and drivers of reforestation: A case study in the Qinling Mountains (China)
Authors: **LI**, Yu, Michigan State University; Andres Vina, Michigan State University; Jianguo Liu, Michigan State University
Offered Presentations: Restorative Ecology - Thursday, April 8: 10:20-10:40 - Y-Z
Abstract: While deforestation continues at the global level and causes biodiversity loss and fragmentation of wildlife habitat, some countries such as China have shown trends of reforestation due to conservation policies in recent years. Since 2000, China has begun a conspicuous reforestation process thanks to the implementation of two national conservation policies, the Natural Forest Conservation Program (NFCP) and the Grain-to-Green Program (GTGP). These are two of the largest conservation efforts in the world and have important global implications. The former protects natural forests through means such as logging bans, while the latter converts croplands on steep slopes to forests or grasslands. Understanding the effects of conservation policies and underlying drivers of reforestation in different regions with various biophysical and socioeconomic characteristics are important for providing essential information for making and implementing more effective conservation policies in the future. In this study, we used the Moderate Resolution Imaging Spectroradiometer (MODIS) Vegetation Continuous Fields (VCF) product to detect the forest cover change between 2000 and 2005 in the Qinling Mountains in Shaanxi Province (Northwest China), an important region for conserving the endangered giant panda and numerous other species. Linear regression models were used to explore the relationships between forest cover changes and different drivers (demographic, economic, biophysical and policy) at the township level. Results show that most townships have experienced forest recovery after the implementation of the NFCP and the GTGP. Reforestation was significantly affected by demographic (population density), economic (percent cropland area), biophysical (initial forest cover conditions) and conservation policy implementation status

(percent GTGP area). These findings suggest that it is important to integrate various factors in understanding patterns and processes of reforestation.
Keywords: Drivers, Grain-to-Green Program, Natural Forest Conservation, Qinling Mountains, Reforestation

129. Multi-Scale Drivers of Interannual Vegetation Dynamics
Authors: **LINDERMAN**, Marc, University of Iowa; Pedram Rowhani, McGill University
Invited Symposium: B-1 - Thursday, April 8: 2:20-2:40 - K-L
Abstract: Year-to-year changes in the timing and overall productivity of vegetation have significant implications for social and natural systems. The spatio-temporal patterns in vegetation dynamics directly impact biodiversity, hydrological partitioning, food security, GHG emissions, and others. Understanding the multi-scalar drivers of these dynamics is essential to better estimate human impacts on natural systems and the potential feedbacks on society. Case studies to be discussed within this presentation will focus on efforts to monitor and estimate the effects of climate, land use, and plot-level characteristics on interannual change of vegetation characteristics and to improve our understanding of the broad-scale implications of agro-ecosystem dynamics. Mixed effects models, for example, suggest that differential climate responses between land-cover types explain the majority of between-plot differences. Whereas, year-to-year climate differences and plot scale land-use factors explain the majority of within-plot trends and interannual variability. Finally, we will discuss the spatio-temporal implications of the differences between drivers and system dynamics based on on-going regional studies for estimating ecosystem responses and human impacts to ecoregion dynamics. These analyses provide further insights into the interactions between climate and human activities at the plot to ecoregion scales and potential coupling mechanisms between socio-economic and natural system processes.
Keywords: Agriculture, land use, MODIS, phenology, prairie

131. Scale dependent correlations between vegetation and environment for pre-European settlement landscapes in Wisconsin
Authors: **LIU**, Feng, University of Wisconsin - Madison; David Mladenoff, University of Wisconsin - Madison
Offered Presentations: Scale I - Tuesday, April 6: 11:20-11:40 - F-G
Abstract: Note: I missed the deadline because I was out of the country longer than I thought. Thank you very much for your consideration. Feng The US Public Land Survey (PLS) data from the US General Land Office provide important baseline information for the pre-European settlement vegetation. In this study, we examined the relationship between historical vegetation in Wisconsin, obtained from the PLS records, and environmental variables across spatial scales. The environmental variables include soil variables extracted from SSURGO database, climate variables from PRISM data sets, and elevation data from USGS DEM data. We used NMS ordination to analyze PLS tree data for the south and north Wisconsin separately. Random forest was also conducted to rank important environmental variables for the distribution of major species across the state. Both NMS ordination and random forest were conducted at four different spatial scales (1 mile × 1 mile, 3 × 3, 9 × 9 and 30 × 30). Ordination results indicated that soil texture variables play a more important role at finer scales while temperature related variables predominate at broader scales. In the north, physical variables are dominant in importance, while in the south there is less congruence with physical variables, apparently due to

higher past fire disturbances. Random forest results demonstrated that soil texture variables are the key environmental variables for pine species while temperature variables play a central role for oak species. These results provide a framework of how environmental variables influence spatial distribution of tree species at multiple scales under minimum human disturbances.
Keywords: NMS ordination, Public Land Survey, Random Forest, scale

132. Quantitative assessment of regional sustainability: A case study of Xilinguole League, Inner Mongolia

Authors: **LIU**, Fengqiao, School of Sustainability, Arizona State University; Jianguo Wu, School of Life Sciences, Arizona State University; Xingguo Han, Institute of Botany, Chinese Academy of Sciences

Offered Presentations: Sustaining Systems - Thursday, April 8: 1:40-2:00 - T-U

Abstract: Sustainability has become the main theme of our era, and landscape ecology has much to offer for studying and achieving sustainability particularly at landscape and regional scales. Using sustainability indicators and principal component analysis (PCA), we assessed the environmental, social, and economic sustainability of 12 Banners and Counties in Xilinguole League, Inner Mongolia, China. Our results showed that the performance of environmental sustainability was determined mainly by temperature and precipitation, soil erosion by wind, and desertification; the performance of social sustainability by education and public health; and the performance of economic sustainability by secondary and tertiary industry, agricultural economics, and husband economics. Based on a composite sustainability index (CSI) that we developed, the 12 Banners and Counties were ranked. Xilinhaote City had the highest CSI value, with the best performance in both social and economic development. Dongwuzhumuqin Banner had a relative high CSI value because of its advantage in economic structure. Taipusi Banner performed much better in social development than the other two dimensions. These results indicate that, to achieve regional sustainability, all Banners and Counties need to strengthen policies and practices in environmental protection and conservation. Our study also has demonstrated that PCA can be an effective tool to reduce the dimensions of sustainability indicators and to help develop aggregated sustainability indices. A proper integration between landscape metrics with sustainable development indicators is needed to better assess regional sustainability and understand its underlying processes.
Keywords: Inner Mongolia, landscape ecology, principal component analysis, regional assessment, sustainability science

133. Coupling Human and Natural Systems: Challenges and Opportunities for Landscape Ecologists

Authors: **LIU**, Jianguo, Michigan State University

Invited Symposium: US-IALE Presidents' Symposium II - Tuesday, April 6: 2:20-2:40 - Masters Hall

Abstract: I will highlight three issues during my presidency (2008-2010). First, landscapes are being viewed as coupled human and natural systems (CHANS). The study of CHANS has been recognized globally as a key interdisciplinary frontier that underpins the science of sustainability at local to global levels. The meeting themes of US-IALE in 2009 and 2010 reflect the CHANS perspective. At the 2009 meeting, the International Network of Research on Coupled Human and Natural Systems (CHANS-Net, www.chans-net.org) organized the well-attended symposium "Complexity in Human-Nature Interactions across Landscapes" and companion workshop.

Second, there has been support for annual meetings from three major federal funding agencies (NASA, NSF, and USDA). To nurture a new generation of CHANS researchers, 14 junior scholars were awarded CHANS Fellowships by NSF-funded CHANS-Net to support their participation in the CHANS events and interactions with senior colleagues at the 2009 meeting. Approximately 10 CHANS Fellowships are anticipated for the 2010 meeting. USDA's National Institute of Food and Agriculture has provided support for the 2010 meeting, including the establishment of the USDA-NIFA Professional Enhancement Awards to support 10 students. Through NASA and Michigan State University, the NASA-MSU Professional Enhancement Awards program will enter its 13th year in 2010, with support to approximately 20 students per year and a total of more than 270 students from over 100 institutions around the world. Third, membership information will be online so all members can renew their memberships and access member information online, thanks to the great efforts of the Webmaster, Web Coordinator, Treasurer, and Membership Committee. In terms of future challenges and opportunities, I think it is important to reexamine landscape ecology from the CHANS perspective, further integrate landscape ecology with social sciences and policy, and promote more interactions between landscape ecologists and various stakeholders (e.g., policy makers, news media, and the general public).
Keywords: complexity, coupled human-natural systems, interdisciplinary, support for junior scholars, sustainability

134. Are there "tipping points" in landscape dynamics with changing climates? A simulation modeling experiment
Authors: **LOEHMAN**, Rachel, USFS Rocky Mountain Research Station Fire Sciences Lab; Robert Keane, USFS Rocky Mountain Research Station Fire Sciences Lab
Invited Symposium: Landscape Ecology of Wildfires: Theory, Modeling, and Application - Tuesday, April 6: 11:40-12:00 - R
Abstract: Climate projections for the next 20-50 years forecast higher temperatures and variable precipitation for many landscapes in the western United States, with associated effects including increased wildfire intensity and severity, increased tree mortality from forest pathogens and drought stress, and changing species distributions and community compositions. Most methods for modeling effects of climate changes on ecosystems and wildland fire depend on gridded climate projections generated by Global Circulation Models (GCMs); unfortunately, these gridded climate data sets contain a high degree of uncertainty, especially at finer spatial scales, and may over- or undershoot critical climatological "tipping points" for landscape structure and function. Alternatively, we have designed synthetic weather streams that define potential climate futures, in which daily temperature, precipitation, and carbon dioxide concentration are systematically and incrementally modified based on historical records and potential future trends. These weather streams are used in the FireBGCv2 simulation modeling environment to identify important ecological tipping points, or critical thresholds, at which relatively small perturbations of forcing variables (e.g. climate) result in large, abrupt, and long-term changes in ecosystem properties (e.g. site carbon, vegetation composition, fire regime). Identification of these tipping points will help assess where and when climatic changes will result in persistent and significant changes in vegetation-fire dynamics.
Keywords: climate, model, threshold, vegetation, wildfire

137. The Global Sustainable Bioenergy Project: Gracefully Reconciling Large-Scale Biofuel Production with Other Land Use Priorities

Authors: **LYND**, Lee, Dartmouth College, Mascoma Corp.; Carlos de Brito Cruz, FAESP; Ethan Davis, Dartmouth College; Andre Faaij, Utrecht University; Jon Foley, University of Minnesota; Jose Goldemburg, Universit of Sao Paulo; Nathanael Greene, Natural Resources Defense Council; Mark Laser, Dartmouth College; Reinhold Mann, PETRONAS Renewable Energy Lab; Patricia Osseweijer, Delft University of Technology; Tom Richard, Pennsylvania State University; John Sheehan, University of Minnesota; August Temu, World Agroforestry Centre; Emile van Zy, University of Stellenbosch

Invited Symposium: Reshaping Landscapes: Bioenergy and Land-use Change - Wednesday, April 7: 10:00-10:20 - K-L

Abstract: The world is currently confused and uncertain about whether to look to bioenergy to play a prominent role in the future, and if so, what policies are needed to ensure a sustainable result. The Global Sustainable Bioenergy (GSB) project seeks to bring needed clarity and resolution to this situation within a three-stage framework: 1) Hold conventions on each of the world's five continents; 2) Definitively test the working hypothesis that it is physically possible for bioenergy to sustainably meet a substantial fraction of future demand for energy services (> 25% of global mobility or equivalent), while feeding humanity and meeting other needs from managed lands, preserving wildlife habitat, and maintaining environmental quality. 3) Stage 3. Analyze and recommend transition paths and policies in light of Stage 2) results, incorporating analysis of macroeconomic, environmental, ethical and equity issues as well as local-scale effects on rural economies. This presentation will report on the GSB project mid-way through stage 1), will look forward to stage 2), and will present perspectives and selected analytical results related to biofuels and land use issues.

Keywords: bioenergy, Global, GSB, Land-use

138. Master Planning Wormsloe: An Integrated Approach for Conserving and Interpreting Landscape and History on a Costal Georgia Plantation

Authors: **MACDONALD**, Eric, The University of Georgia; David Spooner, The University of Georgia; Georgia Harrison, The University of Georgia; Amber Christoffersen, The University of Georgia; Jessica Hyde, The University of Georgia

Invited Symposium: Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History, Isle of Hope, Georgia - Tuesday, April 6: 11:40-12:00 - K-L

Abstract: This presentation investigates the landscape planning process for the Wormsloe State Historic Site, and is part of the "Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History on the Isle of Hope, Georgia" Symposium. Wormsloe Plantation occupies a strategic and significant place in the ecological and cultural history of the Southeastern United States. During summer 2009 an interdisciplinary team of University of Georgia (UGA) researchers, aided by the Wormsloe Institute for Environmental History Science Advisory Board (WIEH/SAC), began planning the future conservation and interpretation of Wormsloe's landscape. Led by UGA faculty, the process developed for Wormsloe integrates a traditional landscape planning and design approach (Lynch and Hack, 1984) with the cultural landscape planning model developed by the U.S. National Park Service (Page et al., 1998). Initial efforts have focused on the integration of existing historical, ecological, and GIS data, and the development of a preliminary landscape design program and concept. In addition, the planning and design process has been modified to accommodate the participation of multiple

property owners and other stakeholders. Toward this end, an initial landscape design "charrette" was conducted in November 2009 to illuminate design alternatives as well as clarify the project design program. A charrette is an intensive, time-limited workshop in which professional planners and designers work collaboratively with stakeholders (Condon, 2008). Future steps will include more extensive landscape documentation and historical research, and the development of schematic design drawings, which will serve future decision making by tying physical interventions to expected impacts on the landscape's ecological structure and function as well as its historical integrity and cultural significance. To be presented at the US-International Association for Landscape Ecology (IALE) symposium on Wormsloe entitled, "Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History on the Isle of Hope, Georgia". April 5-9, 2010, Athens, Georgia.
Keywords: Charrette, Cultural Landscape Report, Design Process, Master Plan

139. Wormsloe Vegetation Geodatabases and Long-term Plot Surveys Related to Legacy Landuse Patterns
Authors: **MADDEN**, Marguerite, Center for Remote Sensing and Mapping Science (CRMS); Phyllis Jackson, Center for Remote Sensing and Mapping Science (CRMS)
Offered Presentations: Resource Management II - Tuesday, April 6: 3:40-4:00 - F-G
Abstract: Establishing baseline information on existing vegetation patterns related to documents and maps of environmental histories can provide insights on past processes that influenced present conditions, as well as a glimpse to the future to ensure sound land management decisions. Thirty permanent plots were located on the Isle of Hope and Long Island, Georgia within the Wormsloe Historic Site based on current vegetation types and historic landuses mapped in 1870. Vegetation and herpetological surveys are being conducted to document current conditions within 20 x 20 m square plots. These surveys will be repeated over seasonal, annual and decadal periods to provide long-term measurements of trends and trajectories in vegetation/herp species and abundance. Such information is invaluable to ecological, anthropological and archaeological studies being conducted by researchers of the Wormsloe Institute for Environmental History (WIEH). The vegetation data also provide the ground truth data needed to define and describe vegetation classes at the plant community (i.e., association) level for mapping from remotely sensed images. As an example of synergetic Wormsloe research and coordination of study design, this study is being coordinated with a dendrochronolgical investigation of tree age related to landuse history and climate factors conducted by Dr. Albert and Kathy Parker from the University of Georgia. The long-term plot locations provide sample locations for tree coring and results from the dendrochronology study (e.g., master chronologies) will provide enhanced understanding of age structure related to stem size within Wormsloe plant communities. Long-term vegetation and dendrochology data can then be applied to environmental impacts of human activities (e.g., agriculture and logging) and storm events, wildlife habitat assessments, monitoring ecological effects of global climate change, rare species inventories, status of invasive plants and recreation of environmental histories, just to name a few.
Keywords: Coastal Georgia, Landuse legacy, Long-term plots, Vegetation surveys

141. HOW WELL DO SOCIO-ECONOMIC FACTORS EXPLAIN LANDSCAPE FRAGMENTATION IN WESTERN EUROPE?
Authors: **MADRI&NTILDE;&AACUTE;N**, Luis, Concordia University; Tomas Soukup,

European Environment Agency; Christian Schwick, Die Geographen Schwick & Spichtig; Felix Kienast, Swiss Federal Research Institute WSL; Jochen Jaeger, Concorida University
Offered Presentations: Simulated Environments I - Thursday, April 8: 11:20-11:40 - T-U

Abstract: Landscape fragmentation caused by transportation infrastructure and urban sprawl has a number of detrimental effects such as reduction in size and persistence of wildlife populations and changes of local climate, and increases pollution and noise from traffic. Therefore, data on the degree of landscape fragmentation are needed for monitoring and assessing the sustainability of human land uses. Such data can also be used to identify regions that are particularly fragmented, i.e., to a higher degree than is justifiable by human presence or economic activities, among other causes. In order to determine the factors related to landscape fragmentation across the European continent, we created a set of statistical models based on socio-economic variables such as population density, GDP, level of education, and volumes of freight and passenger transport. We used effective mesh density (seff) to measure the degree of landscape fragmentation as the response variable for three different fragmentation geometries (including combinations of different road classes and natural barriers). Two factors alone (Population Density and GDP per capita) explained most of the variation (R^2 ranging from 47% to 62%), and the global model had an R^2 between 61% and 84%. Our results suggest that the socio-economic variables in this analysis include the main drivers of landscape fragmentation in Europe. Regions that are more, or less, fragmented than expected were identified; and this information can be used by managers for future environmental politics and decision making.
Keywords: Effective mesh density, Europe, landscape fragmentation, NUTS X regions, socio-economic

142. Spatial variation in WNV vector distribution in NYC
Authors: **MAGORI**, Krisztian, Odum School of Ecology; Kevin Knoblich, Odum School of Ecology; Waheed Bajwa, New York City Department of Health and Mental Hygiene; John Drake, Odum School of Ecology
Invited Symposium: Pathogens in Heterogeneous Landscapes - Wednesday, April 7: 10:40-11:00 - Masters Hall

Abstract: Since its introduction to the Western Hemisphere in 1999, West Nile virus became the most important endemic arbovirus in the United States. We analyze the spatio-temporal variation of mosquito vectors of WNv using a unique mosquito surveillance dataset collected by the New York City Department of Health and Mental Hygiene. As expected, mosquitoes emerge the earliest and in the highest numbers in boroughs of the City with permissive land-cover types, particularly Staten Island, Bronx, and the eastern part of Queens. Culex pipiens, the northern house mosquito, represents the highest relative contribution to the transmission risk of WNv to humans in NYC. However, the Asian tiger mosquito (Aedes albopictus), a very competent vector of WNv, is increasing in abundance since 2004. Based on our analyzes, we suggest that Culex pipiens, Cx. restuans and Cx salinarius mosquitoes are transmitting the virus both between birds and to humans, and that other mosquito species are not significantly acting as bridge vectors in NYC.
Keywords: Aedes albopictus, Culex pipiens, New York City, West Nile virus

143. Can local habitat variation compensate for edge effects? An example with bird diversity in cloud forest landscapes
Authors: **MARCY**, Nathan, University of Florida; Robert Fletcher, Jr., University of Florida

Poster #1: Agrarianism - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Tropical cloud forest supports tremendous biological diversity, which is threatened by habitat loss and fragmentation. Nonetheless, some forms of anthropogenic disturbance may lessen the effects of these processes on wildlife. For example, while clearing forest for pasture reduces the habitat available to cloud forest species, vegetation within pastures may ameliorate that loss. We documented edge effects that occurred from forest birds spilling over into pastures in a cloud forest landscape in Ecuador, and tested whether vegetation in pastures could compensate for the decline in bird diversity associated with increasing distance from the forest edge. We collected data on the spatial distribution of avian diversity at two private reserves containing pasture fragments that ranged in vegetation structure and composition. In some pastures trees were sparse, while in others tree density was high. Pastures contained old growth trees left uncut, young regrowth trees, or plantations of native or non-native species. We sampled 17 pastures for birds using standard point count techniques and sampled vegetation in the same areas. Distance from edge had a highly significant and consistent negative effect on bird diversity in pastures. All types of trees were positively associated with diversity, with the number of remnant trees having the most positive effect. Our results suggest that remnant trees have a greater positive effect on diversity than any form of reforestation, and reduce the negative effects of forest loss and fragmentation by increasing diversity and reducing edge effects within pastures. Our results provide guidance to help improve pasture management in this biodiversity hotspot.
Keywords: birds, cloud forest, diversity, edge effects, pastures

144. Isolated Wetlands in a Changing Landscape, Dougherty Plain, Georgia
Authors: **MARTIN**, Glenn, Warnell School of Forestry and Natural Resources, UGA; Jeffrey Hepinstall-Cymerman, Warnell School of Forestry and Natural Resources, UGA; L. Katherine Kirkman, Joseph W. Jones Ecological Research Center, Newton, GA
Poster #12: Disturbance - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: The Dougherty Plain is a karstic physiographic district located in southwest Georgia, and covering approximately 670-km2. Isolated, depression wetlands are common features of the landscape due to the dissolution of underlying limestone, and the subsequent collapse of the overburden. Such wetlands are particularly vulnerable to anthropogenic disturbance, which may alter the structure and function of these systems for decades or centuries. These wetlands are non-jurisdictional, and currently lack government regulation. We undertook a project to examine long-term changes in the landscape context of isolated wetlands in this region. Specifically, we identified and delineated isolated, depression wetlands for a 10% sample of the Dougherty Plain using aerial photographs from four dates (1948, 1968, 1993 and 2007). We combined these data with a previously constructed spatially explicit historical timeline of land use and land cover (LULC) change across the region. Intra-wetland LULC composition was assessed for each time period, and landscape trajectories depicting the historic context and current fate of wetlands were developed. Preliminary results indicate broad changes in the number, area and LULC context of wetlands in the region between 1948 and 2007. Specifically, many wetlands were ditched, drained and converted to other LULC types, such as planted pine and irrigated agriculture. The wetland LULC history database being developed will provide a historical perspective for ongoing scientific research within the Dougherty Plain. For example, these results will be coupled with extensive and intensive vegetation and water chemistry sampling conducted in 2009-2010 to model wetland response to disturbances. Our long term objective is to develop a

geospatial toolset to assist in the rapid assessment of wetland condition throughout the region.
Keywords: isolated wetland, landscape change, landscape trajectory, southwest Georgia

145. Groundwater mechanism for land use legacies
Authors: **MARTIN**, Sherry, Michigan State University; Dan Hayes, Michigan State University; Daniel Rutledge, Landcare Associates; David Hyndman, Michigan State University; Anthony Kendall, Michigan State University
Offered Presentations: Resource Management II - Tuesday, April 6: 3:20-3:40 - F-G

Abstract: The legacy of past land use/cover plays a driving role in current ecosystem state. Moving beyond correlation, we begin to uncover a mechanistic relationship between lake water characteristics and land use/cover legacies via groundwater pathways. Specifically, we created a MODFLOW-2000 groundwater model of a 2600 km2 watershed in Southeastern Michigan to quantify groundwater travel times. We linked these travel times to historical land use/cover information, indicating differences between perceived land use/cover and effective land use/cover. We present results comparing models of effective versus perceived land use/cover in relation to lake water chemistry.
Keywords: eutrophication, lake, Landscape, limnology, spatial scale

146. Translating potential habitat changes in tree species to climate change based on model dissection and species characteristic responses to disturbance and biological factors
Authors: **MATTHEWS**, Stephen, US Forest Service & Ohio State University; Louis Iverson, US Forest Service; Anantha Prasad, US Forest Service; Matt Peters, US Forest Service
Offered Presentations: Climatic Influences I - Tuesday, April 6: 1:40-2:00 - R

Abstract: The use of species distribution models to evaluate potential responses to climate change is important as we consider management options, yet we must evaluate their uncertainties. We have focused on empirical abundance-based habitat models utilizing decision-tree based techniques (RandomForest) to better understand potential changes of 134 tree species habitats in the eastern US (www.nrs.fs.fed.us/atlas). Before considering climate change impacts, we first assess the model reliability to quantify model differences. Next, we identify the predictor variables that are most influencing the species and whether they are occurring at the broadest extent or characterizing more local variability. To separate the relative scale of influence, we dissect the RandomForest structure to identify the weighted node location for each variable and partition the variable importance scores based on regional and local scales of influence. Using Quercus (n =27) as an example, climate variables, operating primarily at a regional level, tend to be the main model drivers (median =51% weighted variable importance), whereas they tend to drop at the local level (median =35%). In contrast, soil variables carry roughly equal weight at both levels (median of 39% regional and 37% local). We next quantify the influence of biological and disturbance factors that cannot be reasonably modeled to evaluate some uncertainties in habitat models. We consider 9 biological factors reflecting innate characteristics like competition for light and edaphic specificity. Twelve disturbance characteristics address the direction of response to events such as drought, and fire. When taken in conjunction with the outputs of habitat models for this century, we can expect some species to be more tolerant to environmental changes resulting from climate change, while others may be more sensitive than the habitat models alone suggest. We believe these scores based on biological and disturbance factors can provide additional interpretive and practical value to habitat models projections.
Keywords: climate change, Random Forest, Trees

147. Modeling the presettlement distribution of Pinus strobus along environmental gradients in central Quebec (Canada) using land survey records

Authors: **MAURI ORTUNO**, Eduard, Centre d'étude de la forêt, Université Laval; Frédérik Doyon, Institut québécois d'aménagement de la forêt feuillue, UQO; Alison Munson, Centre d'étude de la forêt, Université Laval
Offered Presentations: Distribution I - Tuesday, April 6: 10:00-10:20 - Y-Z

Abstract: Eastern white pine (Pinus strobus L.) was the most economically valuable conifer in eastern Canada during the 19th century. In the province of Quebec, most mature specimens had been selectively logged by the end of that century, leaving only relic populations poorly representative of its original distribution. This study aimed to understand the pre-settlement distribution of white pine in central Quebec, by: (1) relating past white pine presence/absence, as described by land survey records, to environmental variables, and by (2) comparing pre-settlement white pine prevalence with the current one, and (3) comparing pre-settlement relative abundance with the current one. Thirteen land survey logbooks, dating from before the major selective cuts, were used for the analyses, from which 2 614 survey records, listing mature tree species ordered by their abundance, were extracted and geo-referenced. Two white pine surveys, one on the same points surveyors visited in the 19th century, and one elsewhere in the study area, provided the data about current species presence. Logistic regression analysis showed that the presence of white pine was significantly associated with outwash-alluvial and thin glacial-rocky surficial deposits, S-SW-W aspects, and top-upper slope topographic positions, while drainage and slope did not add any extra information. These results demonstrated that the modeled distribution was similar to that expected from the species' autecology. Mature white pine prevalence decreased from 0.282 to 0.161 while its relative abundance decreased from 46.5 % to 11.8 %. The current white pine population was estimated to be 6.9 times less abundant than in the 19th century. These results imply that considerable efforts will be required to restore white pine on the landscape to previous levels; the results of this study may be used to guide and quantify these efforts.
Keywords: eastern white pine, land survey records, pre-settlement forests, vegetation-site relationship

148. A Multi-scaled Graph Theory Approach to Identifying Critical Habitat Clusters within the Playa Wetland Network of the Great Plains

Authors: **MCINTYRE**, Nancy, Texas Tech University; Richard Strauss, Texas Tech University
Poster #33: Scale - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria

Abstract: Playas are intermittent wetlands of the southern Great Plains of North America. Over 20,000 such wetlands occur in Texas alone, forming a network of irreplaceable habitat resources for wildlife. However, numerous wetlands within this network have been destroyed due to draining, infill, or pollution, and climate change models project further disruption of the network. We have been using graph theory to identify nodes critical for maintaining system connectivity in the playa wetland complex. However, this approach is limited to an evaluation of the importance of individual wetlands, yet many organisms are known to respond to wetland density and dispersion. We employed a sliding-window approach to identify critical regions of habitat (wetland clusters) within a subset of the playa network, and to identify the spatial scale(s) at which clustering emerges. In contrast to most graph analyses, which quantify network properties at a single (global) scale, a sliding-window approach provides an assessment of localized network properties. We focused on a subset of the playa network in a ~20,000 km2 area

encompassing 2700 playas in the southern panhandle of Texas. We used contour mapping to visualize these clusters as a function of playa density, linkage density, and other graph properties. The spatial scale of habitat clustering varied with the size of the sliding window, and different aspects of the clustering pattern, such as distribution of network cutpoints, emerged at increasing spatial scales. Using a tool familiar to landscape ecology (the sliding-window approach) in a novel way (applied to ecological networks), our project illustrates how a multi-scaled approach is necessary in examining habitat connectivity.
Keywords: graph theory, network, playa, sliding window, wetland

149. Ecosystem energetics and landscape fire: toward a theoretical framework
Authors: **MCKENZIE**, Donald, US Forest Service; Carol Miller, US Forest Service; Donald Falk, University of Arizona
Invited Symposium: Landscape Ecology of Wildfires: Theory, Modeling, and Application - Tuesday, April 6: 10:40-11:00 - R
Abstract: The landscape ecology of fire regimes analyzes the effects of spatial patterns of fire severity, fire frequency, and fire sizes on ecological processes such as vegetation succession, seed and animal dispersal, species turnover, and other disturbances such as insect outbreaks. Landscape fire is a contagious disturbance that operates at different temporal and spatial scales from vegetation growth and succession and other landscape processes. As such it challenges us to find a theoretical framework of manageable complexity, to reconcile scale mismatches with other processes and avoid the classic "middle-number" problem in mesoscale analyses of ecological systems. We propose, and qualitatively explore, a theoretical model of landscape fire grounded in the interactions between energy fluxes and their controls, or "regulators", across spatial and temporal scales. Both energy and regulation can act as top-down or bottom-up drivers (controls) of fire behavior, fire spread, and fire effects. We suggest that these basic elements of landscape fire regimes may be tractable for establishing scaling laws that provide synthetic quantitative information across scales and also reduce middle-number complexity. Both of these functions can lead to better landscape fire management in a rapidly changing climate.
Keywords: complexity, contagion, energy, regulation, scale

150. Assessing options for control of sudden oak death using landscape epidemiological models
Authors: **MEENTEMEYER**, Ross, Dept of Geography, University of North Carolina; Nik Cunniffe, Dept of Plant Sciences, University of Cambridge, UK; Richard Cobb, Dept of Plant Pathology, University of California, Davis; David Rizzo, Dept of Plant Pathology, University of California, Davis; Christopher Gilligan, Dept of Plant Sciences, University of Cambridge, UK
Invited Symposium: Pathogens in Heterogeneous Landscapes - Wednesday, April 7: 11:00-11:20 - Masters Hall
Abstract: Landscape- to regional-scale models of disease dynamics are increasingly needed to design practicable strategies for control and to examine effects of landscape heterogeneity on epidemic outcomes. Here, we use spatio-temporal, stochastic epidemiological models in combination with finely resolved geographical modeling to predict the spread of the emerging forest disease sudden oak death through mixed host populations, subject to spatio-temporally varying weather conditions. Parameterized via Markov chain Monte Carlo (MCMC) estimation, our model considers three stochastic processes: 1) production of inoculum at a given site; 2) the chance that inoculum is dispersed within and among sites; and 3) the probability of infection following transmission to susceptible host vegetation. In the absence of control, we predict a ten-

fold increase in disease spread between 2010 and 2030 with most infection concentrated along the north coast between San Francisco and Oregon. Results show that most disease spread occurs via local dispersal (<250m) but infrequent long-distance dispersal events can substantially accelerate epidemic spread in regions with high host availability and suitable weather conditions. We examine the efficacy and uncertainty of several control strategies and combinations thereof (e.g. removal of infecteds in disease foci versus isolated outbreaks; removal of susceptibles within and away from disease foci) while considering variable financial limitations on detection effort and scale of deployment. Our results demonstrate that chance long-distance dispersal presents significant hurdles for containment or eradication, but it is possible to slow the spread through substantial control efforts focused on a combination of foci and outbreak treatments. However, insufficient allocation of resources to early detection undermines any control effort. Finally, we found that landscape heterogeneity plays a major role in the efficacy of control, where the cost and uncertainty of control rise substantially in regions characterized by high connectivity of host availability and suitable weather conditions.
Keywords

151. Landscape modeling of multi-strata forest fire severity using alternative remote sensing of Landsat, AVIRIS, and MASTER

Authors: **MENG**, Qingmin, Department of Geography and Earth Sciences, UNC at Charlotte; Ross Meentemeyer, Department of Geography and Earth Sciences, UNC at Charlotte

Offered Presentations: Fire - Wednesday, April 7: 10:00-10:20 - F-G

Abstract: Landscape models of fire severity are needed to better understand the behavior and ecological impacts of wildfires, especially in complex and spatially heterogeneous environments. Remote sensing models of fire severity predominantly focus on the two band Landsat image-derived differenced normalized burn ratio (dNBR) and/or fitting relationships between field measures of composite burn index (CBI) and dNBR to map fire severity at unsampled places. Immediately following control of the fire, we surveyed fire severity of sixty 500 m2 forested plots that were established prior to the wildfire in Big Sur ecoregion. We measured CBI across five forest strata, including substrate, herb, shrub, intermediate-sized tree, and dominant canopy tree layers. Here, we use all the available Landsat spectral information to model the largest wildfire in California's documented history, the 2008 Big Sur Basin Complex fire. Besides AVIRIS (Airborne Visible/Infrared Imaging Spectrometer), a new hyperspectral technology MASTER (the MODIS and ASTER simulator sensor) is used to regionally model fire severity across multiple forest strata in Big Sur. Statistical models with predictors of Landsat bands, Landsat derived NBR or dNBR, image differencing, image ratioing, AVIRIS, and MASTER images indicate the combinations of Landsat bands predicted more landscape variability in fire severity than all the other remote sensing data. Statistical tests of fire behavior and its effects on the heterogeneous landscape had different effects on different forest strata. The empirical comparisons between fire severity and spectral characteristics show similar fire damages occurred within the same or different vegetation stands but in different slope and aspect positions can result in significant different hyperspectral characteristics, which cannot be suitable for fire severity modeling of heterogeneous landscapes. This study shows the combined measure CBI is not optimal to represent multi-strata forest fire severity and dNBR performed poorer than Landsat TM bands for fire severity modeling.

Keywords: Big Sur Basin Complex fire, Heterogeneous landscapes, Hyperspectral remote sensing, Multi-strata forest, Statistical modeling

152. Ecological-Economic Modeling for Sustainable Forest Management

Authors: **MILLINGTON**, James, Michigan State University; Michael Walters, Michigan State University; Megan Matonis, Michigan State University; Frank Lupi, Michigan State University; Susan Chen, UC Davis; Kimberly Hall, The Nature Conservancy; Edward Laurent, American Bird Conservancy; Jianguo Liu, Michigan State University

Offered Presentations: Sustaining Systems - Thursday, April 8: 2:20-2:40 - T-U

Abstract: Forest management approaches that mimic natural disturbances have been proposed as a means to achieve forest sustainability by maintaining both ecosystem function and timber production. In many managed forests, including the northern hardwood forests of North America, selection harvesting intends to mimic natural small-scale canopy disturbances by removing single to small groups of trees. These removals create gaps in the forest canopy, increasing resources to the understory and encouraging the regeneration of shade-tolerant tree species (such as sugar maple). However, several factors, including herbivores that browse these tree species (such as white-tailed deer) can limit recruitment of understory tree saplings to the forest canopy, threatening future forest market (timber) and non-market (wildlife habitat) values. Spatial variability and interactions of these factors across landscapes lead to dynamics that can hinder management. Tools which help managers coordinate timber and wildlife management regimes to be compatible with these dynamics are therefore important for ensuring forest sustainability. The spatial ecological-economic simulation model we have developed and present here is one such tool. The model is parameterized with empirical stand- and gap-level data and examines the interactions among timber harvest, white-tailed deer browse, vegetation dynamics and forest and wildlife values in a managed hardwood-conifer forest landscape of Michigan's Upper Peninsula. We take an integrated approach to combine the USFS Forest Vegetation Simulator with deer population and distribution, understory tree regeneration, and economic market and nonmarket valuation sub-models. Using the model we examine effects of potential deer population management scenarios (e.g., population control, deer winter habitat manipulation) on northern hardwood regeneration success. We illustrate the implications of different spatially coordinated timber management strategies (e.g., coordinated northern hardwood/lowland conifer harvest, northern hardwood harvest only) for forest economics, deer hunting values, and wildlife habitat for songbirds of conservation concern over centurial time extents.
Keywords: deer, forest disturbance, timber, valuation, wildlife

153. Spread and distribution of the monk parakeet across the Chicago metropolitan region

Authors: **MINOR**, Emily, University of Illinois at Chicago; Amela Jakupovic, University of Illinois at Chicago; Henry Ochoa, St. Xavier University; Stephen Pruett-Jones, University of Chicago; Christopher Appelt, St. Xavier University

Offered Presentations: Invasion II - Tuesday, April 6: 3:40-4:00 - Y-Z

Abstract: Habitat conversion and exotic species invasions are two major threats to biodiversity that often occur in tandem. Habitat suitability modeling can be useful for understanding the influence of the former on the latter. We apply this approach, using a CART (classification and regression tree) model, to understanding the distribution and predicting the future spread of monk parakeets in the Chicago metropolitan area. Monk parakeets (Myiopsitta monachus) are native to South America but have become established in cities around the globe. They were first observed in a Chicago neighborhood in the 1960s and have been slowly spreading to the surrounding areas. While they pose a threat to electrical utility facilities and possibly to

agriculture, many Chicago residents love these birds. In an attempt to map every nest in the city, we developed a web site and survey that allows citizens to submit known locations of nests. We then visited each location to confirm and record the location in our database. We also gathered a number of environmental variables for each nest, such as tree canopy and green space in the surrounding landscape, distance to roads and train tracks, and residential density. Using over 300 confirmed nest locations in a CART analysis, we were able to identify the environmental variables that were most important to monk parakeet distribution. These variables were then mapped using GIS to identify suitable habitat for monk parakeets beyond their current range. We found that railroads were important predictor variables and speculate that they may provide different resources or be used as dispersal corridors out of the city.

Keywords: BIRD, exotic species, habitat model, parakeet, Urban

155. Wetland Macroinvertebrate Assemblages: teasing-out the environmental and landscape relationships

Authors: **MLAMBO**, Musa, University of Cape Town

Offered Presentations: Resource Management III - Thursday, April 8: 2:20-2:40 - V-W

Abstract: The Cape Floristic Region (CFR) of South Africa with its characteristic Mediterranean-type climate is one of the "hottest" global biodiversity hotspots, with exceptional high levels of endemism. However, relatively little is known about the biodiversity patterns of wetland macroinvertebrate assemblages of this region and the effect of physico-chemical factors on their distribution. About 140 wetlands exhibiting a gradient of human disturbance and geographic distance were surveyed, yielding 5 new species and providing a better understanding of the distribution patterns of macroinvertebrates. Spatial autocorrelation was found to be less important in explaining the observed distribution. However, it was the environmental variables that successfully explained the significant variation in the assemblage composition. A model containing: pH, Phosphate, Conductivity, Turbidity and Ammonium, as revealed by redundancy analysis, explained more the 80% of the variance. pH and Turbidity which are mediated by catchment land use were significantly correlation with many ecologically important taxa in temporary waters (e.g. Branchiopod), therefore abrupt changes in land use in the catchment will have immediate consequences. Although this study did not explicitly assess hydroperiods, as they are considered to be the primary determinant of temporary wetland assemblages, but no correlation between wetland size & water depth (which are used in the literature as proxies for hydroperiod) and the assemblage was found. This is important for two reasons: 1) this support the significance of small wetlands which have been neglected historically and 2) it raises question about the authenticity of using these two variables as proxies for hydroperiods.

Keywords: bioassessment, biodiversity, macroinvertebrates, spatial autocorrelation, wetlands

156. Enhanced Vegetation Index as a fragmentation indicator

Authors: **MONDAL**, Pinki, University of Florida

Offered Presentations: Remote Sensing - Thursday, April 8: 10:00-10:20 - F-G

Abstract: Ecologists require spatial and temporal remote sensing data to build ecosystem models about vegetation characteristics. The Enhanced Vegetation Index (EVI) is one such continuous variable that correlates well with several components of ecosystem dynamics such as leaf area index, biomass, canopy cover, and the fraction of absorbed photosynthetically active radiation. EVI has been shown to be less prone to saturation in temperate and tropical forests making it more efficient over other widely used vegetation indices such as NDVI. Due to these properties

EVI has been more effective for monitoring seasonal, inter-annual, and long-term variation of the vegetation structure. EVI could be particularly useful in tropical regions where forest degradation or thinning is more prevalent than forest conversion and especially in places where discrete remote sensing classification techniques fail to capture subtle changes within a single class. This study utilizes EVI as an indicator of landscape fragmentation in a human-modified tropical landscape in Central India. Previous study using discrete classification techniques has shown a reforesting trend in this landscape. This study examines if advanced remote sensing techniques using continuous variables (such as EVI) can provide information on long-term effects of conservation efforts on landscape dynamics. The landscape under study hosts a tiger reserve surrounded by significant human settlements. Isolation of this reserve from other forested tracts challenges the very idea of conservation and needs continuous monitoring. EVI as a fragmentation indicator will help better understand fragmentation pattern along with informing landscape practitioners about changing vegetation characteristics.
Keywords: EVI, fragmentation, protected area, remote sensing, tropical forest

159. The USA National Phenology Network Land Surface Phenology/Remote Sensing Phenology Program
Authors: **MORISETTE**, Jeffrey, USGS, Fort Collins Science Center; Jake Weltzin, USGS; Jesslyn Brown, USGS; Geoffrey Henebry, SDSU
Invited Symposium: B-1 - Thursday, April 8: 2:00-2:20 - K-L
Abstract: The USA National Phenology Network (USA-NPN) brings together professional scientists, citizen-scientists, government agencies, non-profit groups, educators and students of all ages to monitor the impacts of climate change on plants and animals in the United States. A key initiative of the USA-NPN is to coordinate activities related to monitoring land surface phenology (LSP) across large areas, including, but not limited to, satellite-derived remote sensing phenology (RSP) products. Main objectives for this USA-NPN initiative are: 1) coordinating RSP/LSP activities across US federal agencies, other national programs, and academic scientists and 2) leading research on the utility and accuracy of RSP/LSP products. This presentation will provide an update on USA-NPN activities and initiate a discussion on how the work presented in the symposium can be extended through coordination with USA-NPN.
Keywords: phenology, remote sensing, USA-NPN

160. Impacts of land-use conversion for bioenergy on wildlife habitat
Authors: **MORZILLO**, Anita, Oregon State University; Ralph Alig, USDA Forest Service
Invited Symposium: B-2 - Thursday, April 8: 2:20-2:40 - R
Abstract: Significant landscape changes could result from bioenergy production in the United States, affecting a wide range of ecosystems goods and services, including wildlife habitat. Key drivers include bioenergy policy (e.g., Renewable Fuels Standard), development of carbon markets, and land conservation policies (e.g., Conservation Reserve Program). Concerns exist that planting trees for bioenergy and carbon credits in previously non-wooded areas may result in significant losses in wildlife habitat. We examine the potential linkages among policy variables that could affect wildlife habitat across regional landscapes. We perform sensitivity analyses involving those variables, such as different scenarios for the future course of the Conservation Reserve Program and afforestation opportunities. We consider these land-use change scenarios and possible impacts on wildlife habitat within a total land base context, comparing scenarios to baseline projections of area changes for major land uses. Impacts focus on disturbances that

drive changes in habitat, such as deforestation. Historical planted areas of short rotation woody crops are relatively small compared to other land base changes such as amounts of forestland projected to be converted to developed uses, however, the potential under climate change policy scenarios as projected by economic models of land use is much larger than historical amounts.
Keywords: aforestation, bioenergy, land use, mitigation, wildlife habitat

162. Ecological trade-offs between agroforestry land-use, plant biodiversity and management intensification: Study on four contrasting agroforestry land-uses in a tropical forest patch of Bangladesh

Authors: **MUKUL**, Sharif, Dresden University of Technology; Narayan Saha, Shahjalal University of Science and Technology
Offered Presentations: Agrarianism II - Wednesday, April 7: 10:20-10:40 - R
Abstract: AAgroforestry, because of its diverse options and structure sometimes believed to suitable for conserving biodiversity, particularly in tropical landscapes where rural people depends heavily on natural resources for sustaining livelihoods. However, since agroforestry systems are subjected to some level of cultural management it is also critical to know how cultural management and different level of intensification affect biodiversity in agroforestry landscapes. We conducted an exploratory survey on four contrasting agroforestry systems; viz., betel-vine (Piper betel) based agroforestry, lemon/horticulture based agroforestry, pineapple based agroforestry, and short-rotation shifting cultivation in a tropical forest patch of Bangladesh, to assess the response of plant community to different level of management intensification. A unique management intensification gradient was created identifying a total of 11 locally used cultural practices followed across the studied agroforestry systems. We recorded 173 plant species (61 trees, 42 shrubs, 47 herbs, 18 climbers and 5 orchids) from forty 10m x 10m plots established in four agroforestry land-use. The Shannon-Weiner biodiversity index calculated was higher for betel-vine agroforestry (3.3), followed by 2.9 for lemon/horticulture agroforestry, 2.2 for pineapple agroforestry and 1.9 in short-rotation shifting cultivation system (comparable to 2.7 for forest). Species evenness index for tree was also higher in betel-vine agroforestry system (0.79). A simple linear analysis was performed for each of the studied agroforestry systems to realize the response of different plant functional groups to a weighted management intensification value. It was found that, the response of different functional groups largely depends on the type of agroforestry practice, the kind of expected products from respective agroforestry systems, and study concluded that, plant biodiversity is highly sensitive to management intensification. Study also suggested that some practice (here betel-vine agroforestry) that evolved through indigenous innovation is suitable for conservation of plant biodiversity and could sometime offer a basis for sustainable forest management.
Keywords: agroforestry, Bangladesh, land use, Lawachara National Park, management intensification

163. Bird use of switchgrass fields harvested for bioenergy in the Midwestern U.S.
Authors: **MURRAY**, Les, Penn State-Abington; Louis Best, Iowa State University
Offered Presentations: Agrarianism II - Wednesday, April 7: 11:40-12:00 - R
Abstract: Growing and harvesting switchgrass for use as bioenergy may impact grassland bird populations in the Midwestern United States. Because the harvest of switchgrass can be conducted during the fall and winter when most bird species have migrated or have completed their breeding cycle the harvest does not have direct effects on breeding birds. The change in

habitat structure and the habitat composition of the landscape from growing and harvesting switchgrass, however, can have strong influences on grassland bird use of the fields. A study of bird abundances in switchgrass fields in Iowa showed that the influence of a bioenergy harvest on birds in switchgrass varied by species' habitat preferences. Generalist species, such as common yellowthroats (Geothlypis trichas) and red-winged blackbirds (Agelaius phoeniceus), were nearly equally abundant in harvested and nonharvested fields. Grasshopper sparrows (Ammodramus savannarum) were more abundant in the shorter, sparser vegetation of harvested fields than in nonharvested fields. Grasshopper sparrow abundance, however, was much lower in the second year of the study than in the first year likely because of increased management of the fields to increase yield. Other species (i.e., sedge wrens [Cistothorus platensis]), however, preferred the tall, dense vegetation of nonharvested fields. The dense cover of nonharvested areas also provided nesting areas for a state-endangered species, northern harrier (Circus cyaneus). In conclusion, while planting and harvesting switchgrass fields in Iowa might increase the abundance of some generalist species and slightly improve the population status of grasshopper sparrows, bird diversity in these fields is generally low. In addition, maintaining nonharvested areas of switchgrass on the landscape seems necessary to support breeding populations of northern harriers if large scale production of switchgrass for bioenergy becomes a reality.
Keywords: bioenergy, biomass, birds, grassland, switchgrass

163. Bird use of switchgrass fields harvested for bioenergy in the Midwestern U.S.
Authors: **MURRAY**, Les, Penn State-Abington; Louis Best, Iowa State University
Invited Symposium: Reshaping Landscapes: Bioenergy and Biodiversity - Thursday, April 8: 10:40-11:00 - K-L
Abstract: Growing and harvesting switchgrass for use as bioenergy may impact grassland bird populations in the Midwestern United States. Because the harvest of switchgrass can be conducted during the fall and winter when most bird species have migrated or have completed their breeding cycle the harvest does not have direct effects on breeding birds. The change in habitat structure and the habitat composition of the landscape from growing and harvesting switchgrass, however, can have strong influences on grassland bird use of the fields. A study of bird abundances in switchgrass fields in Iowa showed that the influence of a bioenergy harvest on birds in switchgrass varied by species' habitat preferences. Generalist species, such as common yellowthroats (Geothlypis trichas) and red-winged blackbirds (Agelaius phoeniceus), were nearly equally abundant in harvested and nonharvested fields. Grasshopper sparrows (Ammodramus savannarum) were more abundant in the shorter, sparser vegetation of harvested fields than in nonharvested fields. Grasshopper sparrow abundance, however, was much lower in the second year of the study than in the first year likely because of increased management of the fields to increase yield. Other species (i.e., sedge wrens [Cistothorus platensis]), however, preferred the tall, dense vegetation of nonharvested fields. The dense cover of nonharvested areas also provided nesting areas for a state-endangered species, northern harrier (Circus cyaneus). In conclusion, while planting and harvesting switchgrass fields in Iowa might increase the abundance of some generalist species and slightly improve the population status of grasshopper sparrows, bird diversity in these fields is generally low. In addition, maintaining nonharvested areas of switchgrass on the landscape seems necessary to support breeding populations of northern harriers if large scale production of switchgrass for bioenergy becomes a

reality.
Keywords: bioenergy, biomass, birds, grassland, switchgrass

164. Are the spatial patterns of wildfire ignitions influenced by the pattern of forest road corridors?
Authors: **NARAYANARAJ**, Ganapathy, South Dakota State University; Michael Wimberly, South Dakota State University
Offered Presentations: Fire - Wednesday, April 7: 11:40-12:00 - F-G

Abstract: Although previous studies have demonstrated that road corridors promote fire ignitions, most have focused on human-caused fire ignitions with the effects of lightning-caused ignition less explored. Few studies have examined the responses of both human- and lightning-caused ignitions to anthropogenic and biophysical factors. Therefore, we sought to examine the difference between lightning- and human-caused fire ignitions in relation to forest road corridors and other anthropogenic and biophysical factors in the eastern Cascade Mountains of Washington State. Fire ignition locations (cases) and area burned data from 1997 - 2007 were obtained and assembled from federal agencies. Random control locations were generated using a 200 meter buffer distance around fire case locations. Both the case and control locations were intersected with the geo-processed explanatory anthropogenic and biophysical variables and values were extracted. We used a case-control logistic regression model for the probability of fire ignition as a function of these explanatory variables. We found that spatial locations of human-caused wildfires were concentrated in areas with high accessibility to humans: close to roads, near high road density areas and near intermix Wildland Urban Interface (WUI). In contrast, spatial locations of lightning-caused wildfires were concentrated in more remote areas: away from high road density areas, away from interface WUI, and away from high population density areas. Lightning-caused fires were also associated with the availability of flammable fuel and other climatic and topographic factors conducive to wildfire ignitions. Differentiating the biophysical and anthropogenic factors that affect fire ignition may help managers allocate fire management resources and locate effective fuel treatments. Future research efforts, including analyses of the traffic volume of roads and area burned in relations to biophysical variables, will further improve our understanding of fire regimes in human-dominated landscapes.
Keywords: Anthropogenic, Biophysical, Case-control logistic regressi, Eastern Cascade Mountains, fire regimes

166. Vulnerability Of Watersheds To Ecological Hazards: The Case Of Daguitan Watershed, Leyte Island, Philippines
Authors: **NASAYAO**, EDILBERTO, Ecosystems Research and Development Service; EMMA GERMANO, Ecosystems Research and Development Service; SEVERINO LACANDAZO, Jr., Ecosystems Research and Development Service
Poster #3: Agrarianism - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: Watershed vulnerability is a condition whereby a watershed is susceptible to ecological hazards that pose damages to people, natural resources, properties and infrastructure. This is the condition of most, if not, all critical watersheds in the Philippines today. During the past decades, Region 8, Philippines has thousands of hectares of forest cover but this had decreased at relatively fast rate due to exploitative resource-use practices which has increased the vulnerability of watersheds. Daguitan River Watershed in Leyte Island, Philippines is a classic example of watershed having conditions considered vulnerable. Floods, loss of biodiversity,

landslides and erosion, and forest fire are the hazards found to have wrought havoc to environment and people. The watershed was assessed as medium in terms of its vulnerability to such hazards. Such level of vulnerability cannot be taken for granted though. The changes of the watershed's forest landscape are suggestive of the continuing destruction of its ecosystem. Conversion of some forest areas to non-forest use thru permanent and shifting agriculture has disfigured the soil environment and made the area open to heavy downpour. Inevitably, soil detachment and transport to low-lying areas and streams occurred. Silt build-up in some portions of the river made the river shallow thereby causing overflow of flood water to adjoining areas destroying crops and farmlands. Besides, the watershed is host to potential landslides and erosion being situated in the Sinistral Philippine Fault which bisects Leyte Island. Other hazards like loss of biodiversity and forest fire though not posing serious threats to the ecology at the moment, indications are that they could potentially be translated into confluence of factors, which could aggravate disasters if mitigating measures are not well-planned and executed. Currently, efforts and resources both from local and national institutions are nil in forestalling disasters and offering communities with even minimal relief.
Keywords: Communities, Ecology, Forests, Hazards, Watershed

167. Landscape Ecology in America - Looking Back, Seeing Ahead
Authors: **NASSAUER**, Joan, University of Michigan
Invited Symposium: US-IALE Presidents' Symposium I - Tuesday, April 6: 10:20-10:40 - Masters Hall
Abstract: The potential strengths of landscape ecology when US-IALE was established are largely realized accomplishments of the field today. These strengths have borne fruit for science and society because they filled a critical gap in between ecological science and drivers of landscape change. These strengths include: The relevance of the landscape concept. This keeps landscape ecology focused on spatial questions and it is inherently a bridge to application. Interdisciplinarity as an identifying characteristic. Mutual learning and research that has extended among natural and social sciences and beyond to practice has enabled landscape ecologists to lead in forging productive paths for sustainability science, conservation biology, ecological design and planning, and coupled natural and human systems. Transformative intellectual exchange with a European science tradition. Exchange between the European tradition that founded landscape ecology and American traditions of science have animated US-IALE since its founding. The mission statement of the International Association of Landscape Ecology, of which the US Section is a part, clearly reflects this exchange, which underscored the fundamental role of humans in ecosystems, and the importance of human-dominated landscapes for science. We have done much to ensure that these strengths are well-recognized and may be further integrated into American science; and that design and planning practice demand relevant science to inform landscape decisions. We need to continue to make the small but sometimes difficult choices to do interdisciplinary work, to improve its efficacy, and to argue for its value in the academy and in science. Ahead, the looming global tension between economy and ecology that has produced climate change and other pervasive forms of contamination challenges landscape ecology to make tighter links between pattern:process insights and knowledge of humans as ecological agents. Our accomplishments in landscape ecology are of greatest interest today as tools for meaningful action.
Keywords: climate change, ecological design, interdisciplinary, landscape change, sustainability science

168. Mountain Pine Beetle-Related Lodgepole Pine Mortality: Multi-Scale Causes and Effects in Rocky Mountain National Park, CO.

Authors: **NELSON**, Kellen, FRWS, CSU; Monique Rocca, FRWS, CSU; Carissa Aoki, GDPE, CSU; Matt Diskin, FRWS, CSU; Bill Romme, FRWS, CSU

Offered Presentations: Invasion I - Tuesday, April 6: 1:20-1:40 - Y-Z

Abstract: An ongoing mountain pine beetle outbreak has been dramatically changing Colorado's lodgepole pine forests since 1996. Warmer climate trends and extensive old forests facilitated this widespread outbreak. We distributed 46 randomly located clusters of three plots across the west side of Rocky Mountain National Park to examine the influence of top-down (environmental) and bottom-up (stand structure) factors on lodgepole pine mortality patterns, and to assess changes to stand and landscape structures through three stages in the eruption. Across the landscape, mean stem mortality reached 47%; however, 71% of basal area was killed. Surviving stand structure experienced large decreases in diameter at breast height (17.4 to 11.0 cm), basal area (29.3 to 8.5 m2 per ha), and density (1393 to 915 stems per ha). Environmental factors (elevation and moisture) and tree size greatly influenced which stands saw high levels of mortality during the early stage of the eruption. In contrast, later stages of the eruption showed stronger relationships with stand structure factors (tree size, basal area, proportion of non-host trees, density and stand age). Changes in forest heterogeneity depended on spatial scale. At the local scale, heterogeneity increased among subplots within clusters, while heterogeneity among clusters on the landscape declined over time. The current mountain pine beetle outbreak has caused extensive changes to the subalpine forest landscape, but high densities of surviving trees and increased stand-scale heterogeneity will allow forest recovery and increased resistance in the face of future outbreaks.

Keywords: Disturbance, heterogeneity, insects and disease, lodgepole pine, mountain pine beetle

169. Identifying Landscape Patterns and Sandhill Crane Flight Avoidance Behavior as Predictors of Power Line Collision-Risk

Authors: **NESS**, Kim, University of Wisconsin-Madison; Janet Silbernagel, University of Wisconsin-Madison; Anne Lacy, International Crane Foundation; Adriane Treves, University of Wisconsin-Madison; John Engels, International Crane Foundation

Poster #15: Disturbance - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: Power lines can be serious flight hazards to large, broad-winged birds, such as cranes. These lines pose a collision-risk because cranes may strike a line and suffer serious injuries or death in certain areas and weather. Previous spatial models of crane ecology with known power line collisions had limited resolution to identify risk factors. A more accurate method correlates crane avoidance flight behaviors near power lines with landscape features to understand the dynamic nature of this power line collision-risk. Thus we refined the method to determine collision-risk for sandhill cranes (Grus canadensis) using spatial analysis of multiple factors. We discern landscape relationships between landcover, weather, crane population density, and how cranes respond with different behavior at varied altitudes near power lines. Observing cranes at a local wetland-agricultural area, we expect to find clustered collision-risk zones (i.e. hot-spots). Using this local level collision-risk, we extrapolate it to the Ecological Landscape level in southeastern Wisconsin to compare against known previous collision mortalities. Finally, our work will make recommendations for electric companies and federal agencies to prioritize these zones for placing avian deterrent markers to increase line visibility for cranes.

Keywords: flight reactions, Grus canadensis, mortality, power line collisions, Spatial analysis

170. SATELLITE-DERIVED LAND SURFACE PHENOLOGY PRODUCT INTER-COMPARISON: TOWARDS AN INTEGRATED VALIDATION APPROACH

Authors: **NIGHTINGALE**, Joanne, Sigma Space Corporation / NASA GSFC; Jeff Morisette, USGS

Invited Symposium: A Land-surface Phenology: A View Through the Lens of Vegetation - Thursday, April 8: 10:00-10:20 - R

Abstract: Accurate determination of the onset and duration of vegetative greenness is vital to the estimation of seasonal carbon dynamics and to assess the impacts of global climate change. In light of the importance of vegetation phenological information, there has been a recent proliferation of land surface phenology (LSP) products derived from moderate-resolution, high temporal frequency satellite sensors. There are currently seven freely available LSP products produced via analysis of time-series Vegetation Index (VI) information from several sensors including: MODIS (Moderate Resolution Imaging Spectro-radiometer); AHVRR (Advanced Very High Resolution Radiometer); SPOT-Vegetation (Systeme Pour l'Observation de la Terre-Vegetation); and MERIS (Medium Resolution Imaging Spectrometer). Both MODIS and SPOT-Vegetation are utilized to produce global coverage LSP products, while three individual LSP products are produced for North America (from MODIS and AVHRR), in addition to those for Europe (MERIS) and South Africa (AVHRR). A number of methods exist to extract phenological events from a VI time-series and extend from simple VI growing season thresholds and ratios, to complex analysis of changes in the derivative of the VI slope calculated using mathematical software. These techniques attempt to extract a number of key dates from the time-series, such as the onset of vegetative greenness, maximum development, end of growing season and duration of the growing season. With the increasing number of LSP products available, a mechanism to determine the relative accuracy of the derived metrics from each product is required. Within the framework of the CEOS (Committee on Earth Observation Satellites) WGCV (Working Group on Calibration and Validation) Land Product Validation sub-group, an overview of the currently available satellite-derived LSP products is being conducted. This comprehensive product inter-comparison will provide information on the merits of different phenology metric determination methods and provide a significant step towards establishing an internationally accepted protocol for LSP product validation.
Keywords: CEOS WGCV LPV, phenology, Satellites, Validation

171. Network theory applications to freshwater ecosystems: up, down, and around

Authors: **NORMAN**, John, Colorado State University; David Theobald, Colorado State University

Invited Symposium: Graph, Network, and Circuit Models of Landscape Connectivity - Thursday, April 8: 10:20-10:40 - Q

Abstract: Landscape ecologists have developed numerous applications of graph and network theory to understand terrestrial, marine, and freshwater ecosystems. Here we discuss network applications to freshwater ecosystems and highlight three critical aspects that arise: scale, weighting, and representation. We have found order-of-magnitude differences in estimates of land use effects across the US (e.g., impervious surface) depending on the grain (i.e. HUC8 vs. HUC10 watersheds) and the methodology used to weight flow between analytical units (or nodes). Representational issues are also important for freshwater systems, which typically represent confluences as nodes and stream segments as network edges. For many applications this works fine, but understanding spatial variation along a stream reach and understanding the

key role of confluences (i.e. Network Dynamics Hypothesis) is challenging. We provide a number of case studies from watershed condition assessments and modeling fish habitat to illustrate these three central issues.
Keywords: connectivity, freshwater, land use, naturalness, Network theory

172. "Brave New Forest": How climate, people, weeds and leaf phenology are changing eastern US fire regimes

Authors: **NORMAN**, Steven, USDA Forest Service Eastern Forest Threat Assmt Center
Invited Symposium: B-1 - Thursday, April 8: 1:20-1:40 - K-L
Abstract: Wildland fire drives and responds to environmental change, yet fire regimes involve a broad array of factors including climate, ignitions, fuels and the forest canopy. This complexity makes it difficult to predict how fire will respond to changes in any single factor, particularly in the eastern US where fires are largely human caused and have been more successfully excluded than elsewhere. A drying climate, invasives or canopy loss could increase fire frequency or severity thereby altering successional pathways. In this paper, I explore how key drivers interact to regulate the eastern US fire season. I compared the record of recent fires by cause with climate and leaf phenology as derived from 230m MODIS imagery. Historically, eastern fires have exhibited a peculiar spring and fall seasonality that coincides with monthly climate and the emergence and decline of deciduous vegetation. Some driving climate factors are independent of phenological change and summer conditions can lead to large fires. Regionally, summer is warmest, but leaf-on conditions reduce surface wind speeds and the extreme variability in surface temperatures and fuel moistures locally—these factors regulate fire behavior. Predicted declines in canopy health caused by stress from insects, drought, invasives and fragmentation could extend the eastern fire season into the summer months and increase the area burned. At the same time, trends toward more mesophytic species may have already reduced the duration of the spring fire season in some areas. While the effects of environmental change are complex, novelty may be better managed by understanding how fire is limited by both climate and leaf phenology.
Keywords: climate change, fire, phenology, remote sensing, United States

173. Evaluating high-integrity conservation linkages for climate change adaptation in the Western U.S.

Authors: **NUNEZ**, Tristan, University of Washington; Joshua Lawler, University of Washington
Invited Symposium: Climate Change and Landscape Connectivity: From Theory to Practice - Thursday, April 8: 11:20-11:40 - Masters Hall
Abstract: The ability of wildlife distributions to move with climate change is likely to be constrained by landscape fragmentation, and improving connectivity is a frequently recommended strategy for climate change adaptation. A coarse-filter approach to prioritizing areas for climate change connectivity identifies linkages based on their ecological integrity, and assumes that these areas are most easily traversed or colonized by species of conservation concern. To evaluate this approach, we examine the overlap between high-integrity linkages and areas of high projected change in vertebrate species composition derived from bioclimatic envelope models. We also identify the proportion of these high-integrity linkages that provide connections across biomes and climate, elevation, and longitudinal gradients. Finally, we use dynamic global vegetation model projections of plant functional types to determine vegetation change within these linkages. This analysis is conducted at two scales, first in the Pacific

Northwest and then across the Western U.S.
Keywords: climate change, connectivity, Gradients, range shifts, vegetation

174. Modeling Direct And Indirect Effects Of US Bioenergy Policy On Global Land Use
Authors: **OLADOSU**, Gbadebo ('Debo), Oak Ridge National Laboratory; Keith Kline, Oak Ridge National Laboratory
Invited Symposium: Reshaping Landscapes: Bioenergy and Land-use Change - Wednesday, April 7: 10:40-11:00 - K-L
Abstract: Land use change (LUC) associated with bioenergy production is a topic receiving great attention from scientists, landscape ecologists, economists and the media. Unlike the direct land conversion for bioenergy production, indirect land use change (iLUC) cannot be directly measured. Thus, estimates of iLUC depend on the ability to model the multitude of intervening market and non-market factors that govern land-use decisions that determine the transmission of indirect effects of bioenergy production within this broader milieu. This presentation examines existing approaches to model the iLUC effects of biofuel production, outlines key issues with past estimates of iLUC, and recommends components needed to improve modeling frameworks to estimate the iLUC impacts of U.S. biofuel policy. The results of research and recent simulations that highlight and address a few of the identified weaknesses will be shared along with suggested next steps towards comprehensive modeling of the iLUC effects of biofuel policy.
Keywords: bioenergy, indirect land use, Modeling, policy

175. Landscape analysis of carbon saturation deficit in an Iowa agroecosystem
Authors: **ONTL**, Todd, Iowa State University; Lisa Schulte Moore, Iowa State University; Randall Kolka, USDA Forest Service
Poster #2: Agrarianism - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Soil organic carbon (SOC) is the largest terrestrial carbon (C) pool and has significant potential to mitigate increasing atmospheric carbon dioxide concentrations through C sequestration. Perennial bioenergy crops grown on agricultural lands have the potential to sequester C through increased SOC levels relative to annual crops from increased C inputs and decreased C losses. Recent work suggests soils have a maximum SOC storage level based on physiochemical properties, with the rate of C gain dependent on the difference in C input and output rates and the soil C saturation deficit, a measure of how far a soil is from it's estimated saturation level. The objective of this study was to determine the C saturation deficit across landscape positions in an Iowa agroecosystem to determine the potential for SOC gains due to increased C inputs from conversion to perennial vegetation following many decades of annual rowcrop production. C saturation deficit in soils (0-20 cm depth) was estimated on five landscape positions (summit, shoulderslope, backslope, toeslope, floodplain) by determining the protective capacity of soils based on soil texture and quantification of the mineral (silt + clay) C content. Results show that texture and mineral C content differed across landscape positions indicating variation in C saturation deficit across the landscape. These results suggest that, along with the potential variation in C inputs and outputs across landscape positions, landscape level variation in C saturation deficits is a major factor in determining the potential for soil C sequestration due to conversion of annual rowcrop production to perennial vegetation.
Keywords: bioenergy crops, carbon saturation, landscape position, soil organic carbon

177. Planning the Natura 2000 ecosystem network across Europe: the role of landscape ecological science in a multiscaled governance process

Authors: **OPDAM**, Paul, Wageningen University Alterra Landscape Center; Claire Vos, Wageningen University Alterra Landscape Center; Irene Bouwma, Wageningen University Alterra Landscape Center

Invited Symposium: Climate Change and Landscape Connectivity: From Theory to Practice - Thursday, April 8: 11:40-12:00 - Masters Hall

Abstract: The European Union's biodiversity conservation policy is based on the strategy of building an Ecological Network. All countries have designated legally protected areas based on actual occurrence of habitat types and target species. These areas are under the EU-nature conservation law (Habitat Directive). Although the Directive also highlights the need for connecting structures in the landscape to ensure the protected areas to be functionally coherent, the implementation of this part of the Directive is up to the decision by member states. Most states are reluctant to designate legally protected connectivity zones, and consider possibilities to develop them on the basis of multifunctional land use. The awareness of the effects of climate change on species distributions and occurrence across regions enhances the urgency to implement connectivity, but strategies and methods are still in their infancy. This is a major challenge for landscape ecological science, since it is not only analytical instruments that are required to determine where the physical pattern of the ecological network is not cohesive enough to facilitate species responses to climate change, but also to develop adaptation strategies that meet the demands of collaborative landscape planning. In this presentation we show how scientists develop methods to evaluate ecological networks for climate proofness, and also planning strategies to facilitate improved permeability in the landscape matrix. This is a combination of large scaled habitat network planning and small scaled collaborative landscape planning.

Keywords: biodiversity, climate change, collaborative planning, connectivity, green infrastructure

178. Reframing the science-practice relationship: incorporating practice into the science mode to learn how landscape ecology can raise its impact

Authors: **OPDAM**, paul, Wageningen University, Land Use Planning Group

Invited Symposium: Editors' Symposium, Landscape Ecology: A History of a Branching Tree or a Converging Stream? - Tuesday, April 6: 4:20-4:40 - Masters Hall

Abstract: The IALE aims to develop landscape ecology as a science base for analysis, planning and management of the landscapes of the world. The aspiration is to provide an interdisciplinary knowledge basis to apply in management and adaptation of landscapes. The underlying assumptions are that the knowledge that is provided is recognized by practitioners as relevant to the problems they face, and can be made applicable within the local context where the decisions about change are being taken, often so in a collaborative planning and design process. However, landscape ecology is still far from fulfilling this goal. Our knowledge base is largely disciplinary organized. Many tools and models are regarded by its potential users as too complicated, too technocratic or too rigid to be applicable in landscape change decision making. In this contribution, I consider how our science can learn to do better. I will discuss 4 models for cooperation between scientists and practitioners, from the perspective of learning to make landscape ecological knowledge more useful to society. Scientists play different roles in these models, some requiring analytical methods to figure out how our knowledge was used in

practice, others demanding design approaches in which scientific knowledge is applied to envision future landscapes. For example, we may want to quantify how scientific results are used and how they influenced decision making. Alternatively, we can choose to develop our tools in the context of a practical case, or develop "boundary objects", e.g. planning concepts and landscape designs, to serve as a common ground for scientists and practitioners. The journal of Landscape Ecology opened a new category of papers: "landscape ecology in practice", which aims to stimulate the role of practical cases in learning how to improve the societal impact of our science.

Keywords: collaborative planning, knowledge coproduction, science-practice interface, societal impact

179. Using a Hydrogeomorphic Typology of Riparian Zones to Analyze Watershed Landscape Distributions for Central Indiana

Authors: **PANUNTO**, Matthew, University of Maryland Baltimore County; Matthew Baker, University of Maryland Baltimore County
Poster #34: Scale - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria

Abstract: Riparian buffers are located at the interface between terrestrial and aquatic ecosystems, and often act as pollutant filters, contributing to the reduction of nutrient loadings to downstream water bodies. Research suggests that the hydrogeomorphic (HGM) context of riparian buffers can influence their filtering capabilities through variations in transport pathways and biogeochemical activity. However, we have limited knowledge about the interaction among HGM settings, flow pathways, and the distributions of both nutrient sources and sinks within watersheds. Utilizing a HGM typology of riparian zones within the Central Indiana till plain, we quantified the distributions of nutrient source areas relative to watershed contributing area as well as riparian buffer area to total riparian zone area throughout a set of three representative watersheds. We found consistent patterns showing greater amounts of incremental contributing area relative to riparian areas in headwaters than along larger order streams, as well as greater nutrient source areas relative to buffer areas. However, along larger order streams, riparian area constituted a greater amount of incremental contributing area, of which was increasingly buffered. These findings suggest that whole watershed assessments of riparian buffers may provide misleading estimates of nutrient filtering when the majority of pollutant loading occurs in headwater locations. Our findings also imply a specific spatial scale at which buffers should be quantified to avoid biased estimates of filtering potential.
Keywords

180. Fire probability modeling at multiple spatial extents: from landscapes to the globe

Authors: **PARISIEN**, Marc-André, University of California, Berkeley; Sean Parks, USDA Forest Service; Carol Miller, USDA Forest Service; Meg Krawchuk, UC Berkeley; Max Moritz, UC Berkeley
Offered Presentations: Simulated Environments I - Thursday, April 8: 11:40-12:00 - T-U

Abstract: Technological advances in conjunction with a flurry of new spatial data have spurred a leap in spatially-explicit fire probability modeling in recent years. Although numerous techniques have emerged for this purpose, not all of them are appropriate at a given spatial extent. At the landscape level (~0.1 to 10 M ha), hybrid simulation models that combine the probabilistic aspects of fire regimes (ignitions and weather) with deterministic fire spread in areas of known vegetation and topography can successfully depict high-resolution variation in

fire probability. These models, which simulate the ignition and growth of a large number of fires, depend on high-quality data, detailed knowledge of fire regimes, and fairly intensive computing. As such, their use is usually compromised when working at larger spatial extents. To address this limitation, another technique, distribution modeling, was recently introduced for the prediction of fire probability across regional (>10 M ha) to global extents. Distribution modeling relates fire observations to large-scale environmental gradients—-most often climate-related—-in a statistical framework. Models can be built from sparse fire observations and require low computing power. In addition, vegetation data is not an essential input to these models because this information is implicitly incorporated in the climate gradients that control vegetation. Although simulation modeling and distribution modeling usually yield more reliable fire probability predictions at landscape and regional-to-global spatial extents, respectively, there appears to be a scale interface at which both modeling types are informative. We show that, in four fire-prone areas of North America, this interface not only allows us to determine the relative utility of each model type, but also provides novel and complementary information on scale-dependent controls of wildfire.

Keywords: distribution modeling, environmental controls, fire, simulation medeling, spatial extent

181. Urban ecosystem pattern change in response to future urban developments in Maricopa County, AZ, USA

Authors: **PARK**, Sohyun, Arizona State University; Edward (Ted) Cook, Arizona State University

Poster #50: Urban Ecosystems - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria

Abstract: Urban ecosystem pattern change in response to urban developments in Maricopa County, AZ, USA Ecosystems in urban region can significantly and instantaneously be influenced by urbanization, altering their pattern and service in landscape mosaic. Therefore, it is important to identify urban growth and subsequent ecosystem pattern change to anticipate possible functional variances and achieve ecological sustainability. This study aims to understand how urban ecosystem structure is likely to evolve in response to the proposed development plans in Maricopa County, Arizona. To measure a selected set of landscape pattern metrics, two main GIS datasets are used: (1) ecosystem data including desert shrub, grassland, managed open space, and agriculture; (2) urbanization data with residential, commercial, and recreational areas. For the former, we used National Land Cover Dataset from the United States Geological Survey (2001) with a resolution of 30m. For the latter, the major development data was obtained from the Maricopa County Planning and Development Department. Using FRAGSTATS, six key landscape metrics, such as Patch Number (PN), Mean Patch Area (Area_MN), Patch Density (PD), Perimeter-Area Fractal Dimension (PAFRAC), Largest Patch Index (LPI), Connectivity (CONNECT) were measured with different scenarios. Depending on the certainty of proposed development plans, three strategic options were made: First, ensured developments that are either already completed or currently under construction are only taken into consideration; Second, urban projects which entitlements were approved by local jurisdictions but nothing is built yet; Third, to reflect any potential developments both the conceptualized plans under review and anticipated projects which plan has not been formally submitted to the planning authority are added to the analysis. The results will demonstrate how the landscape metrics behave with different planning options and which ecosystem type will most likely to be sensitive to urbanization. The study provides an implication on urban landscape

planning, helping planners seek more optimal alternatives among various policy decisions and implementation. Key words: urban ecosystem, landscape metrics, urbanization, landscape pattern, Maricopa
Keywords: ecosystem, landscape metrics, Maricopa, Pattern, urbanization

182. Integrating Dendrochronology with Environmental History to Reconstruct Landscape Dynamics at Wormsloe
Authors: **PARKER**, Kathleen, University of Georgia; Albert Parker, University of Georgia
Invited Symposium: Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History, Isle of Hope, Georgia - Tuesday, April 6: 10:40-11:00 - K-L
Abstract: This presentation is part of the Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History on the Isle of Hope, Georgia, symposium. Our project uses dendrochronological analyses of interannual patterns of tree growth to inform interpretations of landscape history on the Isle of Hope. We are collecting cores from dominant tree species at Wormsloe with both a plot-focused and a species-focused sampling strategy to address several objectives. We are using tree ages and patterns of interannual growth from plot-based sampling to determine the maximum age of overstory trees in different types of vegetation evident at Wormsloe, to reconstruct a timeline of canopy disturbance based on patterns of growth suppression and release, and to interpret patterns of forest stand development. From expanded samples targeting selected dominant (or climatically informative) species, we are also assembling master chronologies that will be used to reconstruct past climatic conditions for the Isle of Hope over a period of several centuries. Information obtained through these dendrochronological analyses will be integrated with archival information to inform the patterns and processes of landscape dynamics, both natural and cultural, that have shaped the modern vegetation at Wormsloe. In this presentation, we share preliminary results from our analyses.
Keywords: dendrochronology, environmental history, southeastern United States, vegetation dynamics

183. Assessing fire severity among interacting fires in the northern Rocky Mountains, USA
Authors: **PARKS**, Sean, Rocky Mountain Research Station; Carol Miller, Rocky Mountain Research Station; Zachary Holden, USDA Forest Service
Offered Presentations: Fire - Wednesday, April 7: 11:20-11:40 - F-G
Abstract: It is well-recognized that wildfires are an important process in many ecosystems, contributing to landscape heterogeneity, nutrient cycling, and fuel consumption. Recent research has suggested that landscapes experiencing natural fire regimes are more self-limiting or "fire resistant". Therefore, many scientists and land managers have been promoting the practice of allowing fires to naturally burn. In most areas of the U.S., however, fires are suppressed for political, economic, and/or social reasons. Some wilderness areas, because they are not actively managed and allow natural fires to run their course, are ideal for studying fire interactions. We studied fire severity within two large wilderness areas in the northern Rocky Mountains, USA. We analyzed a large number of recent (1984 – 2007) fires, examining the portion of each fire that overlapped a previous fire (i.e., it reburned) and the portion that did not overlap a previous fire. For each fire, we compared the fire severity of the reburned area to that of the area that did not reburn. Results show that in areas of reburn, fire severity was considerably less than areas that did not experience a reburn. While these results are not surprising, they add to the growing body of information regarding interactions among fires. Specifically, these results indicate that

where a fire occurs, any subsequent fire will likely burn at a lower severity than if the initial fire had not occurred. This information provides land managers a longer timeframe at which to view the benefits and costs of an individual fire by providing quantitative information on the future reduction in fire severity. Land managers will find these results useful in assessing trade-offs in the decision of whether or not to suppress a wildfire.
Keywords: fire severity, MTBS, wilderness

184. The influence of forest cover structure at different spatial scales in stream fish communities in catchments of the Corumbataí river basin, São Paulo State, Brazil.
Authors: **PAULA**, Felipe, Rio Claro Biosciences Institute, São Paulo State University; Silvio Ferraz, "Luiz de Queiroz" College of Agriculture; Pedro Gerhard, Brazilian Agricultural Research Corporation
Poster #32: Scale - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Atlantic forest at southeastern Brazil has been widely disturbed and converted to agricultural fields since the beginning of the 20th century. These alterations modified landscape structure, reducing forest into small and fragmented patches. As headwater streams are strongly dependent on forest cover, fragmentation can change the structure of lotic ecosystems and aquatic communities, including fishes, since they depend on the structural heterogeneity of the aquatic habitat. In this study, we related fish community structure (species richness and diversity) to forest structure in catchments. Three different spatial scales were considered: whole catchment, 30 meters (m) riparian zone of channel network and 30 m riparian zone of the sampled stream reach. The study was conducted in 60 catchments belonging to Corumbataí river basin, São Paulo State, Brazil. Forest proportion and configuration in the spatial scales considered was calculated using forest cover maps obtained by aerial photographs. Physical attributes of catchments were extracted from the digital elevation model. Fish samples were collected during the rainy season in a 150m stream section using electrofishing. Relationships between community indices and variables of forest cover and stream reach were analyzed using multiple linear regression. Elevation and forest distance to stream channel explained 29% of species richness and 34% of species diversity at catchment scale, and 21% of species richness and 26% of species diversity at riparian zone of channel network scale. In the riparian zone of stream reach, elevation and depth explained 36% of species richness and elevation, conductivity, pH, depth and substrate explained 36% of species diversity. Fish communities structure were influenced by different characteristics of landscape, such as catchment relief, forest configuration and local habitat structure. The landscape has an important role on structuring stream fish communities, and the spatial configuration of forest remnants was more important than forest composition.
Keywords: conservation of biodiversity, fish communities, forest fragmentation, landscape ecology

185. Comparing alternative approaches for spatial habitat modeling: mapping the breeding habitat of the Appalachian Yellow-bellied Sapsucker
Authors: **PEARSON**, Scott, Mars Hill College; John Gerwin, NC Museum of Natural Sciences
Poster #39: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Four analytical approaches for habitat modeling were employed to map the preferred breeding habitat of the Yellow-bellied Sapsucker (Sphyrapicus varius) in North Carolina. The breeding range of this species includes forested habitats across northern North America as well

as a portion of the Southern Appalachian Mountains. Southern populations may be disjunct and ecologically distinct from northern populations, and additional information is needed about their geographic range and preferred habitats. Presence/absence data, GIS maps of elevation and topography, and four quantitative modeling techniques (logistic regression, linear discriminant analysis, Mahalanobis distance, and classification tree) were used to produce habitat maps for this species in North Carolina. Sensitivity and specificity of the quantitative models were compared to each other and to an expert opinion map developed by the NC GAP Analysis Program. The classification tree and a composite model, which combines results from several approaches, had the highest levels of specificity and accuracy. The classification tree method was superior due to non-linear relationships between habitat occupancy and environmental gradients –and- statistical interactions among important habitat variables. Quantitative models revealed that sapsucker occupancy was greatest on submesic mid-slopes, plateaus, and rounded knobs and slopes at elevations between 1160-1400 m. These topographic positions are occupied by high elevation red oak forests as well as some northern hardwood and cove hardwood forests. The modeling results agree with field studies of habitat use in the study region. The elevation range of all occurrences (900-1600 m) disagrees with anecdotal records which list the lower elevation limit for these populations at 1065 m. Quantitative models can be used to refine the coarse-grained GAP models and guide future studies of habitat selection and population dynamics.
Keywords: classification tree, habitat models, southern Appalachian, yellow-bellied sapsucker

186. Is there a solution to the spatial scale mismatch between ecological processes and agricultural management?

Authors: **PELOSI**, Céline, INRA, UMR Dynafor; Jacques Baudry, INRA, UMRSAD Paysage; Michel Goulard, INRA, UMR Dynafor; Gérard Balent, INRA, UMR Dynafor
Offered Presentations: Scale I - Tuesday, April 6: 10:00-10:20 - F-G
Abstract: The major limit to develop robust landscape planning for biodiversity conservation is that the spatial levels of organization of landscape management by local actors rarely match with those of ecological processes. This problem, known as spatial scale mismatch, is recognized as a reason of lack of effectiveness of agri-environment schemes. We did a review to describe how authors identify the problem of spatial scale mismatch in the literature. The assumption is made that the solutions proposed in literature to conciliate agricultural management and conservation of biodiversity are based on theoretical frameworks that can be used to go towards an integration of management processes and ecological processes. Hierarchy Theory and Landscape Ecology are explicitly mobilized by authors who suggest multiscale and landscape scale approaches, respectively, to overcome the mismatch problem. Coordination in management is proposed by some authors but with no theoretical background explicitly mentioned. The theory of organization of biological systems and the theories of Social-Ecological Systems use the concept of coordination and integration as well as concepts of organization, adaptive capabilities and complexity of systems. These theories are useful to set up a new framework integrating ecological processes and agricultural management. Based on this review we made two hypotheses to explain difficulties to deal with spatial scale mismatch: (1) authors generally do not have an integrated approach since they consider separately ecological and management processes, and (2) an inaccurate use of terminology and theoretical frameworks partially explain the inadequacy of proposed solutions. We then specify some terms and highlight some 'rules' necessary to set up an integrative theoretical and methodological framework to deal with spatial

scale mismatch.
Keywords: agri-environmental policy, agricultural management, biodiversity, level of organization, spatial scale mismatch

188. Assessing ecosystem health of rural landscapes based on landscape patterns: A case study in Lijiang County of China

Authors: **PENG**, Jian, College of Urban & Environmental Sciences, Peking University; Yanglin Wang, College of Urban & Environmental Sciences, Peking University; Jiansheng Wu, College of Urban & Environmental Sciences, Peking University; You Li, College of Urban & Environmental Sciences, Peking University
Poster #23: Sustaining Systems - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Ecosystem health assessment is always one of the key topics of ecosystem management. Compared with various studies on the health assessment of single kind of ecosystems at local or national scale, few are focused on assessing ecosystem health of landscapes, which are geo-spatial units composed of different kinds of ecosystem mosaics. Meanwhile, few assessments have focused on the effects of landscape patterns on the healthy status of ecosystems. Taking Lijiang County of China as a case, this study aims to assess ecosystem health of rural landscapes based on landscape patterns. In the assessment, ecosystem health are distinguished between physical health and integrated health of ecosystem. Regarded as the ability to sustain ecosystem structure and functions, physical health of ecosystem is assessed through three aspects, i.e. ecosystem vigor, organization and resilience. And focusing on ecosystem service function, integrated health of ecosystem is considered as the ability of ecosystem to keep physical health itself, and to satisfy human needs for ecosystem services. In details, ecosystem vigor is weighed by mean NDVI; ecosystem organization is measured by selected landscape metrics; ecosystem resilience is evaluated by resilience coefficient of different land use types and associated area ratio; and ecosystem service function is assessed according to ecosystem services coefficient of different land use types and associated area ratio, considering spatial neighboring effects among different ecosystems. The results show that, during 1986-2002, both the status of physical health and integrated health of ecosystem for the whole county are healthy, with a little increase of each index. Although there are only a few changes of the two indexes for all the 24 towns during the study period, there is distinct spatial difference among the towns, and the town stationed by the county government has the lowest value of both indexes.
Keywords: Ecosystem health assessment, Ecosystem service function, Landscape patterns, Lijiang County, China, Rural landscape

189. Ecological assessment of forest policies: Looking for a correct answer to a wrong question?
Authors: **PERERA**, Ajith, Ontario Forest Research Institute; Lisa Buse, Ontario Forest Research Institute; Joe Churcher, Forest Policy Section, Ontario Ministry of Natural Resources
Offered Presentations: Disturbance II - Wednesday, April 7: 11:00-11:20 - Z
Abstract: The expectation is that forest management policies are founded on sound ecological science. If they are not, the effectiveness of such policies may be deemed low and their reliability questioned. Periodic ecological assessments and revisions are therefore conducted to assure the integrity of forest policies. Here we present an ecological assessment of the major forest landscape policy of the province of Ontario, Canada. These policies guide forest harvest patterns over a vast extent, and are predicated on the principle of emulating natural fire disturbances.

With research studies of forest fire disturbance patterns at multiple scales, we assessed the veracity of these policy guidelines and concluded that some directions are congruent with ecological evidence while others are not. Such assessments presume final forest policy goals are ecological when in reality they are an amalgam of ecological, social, economic, and political goals. Thus, it becomes an appraisal of an ecological-socio-economic-political goal using ecological evidence. We argue that a clear articulation of ecological and non-ecological values of forest policies is a priori for their ecological assessment and subsequent improvement.
Keywords: Boreal Forest Fire, Emulating Natural Disturbances, forest policy, Ontario

190. Cellulosic Biomass Production in the Chesapeake Bay Watershed
Authors: **PERLA**, Donna, U.S. EPA, Office of Research and Development
Invited Symposium: Reshaping Landscapes: Bioenergy and Land-use Change - Wednesday, April 7: 11:20-11:40 - K-L
Abstract: The State Governors within the Chesapeake Bay watershed appear committed to furthering the development of biofuels and have been developing Biofuels Action Plans related to this vision. Alternatively, President Obama signed Executive Order 13508, designating the Bay as a National Treasure, and calling for implementation of a strategy to coordinate, expand, and bring greater accountability to speed the Bay's recovery. Given the critical need to understand and mitigate stressors to the Bay, and the high economic and political pressure to develop biofuels within this watershed, it is critical to develop a scientifically based understanding of how biofuels production and use within the watershed may impact priority environmental outcomes, such as water quality, biodiversity, and soil productivity. The Biofuels Advisory Panel to the Chesapeake Bay Commission has identified some critical immediate scientific needs, including: • Developing state specific biomass harvest guidelines (both agricultural and forest). • Verify how the use and harvest of winter crops (such as barley, rye, canola) as biofuels feedstocks and other energy crops (such as switchgrass) can be not only sustainable grown in specific locations within the watershed, but also contribute to reductions of nutrients affecting water quality within the watershed. • Proactively identify safe species and potentially invasive species specific to this watershed and develop tools to assess invasiveness. There is a critical need to accelerate the science behind these and other priority scientific questions relating to biofuels within this watershed.
Keywords: Bay, Chesapeake, invasiveness, nutrients, Watershed

191. Exploring Site Conditions through an Integrated Moisture Index
Authors: **PETERS**, Matthew, U.S. Forest Service; Louis Iverson, U.S. Forest Service; Anantha Prasad, U.S. Forest Service; Stephen Matthews, U.S. Forest Service, The Ohio State University
Offered Presentations: Resource Management II - Tuesday, April 6: 4:20-4:40 - F-G
Abstract: Available soil moisture can provide a wealth of information about site-specific conditions, including long term water holding capacity, flow patterns of water, and suitability for community types to name a few. The Integrated Moisture Index (IMI) is one such metric that is calculated from digital elevation models (DEM) and soil survey data. IMI takes advantages of fine scale soil (NRCS – SSURGO) and topographic (USGS 10 m NED) data, along with an infinite directional algorithm, such as TauDEM, to calculate flow direction and accumulation. When used to stratify the landscape, IMI provides insight into patterns of competition and the effects of prescribed burning. Currently we are using IMI along with other long-term environmental indicators (Palmer Drought Severity Index and Standardized Precipitation Index)

to investigate risk conditions of wildland fires in New Jersey, Ohio, and Pennsylvania. As the wildland/urban interface increases, the potential risk of fire damage to private property poses a major threat. Through risk mapping, we hope to identify areas that local agencies can focus efforts to reduce the risk of intense fires.
Keywords: fire, Integrated Moisture Index, Landscape modeling, Northeastern U.S., risk mapping

192. Predicting the response of Flint River biota to water use, land cover and climate change with spatially explicit metapopulation models
Authors: **PETERSON**, James, USGS, Georgia Cooperative Fish & Wildlife Reserach Unit; Mary Freeman, USGS, Patuxent Wildlife Research Center; W Hughes, USGS, USGS Georgia Water Science Center; Gary Buell, USGS, USGS Georgia Water Science Center; Lauren Hay, USGS, National Research Program; Kenneth Odom, USGS, Colorado Water Science Center; John Jones, USGS Eastern Geographic Science Center; Robert Jacobson, USGS Columbia Ecological Research Center; J Schindler, USGS Eastern Region; Colin Shea, Warnell School of Forestery & Natural Res, Univ of Georgia; Sonya Jones, USGS Southeast Area
Invited Symposium: Linkages Among Landscape, Flow, and Aquatic Habitat: The Upper Flint River Water Availability Study - Tuesday, April 6: 2:20-2:40 - Q
Abstract: River regulation, water use, and land development are among the foremost problems faced by aquatic resource managers. Identifying and quantifying their effects on aquatic communities is crucial for evaluating potential stream conservation strategies. Broader-scale influences such as climate change also can affect water quantity or alter the seasonality of flows. In the upper Flint River basin, increasing demand for water from the steady growth of the Atlanta Metropolitan Area has the potential to alter streamflow throughout the basin. We developed a landscape-scale model to predict the effects of flow alteration on the persistence of fish communities in the upper Flint River basin. The modelling approach integrates geology, geomorphology, hydrology, and landscape characterizations within the basin. Existing data sets have been used to allow regionalization of results to other watersheds while minimizing additional data collection. Hydraulic and ecological models were linked to predict persistence of fish species under future scenarios of flow alteration, land-use effects, and climate change. We intend this as an adaptive framework, within which model components will be iteratively improved with better understanding of mechanisms linking land use, hydrology, and aquatic biota, to provide useful guidance to natural resource managers.
Keywords: metapopulations, multistate occupancy, simulation

193. Assessing performance of conservation-based Best Management Practices: coarse vs. fine-scale analysis.
Authors: **PIECHNIK**, Denise, The Pennsylvania State University - PSIEE; Sarah Goslee, USDA - ARS PSWMRU
Poster #31: Scale - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Detecting watershed-scale efficacy of those best management practices (BMPs) intended to reduce agricultural sediment loading is challenging. Multiple and simultaneous landscape processes, including changes in land-use and in base flow (e.g., drought and storm events) complicate assessing effects of conservation-based agricultural BMPs (e.g., cattle crossings, fencing, buffer strips, and stream-bank stabilization). Water quality and sediment loads were studied within two treatment sub-watersheds with conservation BMPs applied to 91%

and 61% of farms along the stream (BMP1 and BMP2), and one unmodified reference sub-watershed (REF) within the Spring Creek Watershed (Centre Co. PA – Chesapeake Bay Watershed). Land-use mapping within a 100m stream buffer from aerial photography for the three sub-watersheds covered an area of 1,980 ha (40% agricultural use). Percentage of agricultural land-use and total hectares for each sub-watershed was 46% (BMP1: 625 ha), 37% (BMP2: 699 ha), and 17% (REF: 653 ha). Percentage of woodland area per sub-shed was greatest within the REF sub-shed at 45% (377 ha), while the +BMP sub-watersheds had less forested area (BMP1: 19%, 159 ha; BMP2: 36%, 306 ha). Residential, commercial, and transit land-use were similar for all sub-watersheds. Flow paths calculated from coarse- (USGS 30-m DEM) and fine-scale (LiDAR-based sub-meter DEM) topographic data were overlain on land-use and BMP- placement maps. Flow pathways derived from LiDAR data show considerably more potential source-to-stream links than do those from the USGS data. Not all buffers are placed to block movement along these flow pathways; fine-scale drainage networks are not typically considered when placing BMPs. Where fine-scale DEMs are available, efficacy of new BMP locations might increase by considering and including such drainage pathways. LiDAR DEMs are available for Pennsylvania through the PAMAP program to be used in plans to reduce agricultural sediment and nutrient loadings into local watersheds and ultimately the Chesapeake Bay.

Keywords: BMP, LiDAR, pasture managment, sediment load

194. Soundscape ecology: acoustic dynamics of landscapes

Authors: **PIJANOWSKI**, Bryan, Purdue University; Luis Villeneuva-Rivera, Purdue University; Sarah Dumyahn, Purdue University; Brian Napoletano, Purdue University; Bernie Krause, Wildsanctuary Inc

Invited Symposium: Soundscape Ecology: The Complexity of Acoustical Patterns in Landscapes - Tuesday, April 6: 3:20-3:40 - Q

Abstract: Humans are threatening ecosystems globally. Scientists and natural resource managers need approaches that can monitor systems across large regions and provide fine temporal resolution of human impacts to ecosystems. We present data of long-term acoustic recordings in 8 locations and show how entropy measures of acoustic frequencies varies predictably over time and between locations differing in land use. Dawn and dusk choruses are evident in relatively undisturbed forested sites and missing in human-dominated landscapes, low acoustic frequencies compose the most abundant sounds in human dominated landscapes, and night-time acoustic activity is greater than daytime. We use this study to present a generalized framework for how land use and potentially climate change impacts the dynamics of biological sounds in landscapes. In our conclusion, we call for a greater focus on soundscape conservation and attention to how humans impact one of Earth's valuable ecosystem services.

Keywords: biodiversity, entropy, monitoring, rhthyms of nature, soundscapes

196. Movement Paleoecology: Patterns of Movement in Deep Time

Authors: **PLOTNICK**, Roy, University of Illinois at Chicago

Offered Presentations: Distribution I - Tuesday, April 6: 10:20-10:40 - Y-Z

Abstract: Trace fossils (ichnofossils) are the preserved record of animal behaviors. Numerous difficulties plague the behavioral interpretation of trace fossils. First, the identity of tracemaker is often unknown. Second, morphologically similar traces can result from different behaviors. Finally, the prevalent ethological classification of trace fossils has no counterparts in the

behavioral literature of living organisms, which also has numerous idiosyncratic classifications. Nathan et al. (2008, PNAS) have called for a new "movement ecology paradigm for unifying organismal movement research." This approach views movement as resulting from the interactions of the organism's internal state ("why move?"), its biomechanical ability to move ("how to move"), and its navigation capacity ("where to move?") with each other and with the external environment, such as landscapes. The adoption of this paradigm would have significant implications for the study of ichnofossils and has the potential for placing these studies in a far wider common context for the study of movement, while adding the dimension of the evolution of movement behavior in deep time. For this integration to occur, paleontologists need to first consider what are the range of behaviors exhibited by organisms and what are the controls on these behaviors, and then what is the preservation potential of these behaviors and controls in the fossil record. This new framework should explicitly incorporate the evolution of landscapes, such as occurred during the Cambrian radiation and the onset of terrestrial life.
Keywords: fossils, movement, paleoecology, trace

197. Development of a remote sensing methodology to analyze historical changes to the agricultural landscape of Iowa
Authors: **PORTER**, Sarah, Dept. of Geography, University of Iowa
Offered Presentations: Technological Innovation - Thursday, April 8: 5:00-5:20 - Q
Abstract: It is accepted that the agricultural landscape of Iowa has experienced a simplification over the past 80 years, transitioning from smaller farm fields interspersed with native grasses and forest, to large farm fields dominated by two profit generating crops: corn and soybean. This loss of diversity has far reaching implications for the future of Iowa's wildlife. As Iowa's most important game bird, declining population trends for the ring-necked pheasant have generated substantial interest in understanding how pheasant populations change with a changing landscape. Population surveys in Iowa dating back to the 1930's offer a reliable source to monitor changes to pheasant habitat following their introduction and widespread establishment during the early 20th century. Evidence of landscape level change is mainly inferred from statistical records such as average farm size or acres of crops harvested. While this data gives a general idea of landscape trends over time, little is gained in understanding the spatial characteristics of these trends. Aerial photographs dating back to 1937 provide the only visual evidence of landscape change in Iowa. However, lack of efficient or reliable methods to classify these photographs has prevented their use for such purposes. We present a new methodology to this problem through the incorporation of spatial and textural attributes of historic imagery. Land cover classifications traditionally rely on the ability to differentiate the spectral characteristics of various land cover types. Panchromatic imagery lacks this spectral detail, and therefore most historic land cover classifications have relied on manual delineation. This restricts both the spatial scale and reliability of results due to the time consuming and subjective nature of the methodology. Recent techniques involving independent component analysis have proven useful for improving the accuracy of multispectral land cover classifications. This methodology shows promise for increasing the efficiency and objectivity of historic land cover classifications.
Keywords: Agriculture, Habitat, land cover classification, remote sensing

198. Feeding History: Deltaic Resilience, Inherited Practice, and Millennial-Scale Sustainability in an Urbanized Landscape
Authors: **POURNELLE**, Jennifer, University of South Carolina; Carrie Hritz, Penn State

University
Offered Presentations: Landscape Aesthetics II - Thursday, April 8: 1:20-1:40 - F-G

Abstract: The landscape of southern Mesopotamia is a palimpsest of modern and ancient features representing overt attempts to modify the "natural" fluvial regime, incremental changes accruing to long-term subsistence strategies, and events triggered by the interaction of geomorphologic forces with these anthropogenic changes. Using niche construction models informed by mulitscalar settlement surveys, remote sensing data, and paleoenvironmental proxies, this paper lays out historically verifiable signatures of subsistence practices in deltaic settings, examines their long-term ecological impacts, explores their role in the development and durability of complex society, and presents a landscape heritage uniquely suited for multi-millennial-scale examination of sustainable environmental practices.
Keywords: Complex Societies, Deltaic Landscapes, Mesopotamia, remote sensing, Urbam Sustainability

199. Twentieth century wildfire event sizes in California: Implications for landscape resilience.

Authors: **POVAK**, Nicholas, USDA-FS, Pacific Northwest Research Station; Paul Hessburg, USDA-FS, Pacific Northwest Research Station
Invited Symposium: Landscape Ecology of Wildfires: Theory, Modeling, and Application - Tuesday, April 6: 11:20-11:40 - R

Abstract: It has been hypothesized that resilience mechanisms must exist because identifiable ecosystems persist across space and time in recognizable patterns, even in the face of substantial disturbance and climatic and environmental change. Here, we examine the concept of landscape resilience to fire, an indigenous landscape disturbance process. We examine theoretical frameworks that might explain how ecosystem organization and structure emerge on the landscape, including highly optimized tolerance and self-organized criticality, mechanisms that have been used to explain how resilience, robustness, and fragility might co-exist in complex systems. Fire ecology studies of forest and shrubland landscapes to date have focused on fire size distributions and how power law statistics appear to explain them. We review datasets from different fire environments in California to examine the relative stability of power law assumptions. We conclude by examining exogenous (top-down) and endogenous (bottom-up) controls on wildfire event sizes, how these forcings might influence fire regime, and what we might learn from past ecosystem structure and resilience to create more adaptable future landscapes.
Keywords

200. Tree species colonization potentials using a spatially explicit cellular model and factors modifying them

Authors: **PRASAD**, Anantha, Northern Research Station, USDA Forest Service; Louis Iverson, Northern Research Station, USDA Forest Service; Stephen Matthews, USDA Forest Service & The Ohio State University; Matthew Peters, Northern Research Station, USDA Forest Service
Offered Presentations: Climatic Influences I - Tuesday, April 6: 2:00-2:20 - R

Abstract: Our DISTRIB model predicts the change in potential habitats of 134 tree species in the eastern United States, by relating the abundances of tree species according to Forest Inventory Analysis (FIA) data to 38 climate, soil and landscape predictors using decision-tree based ensemble statistical techniques. We alter the climate variables in the ensemble and predict future abundances according to two carbon emission scenarios (high and low) and three Global

Circulation Models (GCMs). However, the limitations of DISTRIB include its inability to account for decreased colonization potentials under current fragmented landscapes, and also how other biological and disturbance factors (MODFACs) may influence species specific response to climate change. We have previously used a spatially explicit cellular model (SHIFT) to assess how landscape fragmentation and current and future abundances can affect colonization potential of several tree species. One of the limitations of SHIFT was its excessive computing time which made multiple runs for calibration and sensitivity analyses difficult. However, we have achieved dramatic increases in speed by using Fast Fourier Transforms to implement the algorithm in MATLAB using image processing techniques, thus enabling us to fine tune the model to achieve better results. Here we present the results of our analysis for several tree species and then explore how the combined DISTRIB-SHIFT outcomes can be altered regionally and locally when we take into account the MODFACs. These steps provide insights into the potential changes in species distributions to climate change and stress the need for multi-model synthesis to quantify uncertainty as we address the complexity of climate change research.

Keywords: cellular model, climate change, MATLAB, RandomForest, species distribution model

201. Patterns of reproduction in northern and southern populations of Ochrotomys nuttalli and Peromyscus leucopus at the landscape scale

Authors: **PRATT**, Nathan, Odum School of Ecology, University of Georgia; Gary Barrett, Odum School of Ecology, University of Georgia

Offered Presentations: Climatic Influences II - Tuesday, April 6: 4:40-5:00 - R

Abstract: Many studies have evaluated the patterns of reproduction for small mammal species; however, few have compared the differences between northern and southern populations. Those that have primarily concentrate on the differences in average litter size between northern and southern populations. We evaluated the differences in seasonal patterns of reproduction in northern and southern populations for two small mammal species. Ochrotomys nuttalli and Peromyscus leucopus are remarkably similar small mammal species with regard to body mass, nest-site preference, feeding behavior, bioenergetics, home range size, periods of activity, and natural history. Both small mammal species show intraspecific differences in reproductive season across their respective ranges. We found that O. nuttalli and P. leucopus tend to switch from a summer breeding season (extending from late spring through early autumn) in the north to a winter breeding season (extending from late autumn through early spring) in the south near the isotherm where mean annual temperature is $15.6°C$ ($60°F$). North of this isotherm, a summer reproductive season is observed, and south of this isotherm, a winter reproductive season is observed.

Keywords: Breeding Season, isothermal tipping point, Ochrotomys nuttalli, Peromyscus leucopus, reproduction

202. Developing Landscape Scenarios: Obtaining and Integrating Expert and Stakeholder Opinion

Authors: **PRICE**, Jessica, University of Wisconsin at Madison; Janet Silbernagel, University of Wisconsin at Madison; Nicholas Miller, The Nature Conservancy, Wisconsin

Offered Presentations: Resource Management III - Thursday, April 8: 2:40-3:00 - V-W

Abstract: Conservation strategies are shifting to distribute protection efforts over larger areas and a broader range of ownerships and management techniques. These 'distributed conservation

strategies,' such as working forest conservation easements, are based on the premise that blending resource extraction and biodiversity conservation should provide socio-economic benefits without significantly compromising the conservation of biodiversity or ecosystem services. However, evaluating the effectiveness of such strategies remains difficult, as traditional monitoring efforts span decades or longer, limiting their immediate applicability. Therefore, we are developing an approach to provide insight into the potential land cover and conservation outcomes of various land management regimes in response to anthropogenic and climate change pressures. This approach integrates spatially explicit landscape modeling with scenario building informed by expert knowledge. Here, we present our experiences building scenarios that are informed by and responsive to local expert knowledge in two conservation project areas in the northern Great Lakes region of the U.S. We discuss how teams with expert knowledge, working in specific places or systems, can form landscape narratives that integrate experiential knowledge with empirical and simulated data. The cooperation and constructive communication fostered by scenario building often leads to a better understanding of the system(s) of interest, builds trust among diverse stakeholders, and sets the stage for continued cooperative conservation planning and management.

203. ABUNDANCE AND RICHNESS OF VERTEBRATES IN TWO CONTRASTING DEFORESTATION PATTERNS IN THE BRAZILIAN AMAZON

Authors: **PRIST**, Paula, São Paulo University; Fernanda Michalski, Pro-carnivoros Institute; Jean Paul Metzger, São Paulo University

Offered Presentations: Disturbance II - Wednesday, April 7: 10:00-10:20 - Z

Abstract: The Brazilian Amazon has several types of deforestation patterns, varying from the typical "fishbone pattern" common to small properties, to deforestation of large forest areas (large-property pattern), resulting in landscapes with different connectivity and disturbance levels. Here, we analyzed the effects of these contrasting patterns on the persistence and abundance of mid-sized and large-bodied vertebrates in a southern Amazon deforestation frontier. From February to July 2009, interviews (n = 150) were used to record the occurrence of vertebrate species from a total of 21 landscape units (4 x 4 km), seven in each of controls, large-properties and fishbone deforestation patterns. Sites in fishbone and large-property areas had similar proportions of remaining forest (~18%), while control forest sites were completely forested. Diurnal line transect census (666 km), was also conducted in four fishbone patterns, two large-properties and two control sites, to obtain abundance estimates. Interviews revealed a significant difference in species richness between fishbone and large-property and control areas (Tukey´s Multiple Comparison test, p<0.001) with an average of 31.3 (SD=4.9), 40.6 (SD=4.6), and 45.7 (SD=2.1) for fishbone, large-properties and controls, respectively. The average abundances of Ateles marginatus, Dasyprocta agouti and Dasypus novemcinctus were higher in the fish-bone pattern compared with the large-property and control sites, whereas for all other species the average abundance was higher in control areas. We also found a higher number of specialist species in the control areas, followed by the large-property pattern, and only generalist species in the fish-bone pattern. The absence of large predators and specialist species from fishbone sites may demonstrate that the deforestation pattern can contribute to the extinction of these and other forest-dependent species. Our results demonstrate that the large-property pattern can maintain a more diverse community of species, including top predators, considered

fundamental for ecosystem integrity.
Keywords: Amazon Forest, Deforestation, landscape ecology, persistence of vertebrates, vertebrates

205. Interpreting the role of habitat and public information on spatial distributions of breeding shorebirds using point pattern analysis

Authors: **PRUNER**, Raya, University of Florida- Dept of Wildlife Ecol & Conservation; Robert Fletcher Jr., University of Florida- Dept of Wildlife Ecol & Conservation; Steve Johnson, University of Florida- Dept of Wildlife Ecol & Conservation
Poster #41: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Many species occur in spatially clustered distributions. While such distributions are often thought to be driven by variation in resources, recent experimental evidence has increasingly found that social information, such as the presence of conspecifics or public information (i.e. the reproductive performance of conspecifics), can drive spatial distributions. Nonetheless, understanding the role of resources and social factors in natural situations has been limited. Here, we provide a novel application of spatial point pattern analysis to interpret the role of resources and social factors in driving the spatial distribution of a non-colonial species, the snowy plover (Charadrius alexandrines). Snowy plovers are often observed nesting close to conspecifics. Our objectives were: 1) to determine whether snowy plover nests were clustered at various spatial scales , before and after controlling for potential habitat selection influencing factors (human activity, predator activity, and prey availability); and 2) to determine whether public information provided by conspecifics was an underlying driver for spatial clustering. Nests locations (n = 463) collected in 2008-2009 at 5 barrier island sites located contiguously in the Florida panhandle were used to analyze spatial patterns. We found that, after controlling for an inhomogeneous Poisson process driven by prey availability, snowy plover nest-sites were consistently aggregated at moderate spatial scales across sites. Bivariate analyses suggested that public information was a strong driver in aggregation, where late nests were more aggregated around early successful nests than to early unsuccessful nests. Our approach provides a rigorous and effective means for unraveling factors influencing the spatial distribution of points and can help identify viable hypotheses for understanding species distributions.
Keywords: Charadrius alexandrines, conspecific attraction, point pattern analysis, public information, spatstat

206. Landscape Effects on the Nesting Success of Grassland Birds in Agricultural Conservation Buffers in Mississippi

Authors: **PUCKETT**, Heidi, Mississippi State University; Loren Burger, Mississippi State University; Samuel Riffell, Mississippi State University
Offered Presentations: Agrarianism I - Tuesday, April 6: 10:40-11:00 - Q
Abstract: As agricultural land use intensifies in the United States, there is a growing need to provide suitable wildlife habitat in agricultural production systems, particularly for grassland birds. Conservation buffer practices can add critical grassland components back into agriculturally-dominated landscapes, thereby increasing the proportion of the landscape in natural communities while minimally impacting crop production systems. The reproductive performance of grassland birds nesting in agricultural conservation buffers, however, may be influenced by the landscape context (e.g., edge habitat, surrounding land cover) in which the buffers occur. Previous work has demonstrated that reproductive success of grassland birds

nesting in strip habitats in agricultural landscapes may be low and varies in relation to strip width, vegetation structure and composition, and landscape context. Thus, the objective of this study was to determine how the type of edge and surrounding habitats within an agricultural landscape impact the nesting success of breeding grassland birds in agricultural conservation buffers. Our hypotheses were nests in agricultural conservation buffers adjacent to woody habitats or habitats with a high amount of human disturbance (e.g., crop land, roads) will have a lower nesting success than nests in buffers adjacent to grassland or pastures, and the proportion of the surrounding landscape in woodland habitat will inversely affect grassland bird nesting success. Results of this study will help characterize the relative contribution of agricultural conservation buffer practices toward grassland bird conservation in southern agricultural systems, as well as assist with the development and refinement of USDA-NRCS Practice Standards, documentation of the ecological benefits of federally subsidized conservation practices, and enhancement of wildlife benefits in agriculture-dominated landscapes.
Keywords: Agriculture, birds, Conservation Buffers

208. Epitomizing the simplicity in complexity of socio-ecological field sampling using an integrated spatial model of complex mosaic of urbanization
Authors: **QURESHI**, Salman, Department of Geography, University of Karachi
Offered Presentations: Urban Ecosystems - Thursday, April 8: 3:40-4:00 - K-L
Abstract: Scientists studying megacities are always confronted with the challenge of stratifying their sampling sites for in-depth field investigations, particularly in developing countries where the urban landscapes do not expand with predetermined plans. The challenge gets more complicated especially for socio-ecological studies; it is primarily because of the complexity of coupled human and natural systems where multifunctional composite of land-uses interfere. This paper presents a brief conceptual framework for developing an urban-rural gradient model, adapted with a set of postulates to systematically theorize the selection of research sites in larger urban agglomerations - formally the megacities. The urban gradient model helped to understand urban development prognosis and growth corridors. It is based on the presumption that it would examine samples from a variety of urban structural forms and functional characteristics; rather all measures of urbanization that would necessarily decrease with distance from the centre. It also transgresses the classical method of sampling along urban-rural transect or sampling grids. An example of framework implementation is presented to probe the pertinence of the proposed methodology. The case study was conducted in the megacity Karachi, Pakistan which is a city of 18 million inhabitants and the greater Karachi covers an area of 3600 km2. Results corroborate the urban gradient as an important research method rather than merely a modeling approach. The framework construct makes it adaptable to varying types of cities, especially fast growing cities with complex land-uses.
Keywords: developing countries, megacities, socio-ecological modelling, urban ecology, urban nature

209. How do landscape factors shape plant and bird communities in newly created grassland on restored landfill sites?
Authors: **RAHMAN**, Md, University of Northampton; Duncan McCollin, University of Northampton; Jeff Ollerton, University of Northampton
Offered Presentations: Restorative Ecology - Thursday, April 8: 10:40-11:00 - Y-Z
Abstract: Recent changes in agriculture have resulted in a critical reduction of semi-natural

grasslands in the UK. The newly created grasslands on restored landfill sites have attracted many ecologists as these sites could mitigate biodiversity loss in fragmented landscape by harbouring a wide range of wildlife. Effects of the surrounding landscape factors such as percentage of cropland, grassland, built-up land, scrubland and woodland were investigated by examining species richness and diversity of plants and birds. The study was carried out on nine restored landfill sites and their corresponding reference sites in the East Midlands region of the UK in 2007 and 2008. Plant species data were collected by random quadrats of 1m×1m from two 100m transects from each site and bird species were assessed using point counts method. A total of 170 plant species and 12 bird species were found in the studied sites. Two red lists bird species Alauda arvensis and Perdix perdix were found profoundly on restored landfill sites during their breeding seasons. Species richness and diversity of plants and birds did not differ significantly between restored landfill sites and reference sites. Principal Component Analysis (PCA) showed that about 33% of plant species composition variation and about 31% of bird species composition variation were explained by landscape variables in the studied sites. Different landscape variables were found significant predictors for different species. This study indicates that the restored landfill sites have potential conservation value and landscape factors should incorporate in the management of these newly created grassland sites.
Keywords: biodiversity, grassland, landfill site, Landscape, restoration

210. MAPPING THE INVASIVE SPECIES, CHINESE TALLOW WITH EO1 SATELLITE HYPERION HYPERSPECTRAL DATA
Authors: **RAMSEY III**, Elijah, U.S. Geological Survey; Amina Rangoonwala, IAP World Wide Services, Inc.
Invited Symposium: C - Thursday, April 8: 4:20-4:40 - R
Abstract: Chinese tallow (Triadica sebifera) is an invasive tree that is causing extensive change to native habitat and associated wildlife. Mapping the distribution of tallow is critical for its control and eradication. The unique phenology of tallow within the coastal landscape was key to its detection with remote sensing. Tallow was first mapped with airborne color-infrared photography during fall senescence, when tallow leaves turned red and yellow presenting a high spectral contrast within the native landscape. The CIR-based mapping produced a high tallow classification accuracy (>95%) but the mapping was labor-intensive and coverage limited (<5 ha), providing neither operationally repetitive nor regional mapping. The necessary trade-off was between the need for high spatial resolution and the need for regional coverage. The satellite EO-1 Hyperion sensor provided the necessary high spectral resolution and spectral unmixing the needed high-spatial resolution. The satellite platform offered repetitive, quantitative, and operational monitoring of tallow phenology. Unmixing applications require that canopy reflectance be related to the canopy composition. To provide that linkage, we developed and implemented an atmospheric correction strategy that provided accurate estimates of canopy reflectance from the Hyperion image data. Following that transform of the image data to canopy reflectance, spectral unmixing classified the canopy compositions throughout the Hyperion image. The subpixel percent-occurrence classification produced three characteristic spectra: (1) senescing foliage and cypress-tupelo trees; (2) shadows and green vegetation; and (3) senescing tallow with red leaves ("red tallow"). The classification was 78% (n=33) accurate in predicting the percent-occurrences of red tallow from the Hyperion data. The Hyperion derived distribution of red tallow was linked to landcovers mapped with Landsat TM data. Tallow occurrences were not detectable in low spectral resolution TM data. Hyperion-derived tallow occurrences linked to

TM-derived landcovers provided that first step toward determining the susceptibility of various landcovers to tallow establishment.
Keywords: Endmember, hyperspectral, Invasive, Mapping, U.S. Gulf Coast

211. Modeling moose population dynamics under multiple climate and browsing scenarios
Authors: **RAPER**, Diana, Oregon State University; Kevin White, Alaska Department of Fish and Game; Nathan Schumaker, US Environmental Protection Agency; Anita Morzillo, Oregon State University
Poster #4: Climatic Influences - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: A major challenge for ecologists is predicting how the distribution and abundance of different species will respond to habitat alterations associated with Earth's changing climate. This task is particularly important for species that play significant ecological roles and serve as critical subsistence resources for rural communities. Our objective is to explore the potential effects of habitat alterations resulting from climate change and moose browsing on the overall moose population of the Gustavus forelands in southeast Alaska. The recent invasion and subsequent population irruption of moose in this region and adjacent areas of Glacier Bay National Park and Preserve may already be having profound impacts on ecosystem dynamics because of high levels of moose browsing on key deciduous plant species. Since their invasion, moose have become an important subsistence resource for the rural community of Gustavus, which likely will be affected directly by changes in the moose population. We use HexSim, a spatially explicit individual-based population model designed for simulating terrestrial wildlife population dynamics and interactions, to evaluate how concurrent climate and browsing-induced changes to vegetation may affect the local moose population. HexSim is parameterized using multiple years of moose habitat use and movement data. Finally, we simulate the Gustavus moose population on multiple habitat maps and summarize the population statistics and vital rates across simulations. This simulation provides a foundation for managers to use for moose harvest assessment and habitat evaluation, and the parameters will be further adjusted with additional field data during the next several years.
Keywords: climate, Habitat, HexSim, Moose

212. Using a chronosequence to link plant spatial patterns and ecological processes in grazed Great Basin semi-arid shrub-steppe communities
Authors: **RAYBURN**, Andrew, Utah State University; Thomas Monaco, USDA-ARS
Offered Presentations: Disturbance II - Wednesday, April 7: 11:40-12:00 - Z

Abstract: We addressed common criticisms of observational plant spatial pattern research through a study in Great Basin (USA) shrub-steppe that has been converted to a managed grazing system. We hypothesized that intraspecific interference and livestock grazing were important community-structuring processes that would leave unique spatial signatures. We quantified crested wheatgrass spatial patterns along a chronosequence of stands that differed only in time since planting (8 – 56 yrs), as well as in a 56-yr old grazing exclosure to examine pattern formation in the absence of grazing. We detected fine-scale regularity, frequently considered a sign of interference, in all stands including the exclosure. Coarser-scale aggregation, which we attributed to the effects of prolonged grazing disturbance, was only detected in the oldest grazed stand. Our results suggest that interference acts over finer spatial and temporal scales than grazing in structuring these stands, reinforcing the importance of interference via resource competition in semi-arid communities. Analysis of exclosure data suggests that, in the absence of

grazing, crested wheatgrass stands organize into a statistically regular pattern when primarily influenced by intraspecific interference. In the presence of prolonged grazing, crested wheatgrass stands become more heterogeneous over time, likely a result of seedling mortality via cattle trampling.
Keywords: GPS, Grazing, interference, plant spatial patterns, shrub steppe

214. Quantifying resiliency in reserve networks
Authors: **RAYFIELD**, Bronwyn, McGill University; Marie-Josée Fortin, University of Toronto; Dean Urban, Duke University
Offered Presentations: Network Theory - Thursday, April 8: 1:20-1:40 - Q
Abstract: Resilient reserve networks are a desirable conservation goal because they have the capacity to maintain biodiversity over the long-term despite ongoing disturbances. Network resilience can be measured as the magnitude of disturbance that a network can absorb before changing its global structure or function. Here, we provide definitions of structural and functional resilience in reserve networks derived from graph, network, and circuit theories. Structural resilience focuses on the structural connectivity effects of disturbances that remove nodes and links. Functional resilience focuses on the consequences of network structural connectivity based on the function of desirable flows (e.g., seasonal migrations) and undesirable flows (e.g., spread of forest fires) within the network. We compare network statistics that differ with respect to the degree to which they incorporate concepts of resiliency such as route redundancy and route vulnerability. Resiliency network statistics are based not only on optimal routes but also alternative pathways through the network. We simulated landscape spatial patterns comprised of three landcover types (inhospitable matrix, hospitable matrix, and habitat) to examine the predictability of the network statistics given controlled changes in landscape composition and configuration. Network statistics that incorporated route redundancy and vulnerability were more sensitive to changes in the area and degree of fragmentation of each landcover type. Resiliency network statistics produced different rankings of reserve patches and links in terms of their importance in maintaining connectivity of the network. We conclude that incorporating concepts about reserve network resilience into conservation planning may lead to a re-prioritization of sites whose protection would best promote the persistence of biodiversity.
Keywords: circuit theory, graph theory, movement, resilience, robustness

216. Understanding schistosome spread: analytical methods for quantifying the role of environmental phenomena in the spread and control of Schistosoma japonicum
Authors: **REMAIS**, Justin, Emory University; Adam Akullian, UC Berkeley; Lu Ding, Sichuan Centers for Disease Control and Prevention; Edmund Seto, UC Berkeley
Invited Symposium: Pathogens in Heterogeneous Landscapes - Wednesday, April 7: 11:20-11:40 - Masters Hall
Abstract: Schistosomiasis has re-emerged in mountainous agricultural environments that had previously attained transmission control in central Sichuan Province, PRC. While it is clear that transmission in this region exhibits a strong response to environmental change, the underlying mechanisms shaping this relationship are unclear. In particular, little is known about how environmental change influences parasite spread. The spread of S. japonicum is mediated by flows in environmental media (e.g. surface water flow), dispersive intermediate hosts, and mammalian host movements through complex landscapes. Quantifying and predicting the degree to which environmental features facilitate or limit connectivity between target populations

remain substantial challenges, particularly in a re-emergent disease context. In western China, the relative importance of the transport of intermediate hosts or S. japonicum larvae through waterways in relation to other potential modes of schistosome spread, such as human and domestic animal movement, is unknown. This talk will introduce functional geospatial models, which we have used to analyze system connectivity in order to improve surveillance and control targeting in the presence of environmental heterogeneity.
Keywords: environmental change, intervention, schistosomiasis, surveillance, tropical disease

217. Biofuel harvests, coarse woody debris, and biodiversity – what we know and what we need to know
Authors: **RIFFELL**, Sam, Mississippi State University; Darren Miller, Weyerhaeuser NR Company; Jake Verschuyl, National Council for Air and Stream Improvement, Inc.; T. Bently Wigley, National Council for Air and Stream Improvement, Inc.
Invited Symposium: B-2 - Thursday, April 8: 2:40-3:00 - R
Abstract: Forest harvest operations often produce large amounts of harvest residue which typically becomes fine (foliage, small limbs and trees) and coarse woody debris (snags and downed logs). If removed at harvest, residual biomass has potential to be a local energy source and to produce marketable biofuel feedstock. But, CWD in particular serves critical life-history functions (e.g., breeding, foraging, basking) for a variety of organisms. Unfortunately, little is known about how forest biodiversity would respond to large scale removal of harvest residues. We calculated 693 biodiversity effect sizes from 25 studies involving manipulations of CWD (i.e., removed or added downed woody debris and/or snags). Diversity and abundance of both cavity- and open-nesting birds were substantially and consistently lower in treatments with lower amounts of downed CWD and/or standing snags, as was biomass of invertebrates. However, cumulative effect sizes for other taxa were not as large, were based on fewer studies, and varied among manipulation types. Little is currently known about biodiversity response to harvest of fine woody debris. Predicting the effects of biomass harvests on forest biodiversity is uncertain at best until more is known about how operational harvests actually change fine and coarse woody debris levels over long time periods. Pilot biomass harvests report post-harvest changes in CWD levels much smaller than the experimental changes involved in the studies we analyzed. Thus, operational biomass harvests may not change CWD levels enough to appreciably influence forest biodiversity, especially when following biomass harvest guidelines that require leaving a portion of harvest residues. Landscape ecology can help reduce this uncertainty by investigating how biodiversity responses scale from the small scale of manipulative experiments (i.e., 10-ha plots) to operational forest management and how biodiversity response to CWD levels might vary at different spatial and temporal scales and in different landscape contexts.
Keywords: biodiversity, biofuel, coarse woody debris, forest management

218. From habitat evaluation to landscape management: implementing landscape ecology in national resource assessments
Authors: **RIITTERS**, Kurt, US Department of Agriculture, Forest Service
Offered Presentations: Resource Management III - Thursday, April 8: 1:20-1:40 - V-W
Abstract: Natural resource policy and management are informed by national status and trends assessments of landscape patterns. This presentation describes the landscape pattern component of the Resources Planning Act (RPA) assessment as an evolution of landscape ecological thinking from an historical focus on wildland habitat evaluation to a current emphasis on

interdisciplinary landscape management in a world dominated by humans. The 2010 RPA assessment is based on three fundamental measures of pattern (density, mosaic, and structure), taken at multiple spatial scales from national land-cover maps, and summarized at landscape and sector levels for the grassland, shrubland, and forest sectors. A pattern forecasting model, integrated within a larger RPA scenario model, identifies probable hotspots of future pattern changes for three land use and population scenarios. The obstacles to implementing landscape ecological principles in nine national assessments over the past decade are illustrated by examples drawn from the RPA assessment (Forest Service), the State of the Nation's Ecosystems (Heinz Center), the Report on the Environment (EPA), and the Montréal Process (Roundtable on Sustainable Forests). The obstacles include biases towards particular causes or consequences of patterns, adherence to scale-contingent mental images, and a reluctance to employ data which are less detailed than one may be accustomed to. In a world dominated by human activities, the capability to produce and use meaningful national resource assessments of landscape patterns requires an interdisciplinary perspective at an appropriate scale, which has proven difficult to achieve in ecology.
Keywords: Assessment, Natural Resources, Pattern

219. Ecological Consequences of Forecasted Urban Growth Using Varying Land Use/Cover Datasets

Authors: **ROBINSON**, Kimberly, Purdue University; Bryan Pijanowski, Purdue University
Poster #48: Urban Ecosystems - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: As the number of people living in coastal zone states continues to grow, it is becoming increasingly important to understand how urban growth can affect both the hydrological and ecological functions of the region. Adding to the complexity of understanding these changes in coastal landscapes is the myriad of available land use/cover datasets, which may vary greatly based on collection and derivation methodologies. Thus, in this research study, we examine urban growth within the coastal zone states of Virginia, North Carolina, South Carolina, and Georgia. We answer the questions 1) How do differing land use/cover datasets affect urbanization forecasts?, 2) What do these differences mean for hydrology within the study region?, and 3) What do the resulting urbanization forecasts mean for ecosystem services and wildlife habitat patches?. Through the use of the Land Transformation Model (LTM2), we show that the extent of urbanization both observed historically and predicted in the future can vary dramatically as a result of chosen land use/cover datasets. Additionally, with the utilization of a simple hydrologic model, we show the potential significance of the datasets to both water flow and storage within the study region. Lastly, we focused our study on the analysis and discussion of possible implications of the forecasted urban growth on ecosystem services and the size, location, and connectivity of habitat patches.
Keywords: Coastal zone, Ecosystem Services, Land Transformation Model, Land use/cover change, urbanization

220. Forest dynamics following a severe bark beetle outbreak in Rocky Mountain National Park
Authors: **ROCCA**, Monique, Colorado State University; Matthew Diskin, Colorado State University; Carissa Aoki, Colorado State University; Kellen Nelson, Colorado State University; William Romme, Colorado State University
Offered Presentations: Invasion I - Tuesday, April 6: 1:40-2:00 - Y-Z
Abstract: Colorado has experienced a severe mountain pine beetle (Dendroctonus ponderosae)

outbreak that has caused widespread mortality of lodgepole pine (Pinus contorta) in over 800,000 forested hectares since 1996. Residents, visitors, and land managers are concerned about the fire hazard posed by beetle-killed trees, and about what will grow where vast lodgepole forests once stood. This project aims to forecast what the lodgepole pine ecosystem will look like 50-100 years following the mountain pine beetle outbreak. To this end, we have described the initial effects of the mountain pine beetle on residual stand structure, understory vegetation patterns, lodgepole pine cone serotiny, and tree regeneration. We define five different lodgepole pine forest types, and show how forest successional trajectories differ between these forest types. Even with anticipated future mortality, our results indicate that surviving trees are plentiful in most of the post-epidemic forests. The release of these surviving trees will likely be the principal mechanism for forest renewal. Lodgepole pine remains the dominant species in over 75 percent of stands. Minor to moderate increases in the relative abundance of non-host species have occurred in many areas, and approximately one-fifth of the landscape is now dominated by Engelmann spruce and subalpine fir. It appears that new lodgepole pine recruitment has not occurred since the onset of the beetle outbreak, nor has the viability of lodgepole seeds from serotinous cones declined in trees dead for 5 years. Our results will guide managers and inform scientists about the extent and severity of the ongoing outbreak. Relationships between canopy fuel structure, serotiny patterns, and pine seed viability will have direct implications for future lodgepole pine and mountain pine beetle management strategies.
Keywords: Disturbance, fire, mountain pine beetle, subalpine forests, succession

221. Land Cover-Based Phenology Derived from MODIS Time Series
Authors: **ROSS**, Kenton, SSAI/SSC; Joseph Spruce, SSAI/SSC; William Hargrove, USFS/EFETAC; Gerald Gasser, Lockheed Martin
Invited Symposium: C - Thursday, April 8: 3:20-3:40 - R
Abstract: This presentation discusses an approach to remote sensing phenology that uses ancillary information to extract phenologies of specific land covers. Given that many applications are specific to certain land covers that may be highly dissected across regional landscapes, it can be desirable to refine mapping of remote sensing wall-to-wall phenology so that it is also specific to targeted land cover types. This work uses MODIS time series data processed using the Time Series Product Tool and the Phenological Parameters Estimation Tool, both developed at Stennis Space Center, to produce phenological information differentiated by standard land cover datasets like the National Land Cover Database. Land cover-based phenologies were generated for both forestry and agricultural applications over the MODIS era. For the forestry application, the approach is applied to Western U.S. forests in the Colorado Front Range, currently affected by mountain pine beetle damage. For agricultural applications, the approach is applied to changing planting patterns for maize across the Central United States. Initial results suggest that seasonal "signatures" for specific land cover types are obtained that would otherwise be obscured. This may provide new inputs for modelers and decision makers.
Keywords: land cover, MODIS, phenology, remote sensing

222. Wormsloe: Preserving a Cultural, Historical and Landscape Legacy on a Coastal Georgia Plantation
Authors: **ROSS**, Sarah, Wormsloe Institute for Environmental History
Invited Symposium: Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History, Isle of Hope, Georgia - Tuesday, April 6: 10:00-10:20 - K-L

Abstract: Wormsloe: Preserving a Cultural, Historical and Landscape Legacy on a Coastal Georgia Plantation Sarah V. Ross Wormsloe Institute for Environmental History Savannah, Georgia University of Georgia Athens, Georgia 30602 sarahvross@gmail.com This presentation will be part of the "Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History on the Isle of Hope, Georgia" Symposium. The Wormsloe Institute for Environmental History and the Wormsloe Foundation are devising a long-term plan for the ownership, protection, management and use of the historic Wormsloe estate. The goals of the project are to achieve financial sustainability, provide opportunities for research onsite, generate a significant public benefit from the use and interpretation of the property, and integrate with programs at the adjacent Wormsloe Historic Site operated by the Georgia Department of Natural Resources. Wormsloe Plantation is the oldest of Georgia's tidewater estates. Claimed and developed by founding Georgia colonist Noble Jones in the mid 1730s, it has remained in the hands of the same family. Located approximately ten miles southeast of Savannah's historic district, Wormsloe occupies a portion of the Isle of Hope peninsula, which lies along the Intracoastal Waterway surrounded by saltwater marsh. Wormsloe's long history, which includes Native American, Colonial, American Revolution, plantation era, Civil War, and reconstruction, is uniquely complemented with an unrivaled collection of books and manuscripts related to Georgia history. These historical events and associated artifacts are linked with the ecologically important, and biologically diverse, landscape. Efforts to conserve the site are aided by an integrated and interdisciplinary approach to ecological, historical and archaeological research. To be presented at the US-International Association for Landscape Ecology (IALE) symposium on Wormsloe entitled, "Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History on the Isle of Hope, Georgia". April 5-9, 2009, Athens, Georgia. Keywords: Conservation, Environmentalism, historical

223. Putting Humans Back into the Ecosystem: Ecosystem Services
Authors: **RUSSELL**, Marc, US EPA; Jim Harvey, US EPA; Darrin Dantin, US EPA; Federico Alvarez, US EPA
Offered Presentations: Landscape Aesthetics II - Thursday, April 8: 2:00-2:20 - F-G
Abstract: Humans live in, influence, pressure, and benefit from ecosystems in many ways. In many places human presence dominates the landscape, especially in urban and agricultural settings. It is difficult to find a place on earth that is not affected in some way by humans. Thus, the definition of ecosystem must include humans along with the rest of the fauna and flora. Humans have often been thought of as an extrinsic source of stress on ecosystems, but any ecosystem-level stress that human actions cause ultimately feeds back through multiple and often complex interacting pathways to change the benefits humans derive from their surroundings. These benefits include, but are not limited to, water, food, protection from flooding, and recreational opportunities. The concept of ecosystem services has been recently embraced as a way to place humans back into the ecosystem, making human stress on ecosystems intrinsic, and closing the feedback loops that link human actions to human costs and benefits from ecosystems. Mapping of ecosystem functions and the ecosystem services they provide to humans is essential in making this information available to the public, public representatives, and scientists. This information provides both the current inventory of services provided by a place and a baseline inventory for predictive models of future production of ecosystem services given human development and climate change scenarios. We present mapped inventories of ecosystem functions for the Tampa Bay, FL watershed and show how these baseline maps are being used as

an education and outreach tool to help place humans back into the "natural" ecosystem.
Keywords: Ecosystems, Functions, Humans, Maps, Services

224. Mapping riparian zones in arid regions using a spatially explicit process-based approach
Authors: **SALO**, Jessica, Colorado State University; David Theobald, Colorado State University; Tom Brown, USFS, Rocky Mountain Research Station
Offered Presentations: Resource Management II - Tuesday, April 6: 4:00-4:20 - F-G
Abstract: Riparian ecosystems are among the most biological diverse, productive, and most threatened ecosystems in many arid regions. However, mapping the location of riparian areas is difficult due to the narrow extent of riparian zones. We have developed a spatially explicit process-based model to improve upon previous approaches to map riparian ecosystems. We incorporated hydrologic and sediment yield data, landscape-level data on valley type and land cover/use, and fine grain data on land cover/use in riparian areas to model riparian ecosystems based on ecological processes in upslope, riparian, and in-channel zones. Fine scale land use modifications within riparian zones were interpreted from aerial photography from the National Agriculture Imagery Program (NAIP) at randomly located "chips" (600 x 600 m plots), selected using a probability based sample design. Within each chip, 300 randomly placed points were classified into three categories: existing riparian zone, human modified riparian zone, and upland. Classification and regression tree [CART] models were used to predict riparian location. The response variable was the riparian classification from collected point data. Predictor variables included landscape level data such as land use, valley and stream type, distance to upstream dams and diversions, streamflow, and sediment data. We demonstrated our modeling approach on the Big Thompson watershed in Colorado, which contains a mixture of land uses that are representative of the mountainous west.
Keywords: mapping ecosystems, proccess based model, riparian

225. Contrasting ecology and culture in Mediterranean ecosystems of Portugal and California
Authors: **SANTOS**, Maria, University of California Davis; James Thorne, University of California Davis; Susan Ustin, University of California Davis
Offered Presentations: Sustaining Systems - Thursday, April 8: 2:00-2:20 - T-U
Abstract: Oak woodland persistence in Portugal and California may only be possible through the integration of both human and natural components. In this study we assessed how socio-economic systems (SES) and ecological requirements of wildlife species are linked to oak woodlands of Portugal and California. More specifically, we (1) applied the SES framework to four resources provided by oak woodlands: forestry, rangeland, agriculture and natural areas; (2) spatialized SES information into predictive models of wildlife presence using remote sensing data; and (3) analyzed how sensitive these resources are to future changes in land use and climate. We found that in both regions the sustainability of extractable resources may be threatened by replacement rate, land-use history, and interdependence with other resources. The non-extractable resources (natural areas themselves) are more susceptible and sustainable management is dependent on the voluntary nature of collective-choice rules. Inclusion of the SES spatial context of all four resources into models of wildlife presence produced the most parsimonious models, as the wildlife species responded to the heterogeneity of resource availability rather than to one resource alone. In addition, inclusion of productivity and stress parameters further improved the predictions of wildlife presence. These results demonstrate that the persistence of oak woodland SES's is tightly linked with the persistence of current land use

and productivity patterns, and changes in any of these parameters is likely to affect natural and human communities depending on them.

226. MODIS Daily and Gap Filled Nadir Reflectances for Regional Phenological Studies

Authors: **SCHAAF**, Crystal, Center for Remote Sensing, Boston University; Yanmin Shuai, Center for Remote Sensing, Boston University; Feng Zhao, Center for Remote Sensing, Boston University; Zhuosen Wang, Center for Remote Sensing, Boston University; Xiaoyang Zhang, Earth Resources Technology, Inc.

Invited Symposium: A Land-surface Phenology: A View Through the Lens of Vegetation - Thursday, April 8: 10:20-10:40 - R

Abstract: For a decade now, albedo and nadir view-angle corrected reflectances have been produced from the Moderate Resolution Imaging Spectroradiometer (MODIS) instruments currently in orbit on NASA's Terra and Aqua satellite platforms. These products are produced by fitting a Bidirectional Reflectance Distribution Function (BRDF) model to all high-quality, multiangle, multispectral, clear-sky, atmospherically-corrected surface reflectances available over a multiday period. At present the operational product (MCD43A) is produced at a 500m spatial grid every 8 days (using 16 days worth of data) and are used for a number of modeling efforts. In particular, the global Nadir BRDF-adjusted Reflectances (NBAR) (and vegetation indices derived from them) are used as the primary input to both the MODIS Land Cover and the Land Cover Dynamics phenology product. Recently however, several value-added products have been produced to aid in regional monitoring and modeling efforts. Global gap-filled snow-free products in both a tiled 500m resolution at a sinusoidal projection and in a global 30arc second resolution at a global geographic projection have been produced. As these gap-filled products have been produced through temporal interpolation of the high-quality operational BRDF retrievals, albedo and NBAR measures for user-specified solar angles can produced (in addition to the standard values at local solar noon). In addition to the gap-filled snow-free products, a daily rolling version of the algorithm has also been developed to allow Direct Broadcast users the ability to attempt a retrieval every day. While informed by the multiday BRDF model, this daily acquisition emphasizes the most recent observation and allows daily monitoring of rapid surface radiation and land surface change phenomena such as crop development and forest foliage cycles. This algorithm can also be tuned and optimized for specific ecological and climatic regimes.

227. Fire and Carbon Cycling in the New Jersey Pine Barrens as a Consequence of Actual and Potential Forest Management

Authors: **SCHELLER**, Robert, Portland State University; Steve Van Tuyl, USDA Forest Service; Kenneth Clark, USDA Forest Service; John Hom, USDA Forest Service; Inga La Puma, Rutgers University

Offered Presentations: Network Theory - Thursday, April 8: 2:40-3:00 - Q

Abstract: Increasingly, individual states are passing legislation to limit state-wide carbon emissions. In New Jersey, such legislation includes maintaining or increasing the amount of carbon sequestered in terrestrial ecosystems, primarily forests. Accounting for natural disturbances which result in greenhouse gas emissions is a necessary component of any plan to manage terrestrial carbon sequestration in forests. However, determining the effects of

disturbances on carbon sequestration is difficult given the complexity of interactions between natural disturbances, succession, and the terrestrial carbon cycle. We estimated the trajectory of total carbon sequestration, including forest soil carbon, as a consequence of wildfires and contemporary forest management in the New Jersey pine barrens (NJPB). To do so, we used the LANDIS-II succession and disturbance model combined with an extension derived from the Century soil model and which estimates above and belowground C dynamics at a monthly time step. The model was calibrated and validated using eddy flux tower and FIA data. We also estimated the effects of two fuels management scenarios: 1) an increase in prescribed fire in Wildland Urban Interface areas of the NJPB and, 2) a reduction in response time to fires as an indicator of reduced staffing in the state wildland fire fighting service. Our results suggest that minor changes in forest management as simulated will not have large effects on C budgets in the NJPB over the next 100 years. Furthermore, our simulations suggest that the NJPB will continually accrue C over the next 100 years although the rate will be subject to inter-annual variation in precipitation and wildfires. We hypothesize that this long-term C accrual is a result of repeated logging and fires over the past 200 years from which these forests are still recovering. Future research will investigate the effects of insect defoliation and climate change on C budgets.
Keywords: carbon sequestrtion, LANDIS-II, New Jersey, pine barrens, wildfire

229. Biofuels, Connectivity, and Wildlife: Building on a Shaky Foundation
Authors: **SCHOOLEY**, Robert, University of Illinois; Bradley Cosentino, University of Illinois
Offered Presentations: Distribution I - Tuesday, April 6: 11:20-11:40 - Y-Z
Abstract: Increased production of biofuels has the potential to greatly alter agroecosystems. In the Midwestern USA, where the landscape is dominated by corn and soybean, perennial grasses such as switchgrass and Miscanthus are being evaluated as additional bioenergy crops. Our understanding of how animal biodiversity might respond to these biofuels is limited. Emphasis has been on use of these crops as resource patches, especially for birds. We contend that many wildlife species will not use these biofuel crops as primary habitat, and thus the emphasis should be changed to how switchgrass and Miscanthus will affect functional landscape connectivity, particularly for non-volant species. Unfortunately, we lack a mechanistic understanding of movement behavior for most species in relation to current landcover types, corn and soybean, which often are lumped together as row-crop agriculture. We provide examples of differential movement resistance provided by corn and soybean including dispersal by tiger salamanders directed by habitat-specific desiccation risk. Ultimately, predicting broad effects of biofuels on biodiversity will require information on spatially-explicit landscape transitions to drive models of landscape connectivity. In agroecosystems, quantifying connectivity is further complicated by the temporally dynamic nature of the landscape features.
Keywords: agroecosystem, biofuels, connectivity, movements

230. Agronomic, Environmental, and Economic Performance of Alternative Biomass Cropping Systems
Authors: **SCHULTE MOORE**, Lisa, Iowa State University; Theo Gunther, Iowa State University; Richard Hall, Iowa State University; Arne Hallam, Iowa State University; William Headlee, Iowa State University; Emily Heaton, Iowa State University; Matt Helmers, Iowa State University; Kirsten Hofmockel, Iowa State University; Tom Isenhart, Iowa State University; Randy Kolka, US Forest Service Northern Research Station; Ken Moore, Iowa State University;

Todd Ontl, Iowa State University
Invited Symposium: Reshaping Landscapes: Bioenergy and Biodiversity - Thursday, April 8:
10:20-10:40 - K-L

Abstract: The U.S. is embarking on an aggressive agenda to reduce dependency on fossil fuels. In response, the demand for biofuel feedstocks will continue to grow into the foreseeable future. While grain-derived ethanol will meet much of the initial need, cellulosic materials are expected to comprise at least a portion of biomass feedstocks and provide a more sustainable solution. We seek to develop a portfolio of cellulosic bioenergy feedstocks that together are productive, profitable, and mitigate the negative impacts of traditional bioenergy crops on the environment. We accomplish this goal through a randomized, replicated experiment comparing five cropping systems across five landscape positions. The experiment was initiated in fall 2008 and is a collaborative effort involving ecologists, agronomists, hydrologists, and economists. We are collecting data on energy and fertilizer inputs, grain crop yields, below ground processes, and standing biomass levels to evaluate economic and agronomic performance. Environmental performance is being assessed using a suite of metrics used to quantify changes in water and soil quality, greenhouse gas emissions, and carbon and nitrogen pools and fluxes. Results on biomass production and variation in soil and water quality by landscape position are forthcoming from this first year's efforts. In summer 2010 we will also measure greenhouse gas emissions and carbon and nitrogen pools and fluxes. Proper siting of these cropping systems across agricultural landscapes will allow producers to maximize agronomic and economic performance while maintaining higher levels of environmental performance compared to a single cropping system.
Keywords: Agriculture, Biomass productivity, Ecosystem Services, Targeting

231. Forecasting changes in water quality and aquatic biodiversity in response to future bioenergy landscapes in the Arkansas-White-Red River basin

Authors: **SCHWEIZER**, Peter, Oak Ridge National Laboratory; Henriette Jager, Oak Ridge National Laboratory; Latha Baskaran, Oak Ridge National Laboratory

Invited Symposium: Reshaping Landscapes: Bioenergy and Biodiversity - Thursday, April 8:
11:20-11:40 - K-L

Abstract: Landscapes with intensive agriculture often contribute to poor water quality and lower aquatic biodiversity. Future projections made by an economic model (POLYSYS) suggest that the dedicated energy crop, perennial switchgrass (Panicum virgatum) will replace pasture and conventional crops in agricultural landscapes of the Arkansas-White-Red River Basin (AWRRB). Little is known about the potential impact of projected landscape shifts on water quality and biodiversity. In this study, we used the Soil and Water Assessment Tool (SWAT) to forecast how alternative bioenergy futures will influence water quality and species richness of native fish and freshwater mussels. We used Poisson regression to model species richness based on occurrence data reported by NatureServe for 8-digit USGS hydrologic units (HUC8), and SWAT-projected water quality. Richness was expressed as a function of river discharge, elevation, HUC8 position within the AWRRB, area in agriculture, number of dams, and SWAT-predicted annual loadings of nutrients and sediment. Alternative models with subsets of predictor variables were compared using information-theoretic criteria. We identified environmental gradients in flow and river discharge as the strongest predictors of species richness in aquatic biota. Water quality predictions suggested that the cultivation of switchgrass may reduce nutrient and sediment loads in drainages dominated by agriculture, and thereby lessen adverse effects on

aquatic biodiversity.
Keywords: biodiversity, bioenergy, switchgrass, water quality

232. Differences in aesthetic landscape preference between natives and immigrants.
Authors: **SEVENANT**, Marjanne, Ghent University
Offered Presentations: Landscape Aesthetics I - Tuesday, April 6: 4:40-5:00 - K-L

Abstract: Actual landscape policy endeavours to manage and design inclusive landscapes, which reflect the aspirations of the general public. This idea is also embraced in the definitions and measures of the European Landscape Convention (Council of Europe, 2000). In Western countries, the general public covers a broad diversity, characterized by various ethnicities. Migration has induced different degrees of familiarity with landscapes in the hosting country. Research on the consequences for landscape perception and preference is limited. In the present paper, the mechanisms determining aesthetic landscape preference are compared between native and immigrant population in the city of Ghent (Flanders, Belgium). Latent preference class analysis is applied to investigate whether and how individual background variables, both socio-economic and socio-cultural, determine landscape preference. In the mixed sample, combining both native and immigrant respondents' samples, the preference differences that emerge are not related to ethnicity. The separate analysis of the Turkish response yields subtle yet significant differences. Compared to native Belgians, Turkish migrants have their aesthetic landscape preference more determined by care and disturbance and less by naturalness and typicality. Contrary to the Belgian respondents, Turkish respondents are unanimous as regards the appreciation of naturalness and urbanization and not as regards valuation of openness. This can be explained by their cultural background. Yet, the immigrant population is not a homogeneous monolith. Apart from behaviour-related variables, also gender and acculturation level gives variation in the appreciation of the surrounding landscape in their hosting city. All this illustrates the need to diversify and try to include as much as possible different population sub-groups when pursuing participatory management in landscape policy.
Keywords: acculturation scale, landscape dimensions, Latent class regression , New Ecological Paradigm (NEP), panoramic photographs

233. USIALE and Challenges of a New Scientific Association
Authors: **SHARPE**, David, Department of Geography
Invited Symposium: US-IALE Presidents' Symposium I - Tuesday, April 6: 10:00-10:20 - Masters Hall

Abstract: David M Sharpe served as the first USIALE President, 1986-1988. On the eve of establishing USIALE, European ecologists and perspectives dominated landscape ecology. USIALE had significant challenges. The first was to attract scientists from diverse disciplines who, together, could address the complexities of landscapes and design research based on ecological theory and developments in ecology emulating from North American. A few geographers and landscape planners were among early members, but most were biological scientists. As landscape ecology has matured, it has become increasingly interdisciplinary. A second challenge was to develop an appropriate research agenda and methods and technologies. Landscape Ecology (Forman and Godron, 1986), a classic book, was not yet published. Spatial-modeling tools and databases were in their infancy. For example, ARC INFO had been released in 1982, but PC ARC INFO was a year away. Satellite imagery was either unavailable or lacked the time series needed to study changes in landscape structure. The National Aerial Photography

Program was just getting underway, so time series was developed through time- and labor-intensive interpretation of older sources. A third challenge was to translate insights from research in landscape ecology into environmental policy. Over the past three decades, findings based on the integration of ecological science and environmental economics have made quantitative assessments of ecosystem services become a driving force for changes in environmental policy. Landscape ecology has sensitized policy makers to such issues as habitat fragmentation, and how landscape patterns contribute to ecosystem services.
Keywords: Ecosystem Services, European perspectives, Interdisciplinary research aga, Spatial modeling, USIALE first president

234. The use of a long-term data set to decipher woody species composition patterns in an urban forest network
Authors: **SHIERK**, Clifford, University of Illinois at Chicago; Emily Minor, University of Illinois at Chicago; Scott Kobal, Forest Preserve District of DuPage County, Illin; Wayne Lampa, Forest Preserve District of DuPage County, Illinois
Poster #51: Urban Ecosystems - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Urban forests play an ecologically important role for maintaining biodiversity in urban areas by serving as habitat patches for both plants and animals in a fragmented landscape. Due to the surrounding land use and anthropogenic disturbances, the introduction of exotic species and potential for biological invasion often threaten to degrade the habitat suitability of these forests. As such, an important research question remains: How do management techniques, local environmental variables, and landscape characteristics affect species composition and the presence of exotic species in urban forests? Since 1979, land managers have been tracking the composition of plant species within 35 1-acre plots located throughout DuPage County Forest Preserves, which are located immediately west of Chicago in northeastern Illinois, USA. A large majority (88%) of the plots are oak-dominated woodlands, with canopy trees composed primarily of oak species but understory trees chiefly comprised of cherry, ash, elm, maple, and other native and exotic species. Over the last several decades, exotic tree species have appeared in approximately one-half of the forest plots, and a variety of management techniques have been used, ranging from intensive (clearing and prescribed burning) to none at all. We used multivariate statistical approaches to examine trends in community composition and exotic species invasions in each plot. While management practice was an important factor affecting community composition, local environmental variables (e.g., soil type) and landscape characteristics (e.g., distance to roads) were also useful predictors of species distributions.
Keywords: exotic species, land cover, land management, Urban Forest, urbanization

235. Quantifying dynamic human footprint: Do landscapes exhibit a legacy of sprawl?
Authors: **SHOEMAKER**, Douglas, Center for Applied GIScience at UNC Charlotte; Ross Meentemeyer, Center for Applied GIScience at UNC Charlotte
Poster #46: Urban Ecosystems - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: The encroachment of urbanization on natural and agricultural landscapes is an acknowledged threat to ecosystems and to the sustainability of the essential functions they provide. High impact patterns of disjunct and low density development, pejoratively know as sprawl, are conceptualized in classic urban growth theory as a dynamic and ephemeral condition that is transformed to "non-sprawl" with densifying inputs of population and infill. Recent evidence suggests that sprawling patterns resist densification, and are in fact increasing at a pace

greater than population growth. We evaluated these hypotheses by conducting a longitudinal study of per-capita land consumption, or human footprint (HF), at four decadal time steps in a rapidly urbanizing metropolis. From historical satellite imagery we mapped urban growth in the Charlotte (NC) metropolitan region and integrated derived settlement patterns with concurrent population estimates to quantify a generalizable, spatially explicit HF metric over the large, heterogeneous region. Remote sensing analysis revealed over 340,000 ha of forest and farmlands were converted to development between 1976 and 2006, increasing the built environment to 22% of the non-water area. Lands converted at a mean rate of 31 ha per day, outpacing population growth 10 to 1. On average inhabitants of the region used 400% more land in 2006 than in 1976, with HF increasing from 0.07 to 0.366 ha per person during the period. Growth and sprawl are related but different: Apportion methods estimate only 36% of area converted was attributed to population growth, with 74% attributed to sprawling consumption patterns. Repeated measures analysis of HF found areas with high antecedent values resisted densification and rose faster than other areas. These results suggest there is a legacy of persistent sprawl-indicated pattern, and that additions of infill and new development have not been accompanied by proportional increases in population, resulting in increased HF values regionally.
Keywords: per capita land consumption, sprawl, urbanization

236. Habitat and Biodiversity Consequences of Future Urban Growth Scenarios in Greater Orlando
Authors: **SIM**, Sunhui, Florida State University
Offered Presentations: Urban Ecosystems - Thursday, April 8: 3:20-3:40 - K-L
Abstract: Urban growth is widely regarded as an important driver of environmental and social problems. It causes the loss of informal open space and wildlife habitats. Given the explosive growth of the Greater Orlando, the methods are needed to model the dynamics of urban systems and their relationships with vulnerable ecological habitats. This study explores the consequences of alternative scenarios of urban growth change on the abundance and arrangement of potential habitat for a suite of species in the Grater Orlando. Scenarios of land cover change are projected using a rule based GIS urban growth model with different growth constraints. These scenarios were developed based on different goals (such as Compact—within current spheres of influence and Agriculture Protection—prime agriculture area masked) and produced vastly different outcomes. The spatial patterns of forecasted development were then compared to several biodiversity response variables that included landscape pattern metrics and species habitats. Potential habitat is defined for each species and spatial pattern of potential suitable habitat for each species is analyzed by suitability analysis. The results will integrate remote sensing and GIS to provide better insight into the spatial-temporal urban dynamics associated with urban growth and its environmental repercussions.
Keywords: biodiversity, Habitat, Orlando, Species Modeling, Urban Growth

237. Fusion of LiDAR and Landsat Imagery for Regional Analysis of Land Use along Urban-Exurban Gradients
Authors: **SINGH**, Kunwar, University of North Carolina at Charlotte; Douglas Shoemaker, University of North Carolina at Charlotte, Charlotte; Ross Meentemeyer, University of North Carolina at Charlotte, Charlotte
Offered Presentations: Remote Sensing - Thursday, April 8: 11:20-11:40 - F-G
Abstract: The vertical dimension of Earth's surface, provided by Light Detection and Ranging

(LiDAR), is a frontier for remote sensing applications in landscape ecology. While found useful for measuring variability in plant community structure at local scales, LiDAR has been largely underutilized for mapping spectrally similar land use types over large regions due to sparse coverage and computational logistics. However, forests, farmlands, and managed clearings are notoriously difficult to discriminate in large, heterogeneous landscapes using moderate-resolution multi-spectral satellite imagery. We examined the hypothesis that integrating vertical components of LiDAR with Landsat TM imagery improves discrimination among these land use types and increases classification performance. We evaluated the relative contribution of LiDAR vertical components to classification accuracy by comparing analyses of TM, LiDAR, and LiDAR-TM fusion along urban-exurban gradients in the rapidly urbanizing region of Charlotte, NC. To identify optimal spatial resolutions for regional-scale analyses, we classified LiDAR and LiDAR-TM data at 1m, 5m, 10m, 15m and 30m resolutions using supervised maximum likelihood (ML) and classification and regression tree (CART) methods; TM was classified at 30m using the same methods, resulting in 22 models for comparison. ML classifications of LiDAR-TM fusions showed average increases in overall accuracy of 10% over TM alone and 23% over LiDAR along. ML classification of LiDAR-TM fusions produced the greatest overall accuracies at 1m, 5m, 10m and 15m resolutions (kappa coefficients of 0.86, 0.83, 0.82 and 0.80, respectively). Producer's accuracies for forest, farmland, and managed clearings increased from 79% to 96%, 82% to 90%, and 62% to 72%, respectively. NDSM, a LiDAR derivative that measures absolute elevation of features relative to the earth's surface, explained over 50% of the variability across all models. We conclude that integration of LiDAR and multi-spectral TM data significantly improves discrimination among spectrally similar land cover/use types over large regions.
Keywords: CART classification, Heterogeneous landscapes, kappa coefficient, LiDAR, Maximum likelihood classificat

238. Spatial nonstationarity in the relationships between bird species richness and environmental determinants in Cuyahoga Valley National Park
Authors: **SKERL**, Kevin, National Park Service
Offered Presentations: Distribution II - Wednesday, April 7: 10:40-11:00 - Q
Abstract: The relationships between bird species richness patterns and their underlying habitat and environmental determinants are often analyzed using regression methods which generate 'global' regression coefficients that are assumed to apply equally across the landscape. However, these relationships may actually vary across space, exhibiting spatial nonstationarity. Under these conditions, bird conservation and habitat management decisions based on traditional global models may be misdirected. Geographically weighted regression (GWR) allows model parameters to vary over space and may therefore be useful in evaluating this issue. In this study, we compare ordinary least squares (OLS) and GWR models of the relationships between forest specialist bird species richness and a set of environmental determinants in Cuyahoga Valley National Park, Ohio. Bird point count and vegetation surveys were conducted in 2001-2 at 345 unique sample points distributed in forest habitat. OLS and GWR models of forest specialists species richness using a suite of vegetation (canopy height and total vertical foliage density) and landscape variables (% slope, % forest cover within 100m, and distances to forest edge, fields, roads and trails) were evaluated. GWR models outperformed all OLS regression models in explanatory power and had lower corrected AIC values. GWR revealed that explanatory power and the influence variables exhibited significant spatial nonstationarity including large areas of

insignificance (e.g., explanatory power ranged from 2%-63% in the model considering distance to edge and slope as independent variables). GWR has been used to examine bird species richness patterns over national and international scales but this study indicates it may also aid in the management of these species at the level of a protected area. Future modeling of forest habitat suitability, predictions of bird distributions, and identification of habitat management priorities will be improved if spatial nonstationarity is addressed through the use of GWR methods.
Keywords: avian ecology, GWR, habitat suitability models, national park, nonstationarity

239. Estimating the effects of land-use change associated with biofuel production on ecosystem services related to biodiversity: EPA's future Midwestern landscapes study.
Authors: **SMITH**, Elizabeth, National Exposure Research Laboratory U.S. EPA; Megan Mehaffey, US Environmental Protection Agency; Rex Johnson, US Fish and Wildlife Service; Brad Potter, US Fish and Wildlife Service; Andy Bishop, US Fish and Wildlife Service
Invited Symposium: Reshaping Landscapes: Bioenergy and Biodiversity - Thursday, April 8: 10:00-10:20 - K-L
Abstract: EPA's Office of Research and Development is looking at the impacts of the current energy policy (Energy Independence and Security Act – EISA) versus a hypothetical "Multiple Services Incentive Policy (MSIP)" in terms of changes to the midwestern landscape and implications for wildlife habitat and associated ecosystem services in the year 2022 (when the EISA expires). The Future Midwestern Landscapes (FML) Study includes 12 states in the upper Midwest, and is designed to inform decision-makers as to the trade-offs associated with land management decisions. Detailed landscapes representing a base year (2001/2002 National Land Cover Database with crop management detail added from the National Agricultural Statistical Survey), the 2022 Biofuels Targets (based on economic modeling of crop acreages combined with soils and tillage practices to disaggregate spatially), and the 2022 MSIP. Through collaboration with the US Fish and Wildlife Service, assessments of changes in available habitat and implications for individual species populations will allow evaluations of changes in services associated with biodiversity existence value and recreational aspects of wildlife viewing and hunting.
Keywords: biofuels, Midwest

240. Urban Foodshed Assessment and Landscape Scenarios in Madison, Wisconsin
Authors: **SMITH**, Vincent, University of Wisconsin-Madison; Janet Silbernagel, University of Wisconsin-Madison; John Harrington, University of Wisconsin-Madison
Offered Presentations: Urban Ecosystems - Thursday, April 8: 4:00-4:20 - K-L
Abstract: Urban agriculture is emerging in the U.S. and in other developed countries as a key feature of community food security, urban greening, economic development, urban metabolic cycling, and other urban re-development initiatives. Continued investment in urban agriculture has the potential to impact community food production as well as alter urban land use, urban composition, and urban function. The purpose of our current research is to explore the current role and future potential of home gardens, community gardens, and urban farms to contribute to community food needs in the Madison, WI Urban Area. The direct benefit of community food production and its impact on land use composition and configuration has implications for those concerned with community resilience and "sustainability". We discuss the development of landscape scenarios based on interviews with urban agriculture experts and practitioners in the

Madison area. We identify influencing factors and barriers to community food production. Narratives cluster into several distinct scenarios and futures with distinct implications for the composition and configuration of agriculture on the urban landscape. Finally, the role of socially constructed narrative in the development of landscape scenarios for explicit spatial analysis and in policy development will be discussed.

Keywords: alternative futures, foodshed, scenarios, Urban Agriculture, urban ecosystems

241. Sustainable forest land use planning: A framework applying a multicriteria - multiobjective analysis as base of a spatial decision support system. A case study in Salta province, NW Argentina.

Authors: **SOMMA**, Daniel, INTA-Instituto Nacional de Tecnología Agropecuaria-Argentina; Jose Volante, INTA-Instituto Nacional de Tecnología Agropecuaria-Argentina; Leo Lizarraga, Administracion de Parques Nacionales; Miguel Boasso, INTA-Instituto Nacional de Tecnología Agropecuaria-Argentina; Cecilia Morales, INTA-Instituto Nacional de Tecnología Agropecuaria-Argentina; María Jesus Mosciaro, INTA-Instituto Nacional de Tecnología Agropecuaria-Argentina; Silvana Castrillo, INTA-Instituto Nacional de Tecnología Agropecuaria-Argentina; Martin Abdo, Ministerio de Agricultura de la Nación; Javier Ramos, Universidad Nacional de Salta; Juan Zamora, INTA-Instituto Nacional de Tecnología Agropecuaria-Argentina

Offered Presentations: Sustaining Systems - Thursday, April 8: 2:40-3:00 - T-U

Abstract: A land use planning process was performed considering the forests regions of Salta province. It was accomplished to determine the best areas and its potentials for: watershed conservation, natural processes maintenance, forest conservation, forest sustainable production, and also, to prioritize areas for agriculture - ranching. We defined four areas of analysis as principal criteria of a multicriteria - muliobjective spatial decision support system: 1) watershed conservation, 2) nature conservation, 3) agriculture-ranching suitability, and, 4) peasant communities-aboriginal people lands. Each criterion included hierarchically some subcriteria. These principal criteria were not considered as having equal relevance. We focused on watershed conservation as the principal criterion and highest hierarchical driver for zoning (including hierarchically sub criteria: roads density, stream corridors, etc.). As a second hierarchical level we considered a multiobjective land allocation (MOLA) analysis. It was designed including two of the principal criteria performing an iterative selection of the best areas for 2-nature conservation and 3-agricultural - ranching suitability. This was based on two previous multicriteria analysis that prioritized areas for nature conservation and, similarly, areas for agriculture-ranching development. At the end, we performed (as the fourth criterion) a social survey to design a spatial mask. This mask served to exclude zones of occupation and traditional use for peasants and aboriginal peoples. We defined and analyzed forty-two (42) watersheds of second level. 11 were uncapable to provide aditional agricultural land. In the others 31 different possible ratios of conversion were founded related with thresholds of possible deforestation considering the watershed hydrological sustainability and resulting new areas for agricultural-ranching expansion. Then, based in: watershed conversion ratio and masked the social survey areas, the MOLA spatially determined the best areas for conservation and agriculture - ranching. Our approach includes a conceptual foundation and flexible spatial answers. This flexibility is valuable when the definitions stage occurs.

Keywords: biodiversity conservation, forest planning, Land use planning, multicriteria analysis, watershed conservation

244. Use of Multi-Year MODIS Phenological Data Products to Detect and Monitor Forest Disturbances at Regional and National Scales

Authors: **SPRUCE**, Joseph, Science Systems & Applications, Inc.; William Hargrove, USDA Forest Service; Gerald Gasser, Lockheed Martin Civil Programs; James Smoot, Science Systems & Applications, Inc.; Kenton Ross, Science Systems & Applications, Inc.

Invited Symposium: C - Thursday, April 8: 3:40-4:00 - R

Abstract: This presentation discusses an application of MODIS phenological data products to detect and monitor forest disturbances at regional and national scales. Forest phenology products have potential for providing unique information on forest health status. Such phenology products are being used by the U.S. Forest Service to develop a national forest threat early warning system. We initially computed a 250-meter vegetation phenological database from Collection 5 MODIS Aqua and Terra MOD13 NDVI time series data for 2003 through 2008. This product line enabled annual per-pixel estimates of NDVI magnitude and day of year for the left minimum, left 20%, left 80%, growing season maximum, right 80%, right 20%, and right minimum of each growing season. Cumulative NDVI products were also computed at 16-day intervals for each sampled year. Phenology parameters were then processed into forest disturbance detection products: Baseline imagery for each phenological parameter was computed from the maximum, mean, or median per pixel value of that parameter across the 2003-2008 time series. For each parameter, baseline imagery was stacked with corresponding annual year products to compute forest disturbance detection products. The latter were then compared to available geospatial data on known disturbance events. Preliminary results suggest that phenology products can provide unique information on changes in forest conditions. For example, 20% left NDVI products enabled visualization of evergreen forest disturbances from hurricanes. Cumulative NDVI products were used with eMODIS expedited NDVI data to generate 2009 forest disturbance detection products during the growing season. End of year MODIS cumulative NDVI products enabled detections of forest disturbances associated with multi-year drought and hurricanes. Forest stand replacement disturbance generally altered the expected behavior of all phenology products that were tried. Ephemeral disturbance can impact phenological parameters of affected forested areas for a given year but does not usually persist in subsequent years.
Keywords: Disturbance, Forest, MODIS, NDVI, phenology

246. Urbanization influences the spread of exotic plants and persistence of native plant diversity
Authors: **STEPHENS DAVIS**, Amy, University of North Carolina at Charlotte; Ross Meentemeyer, University of North Carolina at Charlotte
Offered Presentations: Invasion II - Tuesday, April 6: 4:00-4:20 - Y-Z
Abstract: Land use change and invasions by exotic species are widely recognized as the primary drivers of biodiversity loss. However, few studies have focused on how landscape structure of rapidly urbanizing regions is impacting the spread of exotic plant species and persistence of native plant diversity. Using the rapidly growing metropolitan region of Charlotte, North Carolina as a case study, we examine the hypothesis that landscape structure of the built and natural environment are linked to patterns of native and exotic plant diversity in forests along the urban to rural gradient. We sampled 105 randomly located plots for woody species presence and abundance at 25 forested sites stratified across three land use types (urban, suburban and rural). We investigated multi-scale effects of building and road density on landscape patterns of woody species diversity using linear regression analyses and controlling for spatial autocorrelation.

Road density within 1 km negatively influences native diversity. Building density within 1 km positively influences exotic abundance in urban sites ($r2= .473$), and building density within 200 m for suburban sites ($r2=.340$). We also investigated the relative influence of site and landscape level factors among land use classes and invaded vs. uninvaded plots. Landscape factors explained native diversity most strongly for invaded urban sites while site factors were unimportant. Conversely, in uninvaded plots, site factors were the most significant predictors of native diversity. No statistically significant differences were detected among site and landscape variables when uninvaded and invaded sites were compared and no correlation between exotic abundance and native diversity was observed. Overall, native richness and diversity significantly decrease along a rural to urban gradient and exotic abundance is highest at urban sites supporting our hypothesis that the landscape factors associated with urbanization facilitate the spread of exotic species and negatively impact the persistence of native biodiversity.
Keywords: biodiversity loss, urban forest invasions, urbanization impacts

248. Tradeoffs between biofuel and biodiversity in California—where are the sweet spots?
Authors: **STOMS**, David, University of California Santa Barbara; Theresa Nogeire, University of California Santa Barbara; Frank Davis, University of California Santa Barbara; Stephen Kaffka, University of California Davis
Invited Symposium: B-2 - Thursday, April 8: 1:20-1:40 - R
Abstract: Meeting established goals for biofuels will require extensive land area to grow feedstocks. This area will be obtained by replacing food crops or pasture, or by converting non-agricultural habitats. Such large-scale land use change could have significant consequences for the types and configuration of wildlife habitats in agroecosystems. We generated spatially-explicit crop production scenarios that would meet California's biofuel targets and would be optimal from the economic perspectives of both farmers' and fuel producers. We then modeled the associated effects on habitat suitability for wildlife species. Species-specific changes in habitat suitability for reproduction, cover, and feeding were modeled at 1 square mile resolution for all California terrestrial vertebrates associated with agroecosystems. We identified areas of high potential conflict with wildlife values and also generated alternative scenarios that minimized loss of habitat suitability for all species while meeting biofuel targets. We considered our results in terms of the tradeoffs between wildlife habitat quality and biofuels production and their policy implications. Scenario modeling for biofuels and wildlife were performed through an innovative adaptation of the Marxan conservation planning software.
Keywords: agroecosystems, biofuel, habitat suitability, Marxan, trade-off analysis

249. Mapping exurban development using Landsat imagery
Authors: **SUAREZ-RUBIO**, Marcela, University of Maryland Center for Environmental Science; Todd Lookingbill, University of Richmond; Andrew Elmore, University of Maryland Center for Environmental Science
Poster #40: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Rural landscapes in the United States have changed dramatically in recent decades due to the rapid development of private rural lands into exurban development. Environmental impacts of exurban development may include habitat fragmentation, threats to wildlife, and increased demand for natural resources. Although eastern deciduous forests are thought to have experienced a significant increase in exurbanized area, a rigorous assessment of exurban trends in the eastern United States has yet to be undertaken. The objective of this study was to develop

a novel analytic approach to map exurban development in northern Virginia. We used Landsat TM images (1986 and 2009) and spectral mixture analysis to estimate the fractional cover of each 'pure' material (endmember) within an image. Using training data based on aerial photos, we classified the images using a decision tree and explanatory variables including: endmember fractions for 2009, 1986 to 2009 change in each of the endmembers, change of all endmembers, and change statistics for 4 and 8 surrounding pixels. Finally, terminal nodes from the decision tree that did not differentiate between exurban and urban areas were analyzed using mathematical morphology to assess the shape and form of the landscape elements. Scattered, isolated pixels were considered representative of exurban development. Our maps successfully distinguished between exurban and other types of development and highlights exurban areas that have been incorrectly classified as forests in the National Land Cover Dataset. This classification procedure identified exurban areas which will allow separating the size of ecological effects due to exurban development alone. Information about land cover changes beyond urban fringe will inform policymakers, planners, and land managers about exurban development and will aid drafting policies to direct future growth, and to manage and mitigate potential adverse consequences.
Keywords: Low-density development, mathematical morphology, mid-Atlantic, spectral mixture analysis

250. Wormsloe Plantation and a Useful Environmental History: Exploring Connections between the Environment, Culture, and Economy of a Lowcountry Plantation
Authors: **SWANSON**, Drew, University of Georgia
Invited Symposium: Integrated Interdisciplinary Research of the Wormsloe Institute for Environmental History, Isle of Hope, Georgia - Tuesday, April 6: 11:00-11:20 - K-L
Abstract: Wormsloe plantation is at once a cradle of Georgia history and a natural treasure. As a tract of coastal land that has remained under one family's stewardship since 1733, this historic plantation links the present Lowcountry to its natural and cultural past. This environmental history of Wormsloe combines rich archival sources with ongoing site research in archeology, geography, environmental planning and design, and ecology, in an interdisciplinary attempt to limn the property's past, explain its present form, and assist in future preservation efforts. As a narrative history that engages regional and topical scholarship, this work informs the historical ecology of the site, providing answers to basic questions concerning such topics as deforestation, the built environment, agricultural endeavors, and the political economy of local slavery. In turn, this work benefits greatly from the efforts of researchers in other disciplines, drawing on the fruits of techniques as diverse as ground-penetrating radar and GIS mapping. This reliance on interdisciplinary sources and methodologies also helps this study connect local environments to broader regional and transnational ideas, a fusion that does much to explain human perceptions of the Lowcountry landscape and the values that informed historic land uses. Drawing on such a broad spectrum of scholarship allows Wormsloe's story to range from the specifics of the soil composition of a given cotton field to the suffusing influence of a global cotton market linking Georgia to landscapes in distant Lancashire and India. This contextualization of the Wormsloe environment defines the historic plantation as a cultural as well as a natural landscape. As a history of an intact tract that still faces conservation and preservation questions, this study also seeks to tie historic land use practices to contemporary ecosystems, with the hopes that a thorough understanding of the plantation's past will aid in its future management.

251. Thirty years of forest cover change in Georgia

Authors: **SWENSON**, Jennifer, Duke University; Lincoln Smith, Duke University; Ralph Alig, US Forest Service-PNW; Susan Stein, US Forest Service-WO

Offered Presentations: Resource Management I - Tuesday, April 6: 2:20-2:40 - K-L

Abstract: Human-driven changes in land use have markedly altered forest cover patterns over time in the SE USA. Monitoring, validating and understanding the drivers of these patterns over broad regions is important for resource management and economics, monitoring carbon shifts across the landscape, and understanding long term ecological implications. Although changes in regional forest cover are frequently measured through remotely-sensed time series and monitored on the ground through forest inventories, less frequently are these two data sources compared. Based on an existing dataset (Georgia Land Use Trends-GLUT), we track the changes in land use and land cover from 1974-2005 at 6 points in time across the state of Georgia, and make comparisons of forest cover with the USFS's Forest Inventory and Analysis dataset by county. We trace the frequency of land cover turnover using two different spatial analysis units and examine a limited set of drivers of forest changes. We found that at least ~40% of the Georgia land area has changed at least one or two times from a natural state to a human dominated one, and ~5% transitioned three times or more. Across all time steps there was a net loss of forest, a net gain in urban land cover, and a net loss in agricultural land. We found that forest cover estimates by county from FIA and satellite maps were very close, but varied by time period (e.g., 1998, R2 = 0.90). From 1991-2005, forest conversion was most correlated with proximity to urban areas (R= 0.78), while factors such as recent ownership by entities such as timber investment management organizations (from recent FIA data) were insignificant. Understanding how humans have driven landscape change over time will help us better predict and manage the landscapes of the future with respect to new paradigms such as carbon accounting

252. Modeling natural area connectivity in support of conservation planning in a changing climate

Authors: **THEOBALD**, David, Colorado State University; Sarah Reed, Colorado State University

Invited Symposium: Climate Change and Landscape Connectivity: From Theory to Practice - Thursday, April 8: 11:00-11:20 - Masters Hall

Abstract: Increasingly, scientists are concerned about the robustness of conservation strategies to climate change. As maintenance of landscape connectivity has emerged as a key adaptation strategy, it is crucial to better understand how land use affects connectivity and the potential for adaptation. In the absence of detailed climate forecasts (downscaled) and individual species-habitat relationships necessary to predict range shifts over large extents, a conservative approach is to simply quantify where "natural" areas are more likely to allow species movement and ecological processes to operate, in contrast to highly human-modified landscapes (built-up, urban, cropland, etc.). We examined how current and likely future land use change has affected the landscape connectivity of natural landscapes in the conterminous US by comparing present (2000) and future (2030) land use conditions. Data on natural landscapes are generated from NLCD retrofit land cover types, housing density, presence of transportation networks (roads and

railways), and road use (traffic volume). As a preliminary examination of the potential for natural land cover linkages to facilitate adaptation to a changing climate, we calculated the direction and velocity of movement necessary to maintain the same temperature expected from decadal shifts in climate for A1B and B2 scenarios. We compared the results of these scenarios to identify the patterns and trends of where land use might constrain possible adaptation to climate change.

Keywords: climate change, connectivity, land use, landscape networks, naturalness

253. Effects of Habitat Loss and Fragmentation on the Population Viability of the Siberian Tiger (Panthera tigeris altaica)

Authors: **TIAN**, Yu, Beijing Normal University; Jianguo Wu, Arizona State University; Xiaojun Kou, Beijing Normal University; Jianping Ge, Beijing Normal University

Poster #29: Scale - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria

Abstract: As one of the most endangered species in the world, the Siberian (or Amur) tiger is a keystone species in the Eurasian Temperate Forests of northeastern. Because of its top position in the food web and large territory requirement for survival, the Siberian tiger is regarded as the best indicator of ecosystem health in this region. Before the 20th century, the Siberian tiger was found in Russia Far East, Northeastern China, Eastern Mongolia, and the Korean peninsula, with a total number of more than 3000. Recent surveys indicate that the current tiger population consists of fewer than 600 individuals. The distribution areas are now restricted to one large habitat patch and two smaller ones in Russia Far East, and a few scattered small patches in northeastern China. Besides poaching, the primary threats to tigers' survival are habitat loss and fragmentation induced by human activities. Thus, it is of great importance to understand the effects of habitat loss and fragmentation on the population viability of the Siberian tiger. In this study, we used the RAMAS/GIS software to explore how landscape pattern and conservation plans to affect the population dynamics and extinction probabilities of the Siberian tiger. Our results showed that decreased habitat quality had serious effects on the population viability of the Siberian tiger, whereas the effects of habitat fragmentation were variable depending on the size of habitat patches. Based on our simulation analysis, we suggest to establish high-quality ecological corridors between reserves and between China and Russia. The cross-border corridors would be essential for facilitating animal movements Russia and China, which is key to the long-term survival of the Siberian tiger. Our study provides useful information for regional-scale land use planning and reserve design that are needed for the conservation of this biggest cat species in the world.

Keywords: China, habitat loss and fragmentation, population viability analysis, Russia Far East, the Siberian tiger

254. Local and Landscape factors influencing bird communities in Polylepis forest

Authors: **TINOCO**, Boris, Department of Ecology and Evolution. Stony Brook University; Steven Latta, National Aviary; Pedro Astudillo, Universidad del Azuay - Ecuador; Diederik Strubbe, University of Antwerp - Belgium; Catherine Graham, Department of Ecology nd Evolution, Stony Broook University

Poster #37: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria

Abstract: The number and species of birds occupying a forest patch depend on a series of fragment and landscape level characteristics. Landscapes in the high Andes of Ecuador are dominated by paramo (grass) with small patches of Polylepis forest. Polylepis is a globally

threatened habitat due a long history of human intervention that has lead to its current fragmented distribution. This habitat is important for a number of highly specialized birds, which are currently facing conservation problems. We identified important fragment and landscape level characteristics influencing bird species distribution and abundance in 26 Polylepis forest fragments in Cajas National Park, Ecuador. During 2007, we conducted point counts to gather data on the different bird species inhabiting each fragment. We also quantified the structure and composition of the vegetation in each fragment, and fragment size and shape. To measure the landscape connectivity among fragments, we used landscape circuit theory, which gave us a measure of the potential connectivity of each fragment. After reducing the dimensionality of the predictor variables, we ran a series of generalized linear mixed models to explore the association of a series of fragment level variables and landscape connectivity with the bird assemblage, using an information theoretic approach for model selection. Bird species richness was associated with larger forest fragments and abundance of Gynoxis sp trees. When individual bird species responses were evaluated, the density of mature threes in a fragment and the abundance of Gynoxis sp, were the factors most commonly associated with the abundance of different bird species. Conservation plans in Polylepis forest have focused on conserving the Polylepis tree, but our results highlight the importance of conserving other Polylepis associated species, like Gynoxis, which may be a key resource for the maintenance of bird populations in this high altitude habitat.
Keywords: Andes, fragmentation, Polylepis

255. Evaluating the influence of environmental and social factors on red-cockaded woodpecker (Picoides borealis) dispersal behavior
Authors: **TRAINOR**, Anne, University of North Carolina; William Morris, Duke University; Jeff Walters, Virginia Technical University; Aaron Moody, University of North Carolina
Poster #42: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Habitat loss and fragmentation due to human activities have drastically altered ecosystems size and spatial configuration, thus eroding biological diversity and reducing wildlife populations. One prominent example is the red-cockaded woodpecker (Picoides borealis), a federally endangered species dependent upon mature longleaf pine woodlands diminished to small scattered patches covering only 3% of its historical extent. The persistence of P. borealis populations depends upon the degree to which landscape features facilitate or impede movement between the remaining habitat patches. This 'habitat connectivity' is usually represents dispersal behavior as a single abrupt movement in a featureless landscape. However, many species perform complex prospecting movements, leaving and returning to their home area many times to assess the relative quality of breeding sites based on social and environmental cues before their final dispersal event. Detailed environmental information at regional scales is becoming widely available with recent advances in remote sensing data and techniques. Our objective was to evaluate how habitat quality and open areas between territories and group composition at destination territories influence P. borealis prospecting behavior. P. borealis habitat quality was successfully predicted with a maximum entropy algorithm that integrated spectral (seasonal variation in greenness) and structural (maximum tree height and percent midstory cover) remote sensing data (AUC = 0.841). A discrete choice modeling approach was then used to estimate the probability of P. borealis visiting territories within their prospecting range (average = 3.2 km, SE = 0.02). The top-ranked discrete choice model denoted that group and landscape composition influence P. borealis prospecting behavior. Increased knowledge of P. borealis detailed dispersal

behavior will help identify areas necessary to maintain habitat connectivity and establishing and implementing effective P. borealis management strategies. Subsequently, these complex dispersal behaviors and environmental features will be incorporated in a habitat connectivity model designed to evaluate future conservation actions.
Keywords: dispersal, Maxent, Radio Telemetry, Red-cockaded Woodpecker, remote sensing

256. Effects of Human-Environment Relationships on the Spatio-Temporal Dynamics of Giant Panda Habitat
Authors: **TUANMU**, Mao-Ning, Michigan State University; Wei Liu, Michigan State University; Andrés Viña, Michigan State University; Gary Roloff, Michigan State University; Zhiyun Ouyang, Chinese Academy of Sciences; Hemin Zhang, The China Conservation and Research Center for Giant Panda; Jianguo Liu, Michigan State University
Offered Presentations: Distribution II - Wednesday, April 7: 10:20-10:40 - Q
Abstract: Habitat loss and degradation due to human activities are among major threats to biodiversity in the world. At the same time, conservation efforts have been increasing to mitigate the negative impacts of human activities through reducing exploitation of natural resources and actively restoring damaged landscapes. Therefore, understanding the effects of human-environment relationships, i.e., how human activities affect environment and how they respond to environmental changes, on the spatio-temporal dynamics of wildlife habitat is essential for conservation. In this study, we used the interactions between giant panda habitat and human activities in Wolong Nature Reserve and the adjacent Sanjiang Township, China as a case study to address these issues. While Wolong Nature Reserve sustains ca. 10% of the entire wild panda population, it is also home to ca. 4,500 local residents, and ca. 3,600 people in Sanjiang live just outside the reserve. We mapped panda habitat from 2001 to 2007 using remote sensing images and then related habitat change to anthropogenic factors (e.g., distance to local households and roads) to characterize the human-environment relationships. Overall, the amount of habitat increased ca. 10% in the reserve, which reversed the trend of habitat degradation in the past several decades. However, conspicuous differences in the patterns of habitat change and human-environment relationships were found between the reserve and Sanjiang Township. While panda habitat improved near local households in the reserve, it continued to degrade in Sanjiang, especially near roads and trails. The results suggested that different human-environment relationships determine the processes and patterns of habitat change, and the socioeconomic conditions of local people and implementation of conservation policies may explain the different relationships. This study not only has direct implications for panda conservation, but also increases our understanding of the complexity of human-environment relationships in a coupled human and natural system.
Keywords: CHANS, Giant panda conservation, Habitat change, Human-environment relationship

257. Climatic influences on biomass yields of switchgrass, a model bioenergy species
Authors: **TULBURE**, Mirela, South Dakota State University; Michael Wimberly, South Dakota State University
Poster #5: Climatic Influences - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: The recent U.S. Renewable Fuel Standard calls for 36 billion gallons of ethanol production by 2022 with over half produced from plant biomass. The goal of our research is to assess the sensitivity of biomass feedstock production to climatic change. Switchgrass (Panicum

virgatum L.), a warm season perennial grass native to North America was chosen as model bioenergy species. Yield data from 1,345 observation points associated with 37 field trial locations across the United States were gathered from 21 reference papers. We used PRISM climate data on minimum and maximum temperature (tmin and tmax) and precipitation (ppt) to model variation in switchgrass biomass yields as a function of climate. Climate data were averaged per month, growing season (April-September), and year before harvesting. To determine the most relevant climate variables we performed independent second order polynomial regressions between switchgrass biomass yield and monthly, growing season, and annual summaries of each of the three climate variables (14 x 3 climate variables) and determined their predictive power based on the coefficient of determination (R^2). Average March tmin and tmax, followed by average February tmin and tmax had the strongest association with switchgrass biomass yields. These preliminary results suggest that winter/early spring temperature may influence winter survival and the length of the growing season. These effects might be especially important for the northern distribution of the species. As previous studies suggested, annual precipitation had the strongest association with switchgrass yield, followed by April and growing season precipitation. Multiple regressions performed using the two and the three most important climate variables yielded statistically significant models with relatively low R^2 values. Future modeling efforts will incorporate additional predictor variables such as soil type, management, and origin of the switchgrass cultivar might improve the models, and potential changes in switchgrass productivity under climate change scenarios.
Keywords: biofuels, climate, climate change, switchgrass

258. Things change and remain the same: US-IALE then (1994-96) and now
Authors: **TURNER**, Monica, University of Wisconsin-Madison
Invited Symposium: US-IALE Presidents' Symposium I - Tuesday, April 6: 11:00-11:20 - Masters Hall
Abstract: US-IALE provides a valuable network for landscape ecologists and a forum for sharing new ideas and promoting interdisciplinary research. During my term as president (1994-96), the primary challenge faced by US-IALE was membership. Despite tremendous enthusiasm for landscape ecology as a discipline, the society was still small, and membership turnover was high. Results of a membership analysis, member survey and report from an ad-hoc committee produced recommendations to improve growth and retention of members. The first US-IALE web site emerged from this effort. The second challenge was to solidify the administrative structure, institutional knowledge and records of the society. The bylaws were updated in 1996, and the Executive Committee Handbook was developed for the governing board. The third challenge was planning and vision for the annual meetings to foster innovation while retaining features valued by the members. As landscape ecology became more mainstream, retaining the "cutting-edge" flavor of the annual landscape ecology symposium required more effort. Aspects of these challenges persist today. As we look to the future, we should (1) consider the features of US-IALE that are unique among the professional societies to which we belong and strive to enhance these; (2) retain the strong focus on and opportunities for students and their professional development; and (3) engage more fully in the challenges facing social-ecological systems today.
Keywords: challenges, society, US-IALE

259. Modeling habitat connectivity across scales
Authors: **URBAN**, Dean, Duke University; John Fay, Duke University

Invited Symposium: Graph, Network, and Circuit Models of Landscape Connectivity - Thursday, April 8: 10:00-10:20 - Q

Abstract: Habitat connectivity is playing an increasingly prominent role in conservation and land use planning. Innovative approaches are emerging from various perspectives on graph theory, including transportation, electrical circuits, and social networks. Despite this activity, actually constructing a graph to represent an ecological system remains a significant hurdle in the workflow for graph-based approaches. Here we illustrate a toolkit for graph construction and analysis, based on familiar software (ArcGIS) and the increasingly popular convention of using least-cost paths to model links between graph nodes. The tools range from high-resolution tasks of joining a pair of focal nodes (i.e., corridor design), to regional applications framed in the context of green infrastructure, to subcontinental-scale concerns for habitat connectivity under greenhouse warming. We provide a mix of applications coded in ArcGIS itself, along with links to sophisticated applications provided by software developed in other disciplines (especially, social network analysis). We point to promising areas of research in other fields as these might inform and enrich applications in landscape ecology.
Keywords: connectivity, graph theory, Habitat, least-cost path, network

260. Effects of forest recovery, urban expansion, and climate variability on water provision in a tropical landscape
Authors: **URIARTE**, Maria, Columbia University, E3B; Charles Yackulic, Columbia University, E3B; Elizabeth Lim, Columbia University, E3B
Offered Presentations: Scale I - Tuesday, April 6: 11:00-11:20 - F-G
Abstract: Humans influence their environment through multiple pathways. They directly affect land use and land cover change while substantial indirect effects occur via the atmosphere and hydrosphere. These changes interact with socio-economic and political factors to determine the vulnerability of key ecosystem services, places and people to climatic, economic, and socio-political perturbations. Here we use a Hierarchical Bayesian framework to quantify how changes in urban and forest cover in Puerto Rico from 1977 to 2001 have affected water quality and quantity, and link these changes to socioeconomic, physical, and biological drivers. We rely on USGS water quality and flow data from dozens of gauge stations throughout the island together with detailed climate data, land cover maps, and socioeconomic variables (e.g., census data) to link ecological and socio-economic changes to water quality and quantity using a statistical framework. We examine different spatial, temporal, and political scales of analysis: municipalities, small rural communities, whole watersheds, watersheds that deliver water to rural communities, and average years vs. drought or hurricane years.
Keywords: boundaries, forest transition, scaling, water provision

261. Modeling actual vs. potential distribution of sudden oak death in Oregon: Prioritizing landscape contexts for early detection and eradication of disease outbreaks
Authors: **VACLAVIK**, Tomas, Center for Applied GIScience, UNC Charlotte; Alan Kanaskie, Oregon Department of Forestry; Everett Hansen, Oregon State University; Janet Ohmann, USDA Forest Service; Ross Meentemeyer, Center for Applied GIScience, UNC Charlotte
Poster #21: Invasion - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: An isolated outbreak of the emerging forest disease sudden oak death was discovered in Oregon forests in 2001. Despite considerable control efforts, disease continues to spread from introduction sites due to slow and incomplete detection. Annual field surveys and laboratory tests

between 2001 and 2009 confirmed a total of 778 infected locations. We present two spatial predictive models of sudden oak death establishment and spread risk that are being actively used to target early detection and control further disease spread in Oregon forests. Our model predictions were based on three primary parameters that varied in space and time: atmospheric moisture and temperature, abundance and susceptibility of host vegetation, and dispersal pressure. First, using field data for calibration we applied the machine-learning method, maximum entropy, to predict the actual distribution of the sudden oak death epidemic. The dispersal constraint incorporated in our model estimates the force of infection at all susceptible locations, allowing us to predict the current distribution of the pathogen rather than its potential distribution. Second, we developed a heuristic model using multi-criteria evaluation method to identify large-scale areas at potential risk of infection. We mapped and ranked host susceptibility using geospatial vegetation data newly available from the USFS/OSU LEMMA project. The host vegetation and atmospheric moisture and temperature variables were parameterized in accordance to their epidemiological importance in the disease system. The final appraisal scores were summarized by month to represent a cumulative spread risk index. Our predictions indicate that further disease spread threatens numerous forests across the western region of Oregon. Areas at greatest risk are concentrated in the southwest region of Oregon where the highest densities of susceptible host species exist. This research illustrates how species distribution modeling can be used to analyze the actual versus potential distribution of emerging infectious disease in complex, heterogeneous ecosystems.
Keywords: forest disease, Oregon, risk mapping, spatial prediction, species distribution model

262. An analytical tool for delineation, assessment, and prioritization of riparian buffers for watershed management
Authors: **VAN APPLEDORN**, Molly, University of Maryland Baltimore County; Matthew Baker, University of Maryland Baltimore County
Poster #38: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Riparian areas have been a conservation priority because of their potential to attenuate nonpoint-source pollutants from upslope sources. Although the importance of riparian areas has long been recognized, land managers lack user-friendly tools that would facilitate regional planning by effectively scaling up understanding from local observations to entire watersheds. Here we present a strategic planning tool that integrates hydrologic characterizations with land-cover patterns to rapidly assess filtering potential within and among watersheds. This tool uses publicly-available data to 1) identify potential biogeochemically active zones based on a suite of topographic definitions, 2) calculate the width of buffers along preferential flow pathways from pollutant source areas to a stream network, and 3) prioritize stream-side areas for conservation or restoration based on the amount of source loading. We demonstrate the ability of the tool to calculate summary statistics such as mean buffer width and proportion of unbuffered cropland for all sub-basins within the Chesapeake Bay Watershed (CBW). We illustrate the sensitivity of the tool to regional differences in physiography and land cover patterns by comparing local buffering patterns within two case-study sub-basins in the CBW.
Keywords: Conservation, riparian, strategic planning tool, water quality, watershed management

263. The role of mating systems in the population viability of species inhabiting fragmented landscapes
Authors: **VASUDEV**, Divya, Dept of Wildlife Ecology and Conservation, Univ of Florida;

Robert Fletcher Jr., Dept of Wildlife Ecology and Conservation, Univ of Florida
Offered Presentations: Fragmentation - Wednesday, April 7: 10:40-11:00 - Y

Abstract: Habitat loss and fragmentation are occurring at devastating rates worldwide and are considered the major causes for species' population decline and extinction. While we have an understanding of the effects of habitat fragmentation, the role of mating systems in influencing the dynamics of fragmented populations has received surprisingly little attention. Mating systems influence the age-sex structure of individuals that disperse, and that thus, disproportionately face dispersal costs. The effects of these costs on population dynamics can be envisioned to increase as fragments become further separated and as the surrounding matrix gets increasingly inhospitable. To assess this interaction of mating systems and fragmentation, we constructed an individual-based model of populations inhabiting a fragmented landscape, wherein we systematically varied properties of mating systems and dispersal costs. Mating systems were varied by limiting the maximum number of adult males and adult females within groups, which had an indirect effect of influencing the propensity of sex-biased dispersal. We compared the trajectory of effective population size across a 100-year time horizon, and its deviation from population size. We found that the sex ratio within groups greatly influenced the dynamics of the simulated populations. While monogamous species were the most affected by increasing fragmentation (both isolation and matrix hostility), with the maximum decline in total population size, the divergence of population size from effective population size was the greatest for polygynous species. This trend arises due to the variation in sex ratio emerging from males primarily bearing the cost of dispersal, and as expected, worsened with increased degrees of fragmentation. Thus, polygynous species showed extinction debt, in the form of a latent effect of habitat fragmentation, that could potentially escape detection through common management practices of population censuses, and that thus necessitate investigations of sex ratio or effective population size to gauge the true population status.
Keywords: dispersal, extinction debt, habitat fragmentation, individual-based model, mating systems

264. Habitat of humpback whales (Megaptera novaeangliae) in the North Atlantic Ocean
Authors: **VIGNESS-RAPOSA**, Kathleen, University of Rhode Island
Offered Presentations: Distribution I - Tuesday, April 6: 11:00-11:20 - Y-Z

Abstract: Technological advances have increased the potential to understand broad scale ecological processes that influence biologically significant behaviors. Humpback whales (Megaptera novaeangliae) in the North Atlantic Ocean migrate to genetically and spatially distinct feeding aggregations each summer. The environmental features that drive this matrilineal site fidelity have been examined on individual feeding grounds, but a comprehensive evaluation of the habitat preferences of humpback whales throughout the North Atlantic has not been conducted. Summer sightings of humpback whales in the Gulf of Maine, eastern Canada, and Iceland were analyzed with temporally dynamic environmental variables and spatially static geographic variables to build models to predict habitat preferences. Models were constructed using logistic regression and geostatistics to determine significant variables and estimate spatial parameters, respectively. Twelve models were created based on a priori ecological hypotheses and results from previous studies of individual feeding grounds. The model that explained the greatest amount of variability included all considered variables (month; year; depth; slope; distance from shore, 100-m isobath, 200-m isobath; sea surface temperature (SST); and SST gradient), although the R^2 value was only 0.17. Examining the data more closely, the variable

"region," which identified the feeding ground in which the sighting occurred, was significant ($P < 0.001$). After building site specific models, the explanatory power increased from $R2 = 0.30$ for Iceland to $R2 = 0.38$ for the Gulf of Maine. Interestingly, the model that explained the greatest amount of variability in each feeding ground again included all considered variables. In all three regions, the variables slope and SST had large coefficients, greatly influencing the habitat models. Humpback whales appear to prefer regions close to shore and the 100-m isobath with cool temperatures and steep bathymetric relief.
Keywords: AIC, geostatistics, Habitat Modeling, logistic regression

265. A Web-based System to Link Sounds to the Landscape
Authors: **VILLANUEVA-RIVERA**, Luis, Purdue University; Bryan Pijanowski, Purdue University
Invited Symposium: Soundscape Ecology: The Complexity of Acoustical Patterns in Landscapes - Tuesday, April 6: 3:40-4:00 - Q
Abstract: The study of animal sounds has been usually limited to the species level, for example, the role of particular sounds in intra-specific communication or variation between populations. A new approach to the study of sounds is to treat all the sounds present at the landscape level, referred to as the soundscape. The soundscape could provide information about the use of habitats by species, inter-patch variability, and effects of land-use change. In recent years, custom and commercial equipments have allowed to easily collect sounds from the landscape in digital files, allowing a true capability for long-term and large-scale continuous monitoring of the soundscape. In order to extract the necessary information from the soundscape, new tools need to be developed to manage these sounds archives, which could comprise thousands of files. We are developing a web-based and database-driven system to manage soundscape-related sound files. This system can import and manage sound files collected from monitoring or other spatially-explicit projects and browse these files according to their metadata or from a map based on the GoogleMaps application. The system also allows the manual extraction of features from the sound files as well as conversion, filtering and other types of processing of the sound files. Since the system is spatially-explicit, further analysis can be performed in a GIS by querying the database. This type of system should advance the study of the soundscape and its uses as a monitoring method of the landscape and biodiversity.
Keywords: bioacoustics, monitoring, soundscape, web-based tools

266. Monitoring ecosystem disturbances using Landsat and MODIS data in the southeastern United States
Authors: **VOGELMANN**, James, USGS/EROS; Hua Shi, ASRC Research and Technology Solutions; Todd Hawbaker, USGS/Rocky Mountain Geographic Science Center; Brian Tolk, Stinger Ghaffarian Technologies; Jay Kost, Stinger Ghaffarian Technologies
Offered Presentations: Disturbance I - Tuesday, April 6: 2:00-2:20 - F-G
Abstract: The U.S. Geological Survey is prototyping methodologies to meet requirements of the 2007 Energy Independence and Security Act (EISA), which requires an assessment of current carbon stocks and greenhouse gas fluxes and potential for increasing carbon sequestration under a range of different scenarios. At the same time, we are in the process of updating data developed for the recently-completed LANDFIRE project, which produced nationally consistent spatial data sets describing vegetation and wildand fuel for the early 2000's. As part of these efforts, we are prototyping methods for assessing rates, levels and types of disturbances for the southeastern

United States. Disturbances that we are mapping and monitoring include forest harvesting, storm damage (e.g., caused by Hurricane Katrina in 2005), fire disturbance, and insect damage. We are using the Vegetation Change Tracker (VCT) for assessing forest logging activities, Monitoring Trends in Burn Severity (MTBS) data for assessing fire disturbance, and a combination of MODIS and Landsat Thematic Mapper (TM) data for assessing forest hurricane and insect damage. In all cases, we are using time series of remotely-sensed data for assessing rates and levels of disturbance. In general, the detection and monitoring of forest harvesting is relatively straightforward, but the other types of disturbances are significantly more challenging and require a different set of approaches. Landsat TM has the advantages of (1) being spatially relevant for many natural resource management applications and (2) having been acquired and archived since the early 1980's, thus providing an excellent record for detecting and monitoring long-term changes and trends. Meanwhile, MODIS has the advantage of being acquired nearly daily, which optimizes observations of many intra- and inter-seasonal types of phenomena. We will give an overview of our approaches and findings in this presentation.
Keywords: Disturbance, Landsat, MODIS, monitoring

267. Sustainable forest energy and ecosystem services by accounting for decomposition
Authors: **VOGT**, Kristiina, University of Washington; Daniel Vogt, University of Washington
Invited Symposium: B-2 - Thursday, April 8: 1:40-2:00 - R
Abstract: One of the difficulties of measuring sustainability has been the difficulty of detecting when an activity will shift some land-use choice towards becoming 'unsustainable', i.e., less resilient or being able to recover after a disturbance. Several assessments have been conducted on determining the sustainability of land-use activities and whether humans are extracting too much of earths productive capacity. Even though it is acknowledged that the productive capacity and resiliency of forests are being altered by land-use changes and climate change, the degree to which forest productive capacity is decreasing has been difficult to assess with a high degree of accuracy. These assessments have not addressed the quality of the soil environment and how that controls the level of plant growth possible at a location and how much more of the productive capacity can be harvested without causing degradation of the soil environment. We propose that by focusing on ecosystem service valuation, specifically on decomposition, we can assign value to ecosystem services. It also is an approach that will allow an assessment of the amount of biomass that can be removed sustainably to produce biofuels so that future forest productivity is not altered. Valuing ecosystem service has been difficult but possible by tracking ecosystem productivity and how this carbon is allocated to decomposers. We will present an approach to estimate how much forest materials could be collected for energy that is based on carbon and nutrient budgets (pools and fluxes) at the ecosystem level. Net Primary Production, litterfall and decomposition rates will provide the information that can be used to rank different forests in a cell matrix. Soils and climate change are also included as part of this cell matrix.
Keywords: biofuels, Decomposition, Ecosystem Services, Forests, NPP

268. GUIDOS: a toolbox for landscape pattern and network analysis
Authors: **VOGT**, Peter, European Commission
Offered Presentations: Network Theory - Thursday, April 8: 2:00-2:20 - Q
Abstract: Several tasks in landscape ecology require the analysis of digital images. Recent research introduced Morphological Spatial Pattern Analysis (MSPA) for an intuitive description of image pattern structures and the automatic detection of connectivity pathways. The generic

concept of MSPA is now used by a variety of organizations for structural as well as functional pattern analysis. Reliable corridor detection is an important feature in landscape management, road ecology and conservation biology. Moreover, it is a prerequisite for network and connectivity analysis based on graph-theory approaches. The free GUIDOS software toolbox (http://forest.jrc.ec.europa.eu/download/software/guidos) is designed to provide appropriate tools for the application of recent research studies to scientists and especially newcomers in the field of landscape ecology. GUIDOS can be used for generic image processing tasks, MSPA analysis, post-processing in the included GIS environment, and saving results as GoogleEarth image overlays. The new version of GUIDOS adds a bridge between pattern analysis of MSPA and network analysis performed by Conefor Sensinode: the pattern analysis is transferred into a network of components with nodes and links and their connectivity importance is analyzed. The importance ranking of the MSPA-detected habitats and corridors provides added value in risk assessment studies, landscape planning, and conservation/restoration policies. The key features of GUIDOS will be illustrated on a sample data set.
Keywords: connectivity, corridors, morphology, spatial pattern

269. The Biodiversity Assessment Framework: Indicating Washington's Biodiversity
Authors: **WALTERS**, Steven, University of Washington; John Marzluff, University of Washington; Heather Cornell, University of Washington
Poster #27: Sustaining Systems - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Biological diversity underpins a region's ecological health, determines the services humans obtain from the natural world, and indicates the myriad ways people have influenced nature. Globally, biodiversity is declining. Moreover, a systematic monitoring of biodiversity – its elements, services and responses to people – is lacking. To remedy this void, the Washington State governor created the Washington Biodiversity Council and charged it with developing a program to measure and monitor biodiversity. The effort aims to assess the status of biodiversity, provide legislative and management guidance, and inform and engage the citizenry in understanding the importance of biodiversity. The Biodiversity Assessment Framework comprises the groundwork for the first comprehensive assessment of all facets of Washington's biodiversity. Our approach assesses landscape and ecosystem conditions that support biodiversity, as well as the diversity of species themselves. Additionally, it consists of indicators of not only ecological conditions, but also the interactions between socioeconomic systems and the environmental processes they impact and upon which they depend. It provides information on the status of Washington's biodiversity, environmental factors that affect the quality of life for Washingtonians, and the level of engagement in conserving biodiversity. The analytical underpinnings of the framework significantly contribute to research on biodiversity assessment. It has at its core a conceptual model that explicitly recognizes the integral linkages between biodiversity and human well-being. This comprehensive design expands upon broader national and international approaches by addressing human-biodiversity interactions in an explicitly integrated, coupled human-natural systems perspective.
Keywords: assessment tool, biodiversity, coupled human-natural systems, indicators, landscape-level

270. Forest Vegetation Dynamics in Guizhou Golden Monkey Habitat, China
Authors: **WANDERSEE**, Sarah, San Diego State University; Li An, San Diego State University; Yeqin Yang, Fanjingshan National Nature Reserve

Offered Presentations: Remote Sensing - Thursday, April 8: 11:00-11:20 - F-G

Abstract: Fanjingshan National Nature Reserve in Guizhou Province, China contains the last habitat for and populations of the endangered Guizhou golden monkey (Rhinopithecus brelichi). Local residents have historically harvested forest resources and farmed in the area. Although activity has been regulated since the establishment of the reserve in 1978, human activity within the reserve has been threatening monkey habitat and behavior over the past few decades. Current activities include wood harvesting, tourism, herb gathering, herding, mining, and hunting. Farming has been decreasing since the inception of a farmland to forest program in 2000. These human activity dynamics have landscape effects, including deforestation or regrowth. Satellite remote sensing was used to better understand the spatial distribution and consequences of these dynamics. An analysis of the changes in a spectral vegetation index over time between four types of habitat of varying monkey activity (high, medium, low, and corridor) lends insight into how the landscape is evolving in the face of changing human use. LANDSAT MSS and TM data from 1976, 1994, and 2003 were used based upon timing of key events and image availability. From the satellite data, soil adjusted vegetation index (SAVI) images were generated for average comparison over time among each of the four monkey habitat areas. The forthcoming results will show which habitat areas displayed SAVI increase or decrease over time. The SAVI changes indicate variation in habitat vegetation since the reserve establishment and lend insight into habitat type conservation. The vegetation patterns revealed from the SAVI remote sensing analysis will be compared to participatory mapping results from Spring 2010 field work to determine whether the remote sensing analysis matches local-level dynamics. This comparison will establish the usefulness of the SAVI analysis in characterizing general trends of conservation efficacy and informing management of potential fragmentation and prioritization for action.
Keywords: China, golden monkeys, participatory mapping, remote sensing, vegetation

271. Impacts of climate change on landscape pattern of potential distribution of Qinghai spruce (Picea Crassifolia) in Qilian Mountains, northwestern

Authors: **WANG**, Chao, Key Laboratory of Western China; Zhaodong FENG, Key Laboratory of Western China; Zhonglin XU, Key Laboratory of Western China; Chuanyan ZHAO, Key Laboratory of Arid and Grassland Agroecology of Ministry

Poster #7: Climatic Influences - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: Qilian Mountains is located in the arid area of northwest China. It is hydrologically and ecologically the most important unit because it functions as the water source to support the irrigating agriculture in the oasis and also to maintain the ecological viability in the adjacent desert area. Qinghai spruce (Picea Crassifolia), the dominant species, plays an important role in water reservation function. Based on the potential distribution of Picea Crassifolia simulated by Maximum Entropy model, this paper detects the change of landscape pattern of Picea Crassifolia under future climate conditions. The change of landscape pattern is explained using landscape indices calculated by Fragstats software. The results show that: under future climate scenario (in 2050), the patches of Picea Crassifolia reduce from 289 to 86, the percentage of patches' area accounting for total area of study area raises to 16.47% from 5.17%; the patch density will increase, mean patch area reaches to 5245.35 hm2 from 489.96 hm2; the area-weighted shape index rises, mean Euclidean nearest neighbor distance and contagion will decrease. All above changes mean that distribution area of Picea Crassifolia will increase. and patch denseness will

decrease with increase of aggregation. The increase trend of agglomeration degree is evident.
Keywords: landscape indices, Maximum Entropy model, Picea Crassifolia, potential distribution

272. Landscape Characterization along the Appalachian Trail MEGA-Transect: towards Decision Support for Monitoring, Reporting and Forecasting Ecological Conditions
Authors: **WANG**, Y.Q., University of Rhode Island; Rama Nemani, NASA Ames Research Center; Fred Dieffenbach, National Park Service; Kenneth Stolte, USDA Forest Service
Offered Presentations: Resource Management III - Thursday, April 8: 1:40-2:00 - V-W

Abstract: This study is to reveal landscape characteristics and dynamics of the Appalachian mountain region using Appalachian National Scenic Trail (A.T.) as a MEGA-Transect. Data developed are to be imbedded into a decision support system for monitoring, reporting and forecasting ecological conditions of the Appalachian Mountain region. The decision support system is to provide a coherent framework for data integration, status report and trend analysis. The A.T. traverses most of the high elevation ridges of the eastern United States, extending about 3,676 kilometers across 14 states, from Springer Mountain in Northern Georgia to Mount Katahdin in central Maine. A.T.'s gradients in elevation, latitude, and moisture sustain a rich biological assemblage of temperate zone forest species. The Trail's north-south alignment represents a cross-section MEGA-Transect of the eastern United States forests and alpine areas, and offers a perfect setting for collecting scientifically valid and relevant data on the health of the ecosystems and the species that inhabit them. The A.T. and its protected corridor provide an ideal barometer for early detection of undesirable changes, from development encroachment to recreational misuse, acid precipitation, invasions of exotic species, and climate change. Landscape dynamics has been identified as one of the environmental vital signs to measure long term ecosystem conditions of the A.T. Besides NLCD and LANDFIRE data products, the Terrestrial Observation and Prediction System models allow multi-platform sensor data to be integrated, making it possible to obtain near real-time observations of current ecological conditions as well as predictions for future ecological condition over extensive areas. This presentation will introduce the development of seamless indicator data; integration of remote sensing observation and in situ field monitoring; assessment of historical and current ecosystem conditions and forecast trends of landscape dynamics; and development of an Internet-based implementation and dissemination system for data visualization, sharing, and management.
Keywords: Appalachian Trail, Decision Support, Landscape Characterization, Natural Resources Management, remote sensing

273. Determining Multiscale Spatial Distribution of Coral Reef Fish Assemblages Using Bathymetric LiDAR Data
Authors: **WEDDING**, Lisa, University of Hawaii; Alan Friedlander, University of Hawaii
Offered Presentations: Scale II - Thursday, April 8: 4:00-4:20 - T-U

Abstract: Remotely sensed LiDAR (Light Detection and Ranging) data has recently been utilized to characterize and quantify the geomorphic structure of coral reef ecosystems. However, different components of the fish assemblage respond to the seascape at different spatial scales depending on their size and mobility. LiDAR data was integrated and a landscape ecology approach was applied to quantify the structure, ecology and use of the seascape by coral reef fish assemblages at multiple spatial scales. The scale of influence and ecological neighborhood of functional groups of coral reef fishes was characterized through a multi-scaled approach. We found that different components of the fish assemblage responded to LiDAR-derived seascape

metrics at different spatial scales depending on their size and mobility guilds. This information may be applied to inform the most appropriate scale to conduct spatially explicit modeling and predictive mapping of fish assemblages across the seascape. Marine landscape ecology is a relatively new sub-discipline that is in the process of forming its theoretical basis unique to the marine realm. Identifying relevant scales of influence and ecological neighborhoods for guilds of coral reef fishes (1) represents a critical step in understanding the link between pattern and process in the ocean (2) advances spatially predictive modeling of fish assemblages (3) and also demonstrates a valuable application of LiDAR technology in the marine realm.
Keywords: coral reef fishes, GIS, LiDAR, marine landscape ecology, scale

276. Relationships between LiDAR-derived Rainforest Canopy Structure and Ancient Maya Land Use Legacies
Authors: **WEISHAMPEL**, John, University of Central Florida; Jessica Hightower, University of Central Florida; James Angelo, University of Central Florida; Alison Matos, University of Central Florida; Alexander Rivas, University of Central Florida; Arlen Chase, University of Central Florida; Diane Chase, University of Central Florida
Poster #13: Disturbance - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: Present day rainforests (and other "wild" areas) bear the fingerprints of historic human disturbance. Consequently, to understand ecological structure and function, archaeological knowledge is needed to provide ecologists with a view of past human land use. Some environmental impacts may require several centuries for the disturbed system to return to its pre-human disturbed state, if, indeed, it does recover as most systems are in a state of continual disturbance. Moreover, the system, once disturbed, may undergo an entirely different successional trajectory. Recovery of forest composition and structure tends to be relatively rapid when the disturbance primarily impacts the forest canopy and considerably slower when soils (e.g., fertility and texture) are also heavily impacted. Using airborne LiDAR, we characterized forest canopy (e.g., height, density, gap distribution, vertical organization) and below-canopy archaeological features (e.g., agricultural terraces, residential areas, causeways) in the Maya polity Caracol located in the Cayo District in western Belize. At its heyday prior to 800 AD, Caracol was populated with >100,000 citizens. Supporting agricultural lands in the 200 sq-km area surrounding the Caracol epicenter occupied >50% of the area. In this study, we quantify contemporary canopy differences associated with different land uses from a millennium ago.
Keywords: Archaeology, Canopy, land use, Legacy, LiDAR

277. Taking the Pulse of Our Planet: The USA National Phenology Network
Authors: **WELTZIN**, Jake, USA National Phenology Network
Offered Presentations: Climatic Influences I - Tuesday, April 6: 2:40-3:00 - R
Abstract: Patterns of phenology for plants and animals control ecosystem processes, determine land surface properties, control biosphere-atmosphere interactions, and affect food production, health, conservation, and recreation. The USA National Phenology Network (USA-NPN; www.usanpn.org) is an emerging and exciting partnership between federal agencies, the academic community, and the general public to establish a national science and monitoring initiative focused on phenology as a tool to understand how plants, animals and landscapes respond to climate variation, and as a tool to facilitate human adaptation to ongoing and potential future climate change. In its second year of operation, USA-NPN produced many new phenology products and venues for phenology research and citizen involvement that will facilitate local,

regional or national assessments of phenology. A new web-page contains an advanced on-line user interface to facilitate entry of contemporary data into the National Phenology Database. The new plant phenology monitoring program provides standardized methods and monitoring protocols for 215 local, regional, and nationally distributed plant species. Monitoring methods have been modified to facilitate collection of sampling intensity and absence data for both plants and animals. Coordinated development of regional networks will facilitate focused communication and interaction around regional phenology issues. Future directions include the implementation of a national wildlife phenology monitoring program for the 2010 season; increased integration with national and international formal and informal science networks; enhanced consistency and availability of remote sensing of phenology terminology, methods, products and services; tools for discovery, description, ingestion, curation and distribution of historic phenology datasets; and, improvement of tools for data entry, download and visualization.
Keywords: climate change, education, monitoring, phenology, scaling

278. Regional land use conversion involving forestry and agriculture land in the context of using biomass for bioenergy
Authors: **WHITE**, Eric, Oregon State University; Ralph Alig, USDA Forest Service; Gregory Latta, Oregon State University
Invited Symposium: Reshaping Landscapes: Bioenergy and Land-use Change - Wednesday, April 7: 11:00-11:20 - K-L
Abstract: Biomass is expected to be an important source of renewable energy as part of comprehensive climate change policy. Currently, biomass represents about half of U.S. renewable energy consumption (mostly associated with on-site energy production from timber mills) and the primary biomass feedstocks are waste residues (e.g., timber milling residues). Increased reliance on feedstocks produced specifically for bioenergy may yield changes in traditional production from the forest and agriculture sectors, the rate of land conversion between the two sectors, and resource management practices. As demand for bioenergy increases, biomass production from short-rotation woody crops (SRWC), logging residues, and non-merchantable trees will likely increase. Currently, SRWCs are estimated to comprise less than 0.1% of the agriculture and forest landscape. Timber harvests residues are currently believed to amount to about 64 million dry tons of woody biomass. Using existing research results, we identify considerations and some potential implications of increased use of woody biomass feedstocks. To examine possible future conditions, we use the Forest and Agriculture Sector Optimization Model—greenhouse gases (FASOM-GHG)—an economic dynamic optimization model of the U.S. forest and agriculture sectors—to project future biomass feedstock consumption under both reference and climate policy scenarios and possible effects on forest age classes, forest types, and other forest resource conditions. We report regional-level projections of feedstock consumption for future decades from the forest and agriculture sectors. Additionally, we examine projected impacts to land conversion (e.g., afforestation or deforestation involving agriculture) and management intensity as result of increased demand for bioenergy.
Keywords: biomass feedstock, economic modeling, Forests, land use change

280. Climate change and protected areas in California: Connecting the dots
Authors: **WIENS**, John, PRBO Conservation Science; Christine Howell, PRBO Conservation Science; Diana Stralberg, PRBO Conservation Science; Dennis Jongsomjit, PRBO Conservation

Science
Invited Symposium: Climate Change and Landscape Connectivity: From Theory to Practice -
Thursday, April 8: 10:00-10:20 - Masters Hall

Abstract: Climate change is already contributing to distributional shifts of many species, and the potential shifts will become more extensive under future conditions. Species may shift in response to the direct and indirect effects of changing climate, but their ability to persist in a present or future area is dependent on the availability of suitable habitat and the ability of individuals to reach that habitat. We use the results of species-distribution modeling for California birds to assess: (1) what the models project for future distributions of species and assemblages; (2) how the current and projected future distributions relate to the current array of protected areas in California; (3) how projected future land use may affect the capacity of protected areas to absorb species distributional shifts; and (4) how we should think about "connectivity" in such a changing future.
Keywords: birds, climate change, Conservation, distribution models, protected areas

281. Citizen Science, volunteered geographic information, and Web 2.0… what's it all good for?
Authors: **WIERSMA**, Yolanda, Memorial University; Roman Lukyayenko, Memorial
University; Randy Skinner, Memorial University; Renee Sieber, McGill University; Jon Corbett,
University of British Columbia; Britta Ricker, McGill University; Claus Rinner, Ryerson
University; Brian Klinkenberg, University of British Columbia
Offered Presentations: Technological Innovation - Thursday, April 8: 4:00-4:20 - Q
Abstract: Environmental and ecological issues are complex and often abstract to the general public. Many members of the public spend little time out-of-doors, yet are concerned about environmental and ecological issues. The Geoweb presents exciting new technologies to engage citizens with landscape and environmental issues via Web 2.0 applications. There are challenges in implementing a Geoweb to facilitate public participation. This talk will highlight several Geoweb projects from across Canada. These are part of a funded network project investigating the participatory Geoweb for environmental change. The strategies employed for facilitating public engagement, improving ecological and geographic literacy and generating meaningful engagement on topics including food, climate change, wildlife and conservation planning will be discussed and the potential role of citizen-derived data in landscape ecology research will be highlighted.
Keywords: citizen science, environmental change, Geoweb, participatory GIS, Web 2.0

282. Identifying potential wildlife impacts of bioenergy biomass production: future landscape
scenarios in a case study of planned biomass co-firing in Wisconsin.
Authors: **WILLIAMS**, Carol, University of Wisconsin - Madison; Christine Ribic, USGS
Wisconsin Cooperative Wildlife Research Unit; David Sample, Wisconsin Department of
Wildlife; Christopher Kucharik, University of Wisconsin - Madison
Invited Symposium: Reshaping Landscapes: Bioenergy and Land-use Change - Wednesday,
April 7: 10:20-10:40 - K-L
Abstract: Demand for bioenergy is increasing in Wisconsin due to concerns about climate change, energy self-sufficiency and local air quality in association with combustion of coal for heat and power. Simultaneously, demand is also increasing for ecological services provided by agricultural systems. Little is known, however, about potential landscape-level ecological consequences of large-scale transformation of current agricultural ecosystems to those with

greater bioenergy production. To fill current research and knowledge gaps, and to provide information that may assist policy analysts and decision-makers, we have proposed a modeling-based analysis of potential landscape-level wildlife impacts of lignocellulosic biomass production in a south-central Wisconsin co-firing case study. In the first of a two-phased process we will render landscape scenarios that describe plausible markets (i.e., geographic areas of commercial-scale biomass production) according to different levels of lignocellulosic biomass diversity (e.g., single or multiple plant species), productivity class(es) of lands used in biomass production, and spatial distribution of potential biomass markets (e.g., geographic extent and proximity to the model facility). In the second phase, for a set of focal wildlife species, we will generate habitat suitability maps describing current land use/land cover conditions, as well as that of each future landscape scenario. Difference maps will then be generated to describe and quantify changes (positive, negative, neutral) in habitat suitability resulting from potential land use/land cover change associated with future biomass production systems in Wisconsin.
Keywords: bioenergy, ecological services, land use/land cover, scenario, wildlife impacts

283. Macro-scale Reconstruction and Analysis of Historical Forest Structure in Ponderosa Pine Forests
Authors: **WILLIAMS**, Mark, University of Wyoming; William Baker, University of Wyoming
Offered Presentations: Restorative Ecology - Thursday, April 8: 11:00-11:20 - Y-Z
Abstract: Restoration paradigms are often based upon the historical range of variability, but too often these measures come from reconstruction studies that were focused at modest spatial scales and thus do not provide a complete sample of historical structure. One solution is to use alternative sources of historical data, such as the General Land Office (GLO) survey notes, to map and quantify forest structure over large landscapes. However, it has been posited that GLO surveyors sampled in a biased manner and survey reconstruction procedures have unknown accuracy. We, therefore, sought to test the bias and accuracy of GLO data and to modify and develop methods to more accurately quantify forest structure. Three geographically diverse ponderosa pine landscapes in Arizona, Oregon and Colorado were selected for comparison of forest structure. Forested locations were sampled at the same spatial scale and sampling intensity as the surveyors using both the methods of the surveyors and more accurate plot data at actual corner locations. Tree information in the survey notes was compared to remaining historical trees at survey locations to examine selection bias or error. We found that surveyors sampled without bias 95-98% of the time and that other errors were low. We developed a density estimator for GLO data that utilizes the Voronoi area of a tree which better estimates the mean area per tree. We were able, on average, to estimate density within 20% of the true value and basal area within 21% of the true value depending upon the spatial resolution. The true and estimated composition and diameter class distributions were 90% and 85% similar respectively. Using our revised methodology, forest attributes can be mapped and analyzed across large landscapes with high accuracy and reliability.
Keywords: accuracy, bias, ponderosa pine, reconstruction, restoration

284. Predicting core areas based on resource distribution: putting the burrow before the rabbit
Authors: **WILSON**, Tammy, Utah State University; Thomas Edwards Jr., Utah State University
Offered Presentations: Distribution II - Wednesday, April 7: 10:00-10:20 - Q
Abstract: Landscape ecologists are typically interested in understanding the distribution of species across large land areas. However, evaluating the spatial distribution of resources at fine-

scales is necessary for complete understanding of how animals use occupied habitats. Resource selection is often viewed as a multi-scale process, but is universally tested using only first-order spatial statistics of animal locations, such as kernel density estimators, overlain on vegetation classification. This approach is descriptive, and little a priori thought is put into why one may expect animals to select habitats differentially. We tested several a priori hypotheses about how pygmy rabbits use resources located within their home ranges. We show that burrows are highly clustered by second, not first order processes, and that the burrow pattern is not affected by the presence of rabbit sign at the burrow entrances. We used telemetry locations to show that rabbits do not use habitat uniformly or as predicted by the utilization distribution of their observed locations. However, rabbit core areas can be predicted by resource clusters. We discuss the implications for burrow use and creation processes and suggest future lines of research to elucidate factors that may contribute to the distribution and use of resources.
Keywords: k-function, point pattern analysis, pygmy rabbit, resource selection, second order spatial statistic

285. Linking people with pixels to explore the landscape epidemiology of West Nile virus
Authors: **WIMBERLY**, Michael, GISc Center of Excellence; Ting-Wu Chuang, GISc Center of Excellence; Christine Wey, GISc Center of Excellence; Lon Kightlinger, South Dakota Department of Health; Jennifer Griesse, South Dakota Department of Health; Geoffrey Henebry, GISc Center of Excellence
Offered Presentations: Invasion I - Tuesday, April 6: 2:00-2:20 - Y-Z
Abstract: The connections between humans and the environment are a major focus of landscape ecology. Although much research has explored human impacts on ecological processes, there has been less emphasis on the reciprocal influences of the environment on human well being. One arena in which these interactions are currently being examined is the landscape ecology and epidemiology of infectious diseases. We focus here on several specific technical challenges of linking landscape ecological datasets with disease in human populations. We explore these challenges in two studies of the environmental drivers of West Nile Virus (WNV) in the Northern Great Plains (NGP). At a regional scale, we hypothesized that because of short growing seasons in the NGP, WNV amplification and subsequent transmission to humans is related to the timing of spring onset. Cumulative vegetation indices derived from MODIS imagery were computed at the county level and expressed as deviations from their long-term means. Temporal patterns of WNV incidence were measured as the annual relative risk for each county. Correlations between cumulative NDVI and the relative risk of WNV peaked in mid-June and decreased at earlier and later dates, supporting our hypothesis. At the landscape scale, we hypothesized that the geocoded locations of individual WNV cases are associated with breeding habitat of the primary vector species, Culex tarsalis. To test this hypothesis, we carried out a spatial case-control analysis of WNV cases in relation to land cover and land use in the James River valley of South Dakota. WNV cases were positively associated with grassland habitats and negatively associated with development, supporting our hypothesis. In both examples, a key technical challenge is controlling for the spatial variability in the underlying human population. Development of novel interdisciplinary approaches will be critical in furthering this type of research on the landscape epidemiology of disease in humans.
Keywords: climate, disease, land cover, remote sensing, West Nile virus

286. Influences of landscape diversity and patch area on predation in agricultural landscapes

Authors: **WOLTZ**, J. Megan, MSU Department of Entomology; Doug Lanids,

Offered Presentations: Agrarianism II - Wednesday, April 7: 11:20-11:40 - R

Abstract: Landscapes provide ecosystem services to agricultural systems by supporting predators of crop pests, a service valued at $US 4.5 billion. Habitat management is the practice of providing resources to beneficial insects in cropping systems, often in the form of flowering strips. However, the potential for flowering strips to increase biocontrol depends on the existing abundances of predators in the landscape, and highly simplified landscapes may support fewer predators than more diverse landscapes. To test the effect of landscape characteristics on the success of habitat management, in 2008 and 2009 we measured predators and aphid suppression at soybean fields with and without flowering strips across a range of landscape diversity measured as Simpson's D. Although lady beetles were attracted to flowering strips, this did not translate into differences in lady beetle abundance or aphid suppression in fields adjacent to strips vs. control fields, as predators dramatically suppressed aphids in all sites. Additionally, there were no significant effects of landscape diversity on aphid suppression. The lack of landscape effects are quite surprising given that the range in D values was similar to a 2005-06 study in which D significantly predicted aphid suppression in the same system. However, although D values were similar, the range in spatial grain among landscapes, as measured by area-weighted mean patch size, was substantially less in 2008-09 than in 2005-06. A reanalysis of the 2005-06 data indicated that spatial grain also significantly predicted aphid suppression, indicating that landscape grain may affect the supply of predators to agricultural fields and thus biocontrol services.

Keywords: agroecosystems, biocontrol, Ecosystem Services, predation

287. Complementary Analysis of Land Cover Change and NDVI Trends from the Aral Basin

Authors: **WRIGHT**, Christopher, Geographic Information Science Center of Excellence; Geoffrey Henebry, Geographic Information Science Center of Excellence

Offered Presentations: Remote Sensing - Thursday, April 8: 10:40-11:00 - F-G

Abstract: The shrinking Aral Sea is a startling example of anthropogenic environmental degradation. Impacts of hydrologic modification and climate change occurring throughout the greater Aral Basin (AB) require basin-wide monitoring of ongoing environmental trends. The MODIS 500m global land cover (LC) product (MOD12Q1) is a potential source of such information in a data-sparse region like the AB. However, we find that it is particularly unstable. For example, 24% of AB pixels change LC class between 2001 and 2005. Here we present an alternate analysis of environmental trends in the AB using MODIS data at the same spatial resolution, but taking advantage of temporal information embedded within contemporary NDVI data. NDVI time series from 2001-2008 were derived from 500m MODIS NBAR data (16-d composites reported every 8 d; MCD43A4). Nonparametric trend analysis revealed a number of spatially coherent hotspots of highly significant ($p \leq 0.01$) positive and negative trends in seasonal NDVI. In most LC types we find a highly significant ($p \leq 0.01$) association between LCC rate and NDVI trend. In negatively trending pixels, we find elevated rates of LCC from shrub, savanna, barren, and snow/ice LC classes to grassland. However, apparent LCC may reflect sensitivity of the MODIS LC classifier to regional environmental trends rather than actual LCC. Among positively trending pixels, we find elevated conversion rates from shrub and grassland classes to cropland. In this case, we suggest that increased primary production linked to changes in irrigation practices facilitates detection of cropland in the 2005 global LC product

that was misidentified in 2001. Finally, NDVI trend analysis may reveal more subtle LCC than can be ascribed to discrete changes in LC class. We find that NDVI trend analysis and LCC analysis based on the same underlying 500m MODIS data are complementary, particularly in identifying areas of significant land surface change in the AB.
Keywords: Aral Basin, land cover change, NDVI trends

288. Landscape Ecology: A Pluralistic and Hierarchical Perspective
Authors: **WU**, Jianguo, Arizona State University
Invited Symposium: Editors' Symposium, Landscape Ecology: A History of a Branching Tree or a Converging Stream? - Tuesday, April 6: 3:40-4:00 - Masters Hall

Abstract: Landscape Ecology: A Pluralistic and Hierarchical Perspective Jianguo (Jingle) Wu School of Life Sciences and Global Institute of Sustainability, Arizona State University, Tempe, AZ 85287-4501, USA. e-mail: Jingle.Wu@asu.edu Abstract Landscape ecology is an interdisciplinary and transdisciplinary science that focuses on the relationship between spatial pattern and ecological processes across scales. The goal of landscape ecology is not only to understand this relationship but also to influence it so as to help achieve landscape sustainability. Indeed, the field of landscape ecology was born as an interdisciplinary science when Carl Troll described it as the integration between ecological and geographic disciplines. A salient goal of Landscape Ecology, the flagship journal of the International Association for Landscape Ecology, is to promote interdisciplinary and integrative studies of landscapes on broad scales. Frank B. Golley, the founding Editor-in-Chief, made this quite clear in the inaugural issue of Landscape Ecology in 1987: "The task of correcting biospheric disorder is a universal activity, requiring information and insight from all. We intend that Landscape Ecology have this broad objective and that it be relevant to the problems that face mankind at the end of the twentieth century." This goal seems even more relevant today than ever for both the journal and the field of landscape ecology as a whole. To further promote this goal, here I present a pluralistic and hierarchical framework that facilitates synergistic interactions between biophysical/pattern-process and holistic/humanistic perspectives in landscape ecology. The "hierarchical" view here recognizes the varying scope and degree of cross-disciplinarity in landscape ecological studies, whereas the "pluralistic" view stresses the importance of different disciplines and perspectives. In addition, as the current Editor-in-Chief of Landscape Ecology, I will discuss trends and highlights of the publications in the past 5 years and some thoughts on the journal's future direction.
Keywords: landscape ecology

289. Detecting wetland changes on the Mississippi Gulf Coast using remotely sensed images
Authors: **WU**, Wei, University of Southern Mississippi; Greg Carer, University of Southern Mississippi; Patrick Biber, University of Southern Mississippi
Offered Presentations: Remote Sensing - Thursday, April 8: 10:20-10:40 - F-G

Abstract: Quantifying the historical changes of coastal wetlands is necessary to identify the causes of the changes for the ecologically important ecosystems. We applied a sub-pixel change detection approach using Landsat TM-5 images (available at Global Land Survey (GLS) datasets) and high-resolution Digital Orthrophoto Quarter Quadrangels (DOQQ) (produced by the USGS) to detect the areal changes of three types of coastal wetlands on the Mississippi Gulf Coast since 1980s. The three types of coastal wetlands include salt marsh, dominated by Spartina Alterniflora and Juncas roemerianus; brackish marsh, including Distichlis spicata and Spartina

patens species; and intertidal freshwater marsh, divided into oligohaline sawgrass and oligohaline mixed. We implemented a canonical correlation analysis in the sub-pixel approach to relate the proportions of the three types of coastal wetlands in each pixel (30 by 30 meters) to the digital numbers of the seven bands and selected band ratios. We then applied the relation to the independent time-series TM-5 images to derive the wetland areas over time. The results have shown significant areal changes of the three types of coastal wetland over the last three decades. They can be further used to generate the necessary parameters for the wetland change models, such as wetland erosion rates, in order to predict the future wetland distribution under accelerated sea level rise.
Keywords: change detection, coastal wetland, remote sensing

290. Exploring the effects of landscape and riparian condition on a fish index of biotic integrity in the Southern Plains ichthyoregion of Alabama
Authors: **WYNN**, Elizabeth, Geological Survey of Alabama; Pat O, Geological Survey of Alabama; Tom Shepard, Geological Survey of Alabama
Poster #10: Disturbance - Tuesday, April 6: 5:30-7:00 - Hill Atrium
Abstract: An Index of Biotic Integrity (IBI) was calculated from 81 fish sampling sites in the Southern Plains ichthyoregion of Alabama in 2008. The IBI metrics were tested across a gradient of habitat and human disturbance parameters. While the local habitat assessment parameters were widely correlated with IBI metrics, most of the landscape scale human disturbance parameters (generated with ATtILA) showed weak relationships with IBI metrics. The exception was percent pasture, which showed a significant positive correlation with diversity IBI metrics. Numerous studies have provided strong statistical evidence of the importance of surrounding landscape and human land use to a stream's ecological integrity. However, current understanding of the relationships between anthropogenic activities and the ecological integrity of streams has been confounded by covariation between human-induced and natural gradients, issues of scale, and the uncertain effect of land use legacies. A suite of landscape metrics were tested for correlative power with the IBI metrics, to determine which parameters were most important in defining landscape influence on the biotic integrity of streams in the Southern Plains Ichthyoregion. Descriptive and multivariate statistical methods were used to eliminate any metrics which were highly correlated with watershed area, and redundant metrics were removed as well. The analysis revealed that percent pasture, which the human disturbance index had found to be positively related to diversity IBI metrics, covaried with decreased urban area, because pasture dominated least disturbed sites and preserved riparian vegetation cover. This analysis has provided new landscape metrics to incorporate into ATtILA's human disturbance index, making the program more robust in identifying human disturbance in the Southern Plains itchthyoregion and Southern Coastal Plains ecoregion.
Keywords: Index of biotic integrity, landscape metrics, remote sensing, riparian buffer, sub-pixel classification

291. Simulating the impacts of altered fire regimes and landscape structure on plant invasion in the southern Appalachians
Authors: **XI**, Weimin, Texas A&M University; Szu-Hung Chen, Texas A&M University; Andrew Birt, Texas A&M University; John Waldron, University of West Florida; Charles Lafon, Texas A&M University; David Cairns, Texas A&M University; Maria Tchakerian, Texas A&M University; Kier Klepzig, USDA Forest Service; Robert Coulson, Texas A&M University

Poster #17: Invasion - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: Southern Appalachian forests experience multiple environmental threats, including periodic fires, insect outbreaks, and more recently through exotic invasive plants. Past studies suggest that multiple disturbances interact to shape species-rich forest landscape, and hypothesize that change in fire regimes, and increasing landscape fragmentation, may influence invasive processes. However, the long-term impacts of these multiple factors, and forest management practices required to reduce damage from invasive plants are still unclear. We have developed a modeling approach to explore the synergistic effects of fires and fragmentation on the spread of an exotic invasive plant, Princess Tree (Paulownia tomentosa (Thunb.) Siebold & Zucc. ex Steud.). LANDIS-II, a spatial explicit forest succession model, was used to simulate vegetation dynamics and woody plant invasion in a xeric oak-pine landscape, which captures the predominant vegetation distribution in the southern Appalachian Mountains. We parameterized a pool of the 36 most dominant tree species and, using a variety of forest fragmentation and fire scenarios, simulated changes in the abundance of the over a 200-year period. We found that intermediate level of fire frequency promoted spread of the Princess Tree, but that low and high extremes of the fire frequency limited its invasion. We also found that the increase in forest boundary, (or the edge effect) caused by forest fragmentation, increased the relative abundance of Princess Tree. These results suggest that effective fire and forest management could help reduce the invasiveness of this species. More generally, the model framework that we have developed will allow us to investigate the factors that promote the spread of other invasive species, and in turn help foresters to manage other invasive plant problems.
Keywords: altered fire regimes, landscape fragmentation, multiple environmental threats, plant invasion, Southern Appalachian forests

292. Glacier to Ocean: understanding the effects of land use change and climate variation on water budgets in southern Chile

Authors: **YACKULIC**, Charles, Columbia University; Maria Uriarte, Columbia University; Ajit Subramaniam, Columbia University; Christian Little, Columbia University; Kathie Weathers, Cary Institute; Eli Dueker, Columbia University
Offered Presentations: Climatic Influences I - Tuesday, April 6: 2:20-2:40 - R

Abstract: An important step in understanding how human effects on climate and land use affect natural systems is to determine how these changes alter fluxes across ecosystem boundaries. Here we focus on understanding how land use change and climate variability have altered the transport of water from the Andes and other upland areas through lower altitudes and into near shore ocean communities over an approximately 100,000 km2 section of Chile. In this system, climate change and variability may be acting not only on the inputs, altering the frequency of el Niño and la Niña events, timing and intensity of precipitation and rates of glacial melting, as well as rates of coastal upwelling. The changes are augmented by conversion from native forest to exotic plantations over the last few decades in the Northern portion of our study zone. Understanding the behavior of these systems requires that we acknowledge various sources of uncertainty and build appropriate model structures to allow for robust inference. We develop a Bayesian Hierachical model that couples land use data from 1997 and 2007, climate data, high resolution long-term waterflow records from 71 flow stations, and measures of turbidity, chlorophyll and temperature along the Chilean coast to determine the relative importance of different land uses and inter-annual variation in climate on spatial and temporal patterns of water

flow and coastal water quality.
Keywords: Chile, climate change, Modeling, scaling, water

293. Landscape recovery assessment in impacted natural conservation area one year after the Wenchuan Earthquake in China

Authors: **YANG**, Le, Depart. of Landscape Architecture, UW-Madison; Janet Silbernagel, Depart. of Landscape Architecture, UW-Madison; Annemarie Schneider, Center for SAGE, UW-Madison
Offered Presentations: Disturbance I - Tuesday, April 6: 1:20-1:40 - F-G
Abstract: The Wenchuan Earthquake occurred in May 12th 2008 and caught worldwide attention for its violent impacts to the protected panda conservation and surrounding area. In the past year, great efforts have been taken to protect the surviving natural resources and restore the impacted area. Now is the time to assess how well the landscape has recovered and what changes occurred in the past year, which could affect the future development in the region. This research applies change detection methods using multi-temporal Landsat TM imagery to analyze patterns of landscape changes in the past year's impacted area. We also apply GIS spatial analysis to integrate multiple data layers including land cover type before earthquake, DEM, major faults in the area etc, to interpret the spatial patterns of the landscape change. The results suggest that the efficiency of landscape recovery relates to elevation, distance to the water and the level of vegetation loss in the earthquake. With such information we can identify several hot spots to prioritize recovery areas and create more efficient conservation strategies.
Keywords: change detection, land cover change, landsat TM, panda conservation, Wenchuan earthquake

294. Mechanisms for effective conservation in coupled human-natural systems

Authors: **YANG**, Wu, Michigan State University; Wei Liu, Michigan State University; Mao-Ning Tuanmu, Michigan State University; Andres Vina, Michigan State University; Jianguo Liu, Michigan State University
Offered Presentations: Landscape Aesthetics II - Thursday, April 8: 1:40-2:00 - F-G
Abstract: Conservation efforts have been increasing worldwide to mitigate habitat loss and ecosystem degradation. However, relatively few studies have integrated demographic, economic, and sociopolitical information to understand the mechanisms of effective conservation in coupled human and natural systems. To fill this knowledge gap, we selected Wolong Nature Reserve (WNR) for giant pandas and four villages in the adjacent Sanjiang Township in Sichuan Province, China, as study areas. WNR was established in 1975 with a current size of ca. 2000 km2, and ca. 4500 local residents in over 1100 households distributed in two townships. Sanjiang is ca. 485 km2, with ca. 4000 local residents in over 1100 households in 9 villages. Since 2001, these areas have been implementing the Natural Forest Conservation Program (NFCP), a national conservation program aiming to protect and restore natural forests through means such as logging bans. Subsidies are provided to households in WNR and two of the villages in Sanjiang. To quantify the effectiveness of the NFCP, we developed forest maps before and after the implementation of the NFCP using Landsat TM and ETM+ data. Then, we compared forest change rates among the study areas. To understand the mechanisms of effective conservation, we first conducted interviews with relevant governmental officials to acquire detailed information on the NFCP. Second, we interviewed 280 households to collect demographic, economic, and sociopolitical information related to conservation effectiveness.

Third, we identified factors that affect forest changes. Finally, we found the following factors that significantly contribute to effective conservation: 1) combination of top-down control and bottom-up feedback; 2) forest monitoring by households; and 3) appropriate punishments and incentives (e.g., subsidies to households). Our findings may help further enhance conservation in our study areas. They may also provide useful insights to NFCP implementation in other areas in China and conservation in other regions worldwide.

Keywords: effective conservation, giant pandas, natural forest, Wolong Nature Reserve

295. Modeling scales of associations between Sicypoterus japonicus and the stream features by using hierarchical linear models

Authors: **YU**, Hsiao-Hsuan, Department of Bioenvironmental Systems Engineering, NTU; Yu-Pin Lin, Department of Bioenvironmental Systems Engineering, NTU; Cheng-Long Wang, Department of Bioenvironmental Systems Engineering, NTU

Offered Presentations: Scale II - Thursday, April 8: 4:40-5:00 - T-U

Abstract: Ecological patterns are determined by a variety of processes, both physical and biotic, each operating over a different range of spatial and temporal scales. Understanding patterns in ecological systems depends on the ability to adopt methods that can analyze, test and draw inferences from measured associations between variables across scales in a stream system. This study addresses the cross-level interaction between density Sicypoterus japonicus and habitat features via scales by hierarchical linear regression analysis. Data applied were investigated and quantified at 70 stream sections distributed among 14 reaches in Datuan stream catchment in northern Taiwan from fall in 2007 to summer in 2008. Moreover, the influence of spatial autocorrelation for each sample spot was also considered in the hierarchical linear modeling. Results of hierarchical linear model (HLM) showed density of S. japonicus was influenced by habitat environmental variables at both section and reach levels. Contextual effects contributed by water depth, stream width, and soil erosion index to the density of S. japonicus were declared by the data of winter. Although S. japonicus density varied significantly among both sections within reaches and discrete reaches, the cross-level interactions are not always affective for distribution, processes, and activities of S. japonicus during all the seasons. The illustration of HLM provides a throughout description for multiple processes and activities of S. japonicus among and within scales along all seasons and also affords an overall annual framework for the reciprocity of environment and species in river. Moreover, the spatial autocorrelation terms improve the performances of the HLM models for delineating relations between fish density and habitat features among and within various scales.

Keywords: cross-level interaction, Datuan stream, hierarchical linear model, hierarchical linear regression, Sicyopterus japonicus

296. Spatial relationships among soil nutrients, biodiversity, and aboveground biomass in the Inner Mongolia Grassland, China

Authors: **YUAN**, Fei, Arizona State University; Jianguo Wu, Arizona State University; Yongfei Bai, Institute of Botany, Chinese Academy of Sciences; Chris Clark, Arizona State University; Xingguo Han, Institute of Botany, Chinese Academy of Sciences; Jianhui Huang, Institute of Botany, Chinese Academy of Sciences

Poster #24: Sustaining Systems - Tuesday, April 6: 5:30-7:00 - Hill Atrium

Abstract: The relationship between biodiversity and ecosystem function (BEF) is a central issue in ecology, and a number of recent field experimental studies have greatly improved our

understanding of this relationship. Few studies, however, have been devoted to examine the role of spatial heterogeneity in shaping BEF relationships. The goal of our research was to address the following research questions based on data from the Inner Mongolia Grassland Removal Experiment (IMGRE) located in northern China: What are the spatial patterns of soil nutrients, aboveground biomass, biodiversity indices, and species composition? How are these variables related spatially? How do these relationships differ at the levels of individual species and plant functional types? Specific variables of interest included: soil nutrients (i.e. soil organic carbon, SOC, total nitrogen, TN, and total phosphorous, TP), biodiversity indices (i.e. species richness, Shannon-Weaver index, and evenness index), and aboveground biomass (AGB). We carried out the analysis at three organizational levels: individual species, plant functional types (PFTs), and the entire community. Five PFTs were distinguished: perennial rhizome grasses (PR), perennial bunchgrasses (PB), perennial forbs (PF), annuals and biennials (AB), and shrubs and semi-shrubs (SS). Our results show that: (1) Most variables were spatially autocorrelated; (2) The characteristic scale of spatial patchiness varied with different variables; (3) SOC, TN, and TP were highly correlated with each other; (4) species diversity was negatively correlated with AGB at both species and PFT levels; and (5) Dominant species, as well as major PFTs, were negatively correlated, supporting the hypothesis of compensatory effects.
Keywords: biodiversity, Ecosystem functioning, Semivariance, spatial heterogeneity

297. Conspecific and heterospecific attraction in the assessment of functional habitat connectivity patterns for a social primate.

Authors: **ZEIGLER**, Sara, University of Maryland; William Fagan, University of Maryland; Maile Neel, University of Maryland; Leonardo Oliveira, University of Maryland; Becky Raboy, Smithsonian National Zoological Park
Poster #44: Resource Management - Tuesday, April 6: 5:30-7:00 - Pecan Tree Galleria
Abstract: Habitat loss and fragmentation are major drivers of global biodiversity loss, leading to reductions in population abundance, distribution, and genetic diversity at the species-level. Research has recently centered on the importance and maintenance of functional connectivity to mitigate the threats posed by habitat loss and fragmentation. This research, however, typically focuses only on landscape features such as inter-patch distance and matrix composition. We suggest that patch occupancy should also be included in analyses of functional connectivity for social species. Evidence shows that individuals of some species use public information conveyed by conspecifics and/or heterospecifics to influence dispersal and settlement decisions. Dispersing individuals are drawn to occupied patches because the presence of conspecifics and/or heterospecifics suggests that habitat in that patch is of good quality. This conspecific and heterospecific attraction could influence movement between patches and ultimately long-term metapopulation dynamics. The objective of this paper is to assess functional connectivity patterns, with and without conspecific and heterospecific attraction, between forested habitat patches for the Endangered golden-headed lion tamarin (GHLT; Leontopithecus chrysomelas) throughout its range in Bahia, Brazil. We use a supervised habitat classification of Landsat 5TM imagery and a graph-theoretical approach to illustrate that connectivity patterns change when conspecific and heterospecific attraction is included in connectivity modeling (by increasing the probability of connectivity for occupied patches). We also show the range-wide level of functional connectivity between forest patches, the location of groups of forest patches (components) that are likely to have a high level of GHLT movement between them, and key forest patches that may be disproportionately important for GHLT movement throughout the

primate's range.
Keywords: Atlantic forest, circuit theory, Golden headed lion tamarin, graph theory, metapopulations

298. Monitoring Fall Foliage Dynamics Using Time Series of Satellite Data
Authors: **ZHANG**, xiaoyang, ERT at NOAA/NESDIS/STAR; Mitchell Goldberg, NOAA/NESDIS/STAR
Offered Presentations: Simulated Environments II - Thursday, April 8: 1:40-2:00 - Y-Z
Abstract: Fall leaf color is a phenomenon occurs in many deciduous trees and shrubs worldwide. The most brightly colored fall foliage is found in most of mainland Canada, most of the United States, Scandinavia and Northern Europe, Russia and Eastern Asia. While fall foliage is an important research field of physiology, biochemistry, and molecular genetics to understand the complex mechanism of leaf color changes, monitoring fall foliage has emerged as a great interest to climate change, carbon cycle, ecology, and tourist industry. To this end, the field observations of fall foliage have been widely conducted in forest-ecology networks and citizen-scientist networks. However, little or no effort has been devoted to monitoring the development of regional fall foliage using satellite data. This study develops an innovative approach to monitor fall foliage status by means of a time series of Normalized Difference Vegetation Index (NDVI) derived from satellite data. Particularly, the time series of NDVI is simulated using a sigmoidal model to remove the observations with bad quality and to fill the temporal gaps caused by cloud impediments. The modeled NDVI greenness during a vegetation senescent season is then converted to the normalized brownness which is comparable among the areas with different vegetation abundances. The normalized brownness is further associated to the development of fall foliage status. Finally, this approach is tested using MODIS (Moderate Resolution Imaging Spectroradiometer) and AVHRR (Advanced Very High Resolution Radiometer) data in Northeastern United States and the results are verified using a set of field measurements.
Keywords: Fall Foliage, Monitor, phenology, Satellite data, Time series

299. Management Effects on Parasitic Wasp Diversity in Mt. Wuyi Agro-Forestry Landscape
Authors: **ZHENG**, Yunkai, Institute of Applied Ecology, FAFU, Fujian China; Minsheng You, Institute of Applied Ecology, FAFU, Fujian China; Jun Jiao, Institute of Applied Ecology, FAFU, Fujian China; Jinyu Li, Institute of Applied Ecology, FAFU, Fujian China
Offered Presentations: Invasion I - Tuesday, April 6: 2:40-3:00 - Y-Z
Abstract: Modern agriculture is one of the main anthropogenic threats to biodiversity. To explore the effects of agricultural intensification we investigated parasitic wasp in two years studies; in 2007 in paddy fields, edge area, agro-forestry zone and in 2008 in paddy fields, agro-forestry in the same region. Both aimed to study the effect of management on parasitic wasp diversity and composition at local and landscape scales. In 2007, we used a paired design for paddy fields, edge area, agro-forestry zone (extensively vs. intensively grazed). In 2008, a gradient design was applied with a total of seven land-use intensity categories. In both studies, sampling was carried out using sweep net with the same sampling effort. Linear mixed models showed that high intensity in paddy had a positive effect on parasitic wasp richness and abundance. Landscape diversity had a positive effect only on parasitic wasp. In the case of paddy fields, the management intensity (nitrogen fertiliser kg/ha) had a negative effect on parasitic wasp richness and no effect on agro-forestry zone parasitic wasp richness and abundance. After variance partitioning, both local and landscape characteristics seem to be important for both paddy fields

and agro-forestry parasitic wasp communities. Based on our results, we think that current and future agricultural biodiversity conservation should be concentrated on cropland extensification. Low intensity croplands and agro-forestry could act as a buffer zone around the paddy fields, at least in this biogeographic region.
Keywords: fertiliser, harvesting, scale effects, species composition, species richness

300. The river restoration at the landscape scale in Dongjiang River watershed, China
Authors: **ZHOU**, Ting, Sun Yat-sen University, Arizona State University; Shaolin Peng, Sun Yat-sen University; Jianguo Wu, Arizona State University
Offered Presentations: Simulated Environments II - Thursday, April 8: 2:40-3:00 - Y-Z
Abstract: Studying and improving the relationship between landscape pattern and ecological processes is a central issue in landscape ecology. Understanding how land use and land cover change influences the flow and water quality of rivers is critically important for wetland restoration. Human activities have transformed the landscapes in South China where damaged river systems need to be restored for achieving environmental sustainability. Based on remote sensing and field survey data, we quantified the spatial patterns of different land cover types in the Dongjiang River watershed landscape of Guangdong Province, China between 1990 and 2006, and then analyzed how river flows and water quality were related to landscape attributes. Our results show that the upper reach of the river was highly fragmented with high patch density and that the water area decreased significantly in the lower reach due to the encroachment of other land uses. We also found that water quality was positively correlated with woodland area, but negatively correlated with built-up area as well as human population and GDP. Overall, water quality was worst in the lower reach. These findings are important for restoring the river ecosystems in this region. In particular, ecological restoration should focus on land use planning that aims to increase forest cover and river connectivity. In addition, the control of pollution sources associated with human populations and economic activities must be explicitly incorporated in landscape management practices.
Keywords: anthropogenic impacts, China, Dongjiang River, Landscape pattern, river restoration

302. Biomass resources and population change in the Chitwan Valley, Nepal
Authors: **ZVOLEFF**, Alex, San Diego State University; Binoj Shrestha, Institute for Social and Environmental Research - Nepal; Li An, San Diego State University
Offered Presentations: Scale II - Thursday, April 8: 3:20-3:40 - T-U
Abstract: The Chitwan Valley, in southern Nepal, offers an ideal setting for studying linkages between population processes and environment. Bordered by the Chitwan National Park, the valley was partially cleared of forest for settlement in the 1950's and currently supports a large, mostly agricultural population. Concerns regarding the close proximity of the population to the national park, and their need for forest resources, led to the establishment in 1996 of a community managed buffer zone surrounding the park. To better understand possible linkages between population change, wood resource collection (for fuelwood and timber), and land-use/land-cover change within the valley and buffer zone, a survey focusing on wood usage and collection was conducted in the fall of 2009. The survey was administered to 80 households in the southeastern part of the Valley in the area adjacent to the Chitwan National Park and surrounding buffer zone. A survey aimed at quantifying woody biomass and woody detritus was also conducted on 58 forest plots in the buffer zone to examine spatial patterns in both live woody forest biomass and woody detritus. Drawing on existing demographic data from the long

running Chitwan Valley Family Study, we explore linkages between biomass collection and landscape change, and explore the influence of demographic factors (such as age and ethnicity) and of population change (such as changing household size) on household-level wood resource needs within the valley using a dynamic agent-based model. This reasearch is significant in explaining the role of reciprocal connections between micro-level social and environmental change in influencing macro scale social and environmental outcomes. Understanding these relationships is critically important in areas like the Chitwan Valley, where a rapidly growing human population borders a protected area of international signficance.