POSTER SESSIONS
Posters can be set up anytime starting after **Monday, April 9th at 12 noon**. Posters MUST be up by the start of the first poster session on Tuesday from 5:30-7:00 pm. They can be torn down Wednesday evening after 6 pm. If you are presenting a poster, you must staff your poster during the poster session. Abstracts can also be viewed online at [http://www.usiale.org/tucson2007/session.php](http://www.usiale.org/tucson2007/session.php).
Explaining and predicting the distribution of Celastrus orbiculatus in the Southern Appalachians using hierarchical Bayesian modeling

Thomas Albright, University of Wisconsin - Madison
James Clark, Dean Anderson, Scott Pearson, Monica Turner

Abstract: Celastrus orbiculatus (Asiatic bittersweet) is an exotic vine that is invasive in forests of the southeastern US. This species is of significant ecological concern, and more information is needed about the factors that govern its occurrence and its potential future distribution in the region. We compiled occurrence information from two databases, prepared pertinent topographic, land use, land cover, and landscape GIS data layers, and developed hierarchical Bayesian models to infer the role of ecological factors of hypothesized importance. Hierarchical Bayesian modeling offers a highly flexible analysis framework that is well suited for handling disparate datasets, spatially and temporally structured variance, and random and fixed effects, which are all characteristics of the data in this study. Analysis was conducted over an approximately 54,000 km² area at a 30 m x 30 m grain. To evaluate the models, we conducted field surveys along transects at over 50 spatially stratified sites in the region. Results suggest that elevation, developed land fraction, road density, forest fraction, and terrain slope may all be important in shaping the distribution of C. orbiculatus. Furthermore, occurrence appears to be associated with proximity to the Asheville, NC metropolitan area, which is cited as a probable source area for the initial introduction of C. orbiculatus in the region.

Topic Area: Species distributions: invasives

Symposium: Oral session

Time: Tuesday, 3:40-4:00, Salons F, G & H
Cluster identification using a parallel Hoshen-Kopelman adaptation with finite state machines

Matthew Aldridge, University of Tennessee

Abstract: The Hoshen-Kopelman (HK) cluster identification algorithm is an efficient one-pass agglomerative method for assigning unique labels to homogeneous patches in a two dimensional lattice. This research is an extension and modernization of previous work on improving efficiency by parallelizing a finite state machine (FSM) implementation of the HK algorithm. The FSM implementation allows a potential decrease in running time by reducing the number of neighboring cell comparisons (i.e., memory accesses). Whereas the original HK algorithm identifies clusters using a simple four-way neighborhood rule ('NEWS'), this adaptation enforces the nearest-eight neighborhood rule, which is more suitable to many applications involving geospatial data. Furthermore, this method may be extended to higher dimensions in order to cluster spatial data over time. Possible applications of a three-dimensional extension include tracking individuals over time to discover relationships among them or to examine regions of change over time. However, certain data impose additional challenges due to sparsity and scale, but strategies may be devised to overcome these hurdles in an efficient manner.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 2:00-2:20, Salon E
Harvesting: a keystone process in cover type evolution at landscape level? Fourteen landscape histories in Quebec (Canada)

Eric Alvarez, Laval University
Louis Belanger, Louis Archambault, Frederic Raulier

Abstract: Criteria and indicators have been developed to monitor the effectiveness of our efforts in sustainable management of forests. Although natural variability is considered as the best benchmark to define biodiversity indicators, many authors have argued that this approach is limited to steady-state equilibria. In our study area, we postulated a non-steady state situation, as the area has been subjected to periodic big fires and insect epidemics. To compensate for the limitations of the natural variability approach, we developed hypotheses that expressed the impacts of harvesting as a keystone process on the evolution of forest cover. Hypotheses have been applied on fourteen landscapes that average 300 km2. For each landscape, we monitored the evolution of forest cover for four periods of time (1946, 1957, 1976 and 1996), through natural disturbances and harvesting. Although we noticed some impacts of harvesting, particularly on jack pine (Pinus banksiana Lamb.) stands, we could not conclude that harvesting has been a keystone process for the evolution of forest cover at the landscape level. However, harvesting may have homogenized forest cover. To understand the evolution of forest cover, we use concepts associated with hierarchy and chaos theories. Management recommendations are discussed.

Topic Area: Managed landscapes

Symposium: Oral session

Time: Friday, 9:20-9:40, Salon E
Impacts of demographic compositions on long-term population and landscape dynamics

Li An, San Diego State University
Jianguo (Jack) Liu

Abstract: The impacts of human population on land use and land cover changes have been well studied at the aggregated level, but little research has been conducted to disentangle the relationship between demographic compositions and land use/land cover dynamics. The goal of this paper is to explore the impacts of micro-level demographic compositions on long-term population, household number, and landscape dynamics using an existing agent-based spatial model. This model links human individual- and household-level information with geographic, ecological, and socioeconomic information to understand the dynamics of the coupled human-natural system in Wolong Nature Reserve (China) for giant pandas. It simulates how changes in demographic compositions (e.g., proportions of senior people) affect future population (e.g., size and structure), household number, land cover, and panda habitat over long time periods (e.g., 50 years). Simulation results show many complex consequences. For instance, future landscape patterns may be path-dependent, i.e., a small difference in the initial demographic composition may cause a quite different and probably irreversible future landscape. This research may also provide useful information for planning and managing future land use and land cover changes.

Topic Area: NASA-MSU Golley-Odum Symposium: Drivers and implications of land use and landcover change

Symposium: Oral session

Time: Thursday, 11:00-11:20, Salon D
Incorporating landscape ecology into the selection and design of conservation reserves in the Northeast

Mark Anderson, The Nature Conservancy

Abstract: Protected areas are the foundation of The Nature Conservancy’s conservation efforts. Evidence increasingly suggests, however, that attention must be paid to landscape processes both within and surrounding the protected areas in order to sustain biodiversity targets. Further, it is now clear that species and ecosystems are dynamic in space and time. We incorporated landscape ecology principles into our reserve selection process and into the site design of individual reserves. For site selection, disturbance patch size and species minimum area requirements were used to address the question of how big a reserve had to be. For site design we developed spatially explicit data to evaluate the questions concerning: 1) How is the landscape constructed? 2) Where are the critical conservation features located and how do they depend on the landscape? 3) What is the condition of the surrounding forest matrix? 4) Where are the major constraints and threats relative to the conservation targets? Biophysical features such as geology, topography, elevation, ecosystems, species populations, and land cover were compiled to address the ecological issues. Data on roads, dams, toxic release points, road stream crossing and land ownerships were used to assess threats and opportunities. We used the information to select and design conservation sites that were integrally connected to the landscape and its processes. We hope the reserve networks allow and account for dynamic changes and future uncertainties.

Topic Area: Putting theory into practice: application of landscape ecology principles into environmental decision-making

Symposium: Oral session

Time: Tuesday, 11:20-11:40, Salon E
Green Areas as an element in a disturbed urban landscape; their functionalities on socio-economic and ecology; an example of megacity Karachi/Pakistan

Muhammad Mushahid Anwar, COMSATS Institute of Information Technology

Abstract: The conservation of natural resources and protection of valuable open spaces are important in maintaining and improving the high quality of life that urbanities desire. The community's natural resources and open spaces can be viewed as its "green infrastructure." In our age of cities we observe an increasing concentration of population in urban regions. Fast and uncontrolled city growth, especially in emerging and less developed countries, leads to several problems. Increases in gap between supply and demand of basic infrastructure like public transport, public sanitation, water, energy, and of public services like health, education and security, as well as the heterogeneous regional distribution of services and infrastructures according to social and economical differences, harms economy, ecology, welfare and quality of life of the urban population. The green areas are observed as a much disturbed element in densely populated megacities in developing countries. Why are green areas considered an element in a disturbed megacities landscape? The study formulates the following questions: (1) How public parks contribute in socio-economic improvement of neighborhoods? (2) What contribution parks play in enhancing ecological relations? (3) What role should management play in enhancing the quality of public parks in order to ensure equitable distribution of benefits to the residents, visitors and wildlife? Besides theoretical linkages and approaches, a case study of an especially concerned city in Pakistan was used to find out answers on the above mentioned questions. On the example of selected regions of the city, the significance and applicability of the above mentioned questions will be discussed. The main idea of this paper is to show how much urban green is important and what is available in the megacity Karachi/Pakistan. Results can be used for development of urban green spaces and biodiversity for future. Also for the improvement of socio-economic status, social and planning-related values can be identified and analyzed.

Topic Area: Cultural landscapes I

Symposium: Oral session

Time: Thursday, 3:20-3:40, Boojum
Using land surface phenology to explore the effects of landscape and riparian features on nutrient discharges in tributary watersheds of Chesapeake Bay

Matthew E. Baker, Utah State University
Michael A. White, Donald E. Weller and Thomas E. Jordan

Abstract: Remote sensing of land surface phenology has long promised an unprecedented ability to incorporate seasonality into models of landscape or watershed function. Within the last five years, research has shown that land surface phenology, the integral signal of atmospheric, snow, soil, cloud, and vegetation, can be dramatically different than vegetation phenology alone. Consequently, there is a strong need to understand the relationship between remotely sensed land surface phenology and a variety of ground-based processes. Here, we use newly developed functional measures of riparian configuration and near stream forests to explore variation in seasonal patterns of plant uptake and nutrient export from tributary watersheds of Chesapeake Bay. First, using a recently developed land surface phenology technique designed to represent a continuum, rather than a specific event (i.e. the start of the growing season), we calculated the daily percent above threshold (PAT), a metric of the percent of a watershed above a locally assigned greenness value. We found that spring increases in PAT values (green-up) were strongly and consistently related to reductions in weekly nitrate yield, suggesting an interaction between vegetative N demand and stream nitrate. Second, we found that PAT correlations with nitrate yield were sensitive to green-up signals corresponding to streamside forest. Finally, we explored whether well-buffered watersheds reduced spring nitrate yields faster than watersheds without buffers. Our findings may have implications for understanding patterns of spring nitrate delivery to the Bay, and may suggest a strategy for delaying seasonal eutrophication in downstream estuaries.

Symposium: Poster Session
The effects of prescribed fire on avian foragers in the ponderosa pine forests of the Southwestern US

Lindsay Berk, University of North Carolina

Abstract: Many bird populations have declined due to changes in fire regime and the resulting alteration of habitat. Some studies show that birds exhibit higher diversity in fire-maintained landscapes versus unmanaged landscapes, but the impacts of prescribed fire and the mechanisms behind avian responses remain unclear. Few studies have addressed the effects of prescribed fire on bird communities of the Southwest, especially in reference to these impacts on foraging behavior. Here I illustrate a study that evaluated fire as a restoration tool for bird communities in the Southwest, addressing the following questions: 1) does foraging behavior impact avian responses to fire treatments at multiple spatial scales; and 2) how do birds alter their guild structure and behavior in response to these treatments? We implemented a prescribed fire treatment at study sites situated in southwestern ponderosa forests and sampled vegetation structure, bird species abundance, and foraging behavior at all sites. With these data, we can examine how birds respond to fire treatments through their differing densities, foraging behaviors, and through scaling effects of these responses. These results will offer insight into avian responses to prescribed fire and provide land managers with the necessary information to continue efficient forest management practices.

Topic Area: Disturbance effects

Symposium: Oral session

Time: Thursday, 3:40-4:00, Salon D
An emerging national phenology network for the U.S.A.

Julio Betancourt, US Geological Survey
Mark D. Schwartz and NPN Implementation Team

Abstract: Variations in phenology affect the abundance and diversity of organisms, their interspecific interactions, their ecological function, and their effects on fluxes in water, energy, and chemical elements at various scales. Phenology can be used as a predictor for other processes and variables at local to global scales, and could drive ecological forecast models with both scientific and practical applications. The National Phenology Network (NPN) is an exciting plan to engage multiple federal agencies, environmental networks and field stations, educational institutions, and citizen scientists in repeatable seasonal observations of plants and animals across the U.S.A. Included in the monitoring strategy are intensive sites (e.g., those with flux towers); spatially-extensive networks (e.g., weather stations, field biological stations, experimental forests, national parks, and wildlife refuges); college campuses and public volunteers; and the remote sensing community. An undertaking of this size will require meticulous planning to guide the collection, analysis and use of the data, and to ensure the success of the network over the long term. In the short term, NPN will establish a National Coordinating Office in Tucson under the auspices of USGS and the University of Arizona, and will launch the first set of phenological observations nationwide in growing season 2007.

Topic Area: Phenologies as integrative phenomena for landscape research

Symposium: Oral session

Time: Friday, 8:00-8:20, Salon D
Spatial distribution of mountain pine beetle in Morice Timber Supply Area in western British Columbia between 1995 and 2002

Magda Biesiada, University of Toronto
Marie-Josee Fortin, Trisalyn Nelson

Abstract: Mountain pine beetle (MPB, Dendroctonus ponderosae) outbreaks are spreading at an unprecedented rate in British Columbia. To better understand which factors prevail in the spatial distribution of MPB, infestation data in Morice Timber Supply Area (Western British Columbia) from 1995 to 2002 were analyzed using classification and regression trees (CART). CART models revealed a number of relationships between the spatial distribution of aerially detected MPB infestations and coarse topographical and environmental variables. The CART models used variables related to elevation, stand age, crown closure, total precipitation, and minimum temperatures in fall and winter. The MPB occurrence was associated with elevation less than 800m, stand age between 125 and 180 years, total yearly precipitation less than 500mm, relatively warm falls (minimum temperature more than -9°C), and cool winters (minimum temperature less than -30°C). The most important relationship was detected between the MPB occurrence in a given year and the number of beetle-infested cells in a preceding year (in a 9-cell analysis window). On average, the beetle occurrence was associated with between 2.5 and 5.5 beetle infested cells in a previous year. Hence, in the presence of a host, the best predictor of MPB infestation is the spatial extent of prior MPB occurrence.

Topic Area: Species distributions: populations

Symposium: Oral session

Time: Thursday, 10:00-10:20, Salons F, G & H
The effects of wetlands on zebra mussel (Dreissena polymorpha) dispersal in coupled lake-stream systems

Betsy Bodamer, University of Toledo - Lake Erie Center
Jonathan Bossenbroek, David Hartson

Abstract: Stream connectivity is a major means of zebra mussel spread throughout inland lakes. We hypothesized that vegetated waterways, i.e. wetlands, would hinder downstream dispersal of zebra mussels in connected inland lake systems. To test this hypothesis, veliger (juvenile) abundance, recruitment, and adult mussels were surveyed in five lake-wetland systems in southeastern Michigan from May through August 2006. Sampling was conducted downstream of an invaded lake, beginning at the upstream edge of aquatic vegetation and continuing downstream through the wetlands. We compared our data to zebra mussel abundance patterns previously found in lake-stream systems that had little or no vegetation. In our study, veliger abundance decreased rapidly in vegetated waterways compared to reported rates in non-vegetated waterways. Veligers were rarely found more than 500 meters from the beginning of vegetation, while in unvegetated streams veligers can be found for 18 kilometers. Recruitment and adult mussels were extremely rare beyond open water in the wetland systems studied. Our results suggest that densely vegetated aquatic ecosystems limit the distance that zebra mussels can disperse downstream from invaded sources.

Topic Area: Species distributions: invasives

Symposium: Oral session

Time: Tuesday, 4:00-4:20, Salons F, G & H
Modeling the long-distance dispersal of the emerald ash borer

Jonathan M. Bossenbroek, University of Toledo

Abstract: The ash trees (Fraxinus spp.) of North America are at great risk from the invasion of the emerald ash borer (Agrilus planipennis), which has already damaged ash trees in large areas of Michigan, Ohio, and Ontario. The emerald ash borer can disperse naturally and be transported by people via firewood and other wood products. A gravity model was developed to predict the movement of individuals between emerald ash borer source areas to campgrounds. In our model, we estimated the proportion of individuals traveling from each zip code to over 1000 public and private campgrounds in Indiana, Michigan, and Ohio. Median income for each zip codes was also incorporated into the model. Within the gravity model framework, movement of campers was based on the distance to and attractiveness of destinations. Parameterization of the model was done by comparing model results to reservation data from State Park campgrounds. Our results provide a relative level of risk of invasion for each campground within the study area. High risk campgrounds are predicted to exist throughout the study area and not just close to the current range of the emerald ash borer.

Topic Area: Species distributions: invasives

Symposium: Oral session

Time: Tuesday, 5:00-5:20, Salons F, G & H
Effects of road development and logging on the southern range limit of wolverines in boreal forest

Jeff Bowman, Ontario Ministry of Natural Resources
Justina C. Ray, Audrey J. Magoun and F. Neil Dawson

Abstract: The southern range boundary of wolverines in North America has contracted during the period of European settlement, presumably due to human encroachment. In Ontario, Canada, wolverines are at the extreme southeast of their current geographic range on the continent. They occur there in boreal forest at low population density and are a species at risk. We carried out an aerial survey during winter 2005 across the wolverine’s southern range boundary to determine whether their distribution was consistent with hypothetical limiting factors. We surveyed an area of 58,800 km², stratified into 588 hexagons. Within each we assessed the presence of wolverines, their major foods (deer, moose, caribou), their major competitor (wolves), forest cover, logging activity, and the density of roads. Our results suggest that wolverines were indirectly affected by roads and logging. Logged and roaded landscapes were preferred by abundant deer and moose, and avoided by caribou. The resulting increase in ungulate biomass in logged and roaded areas supported higher wolf abundance than uncut areas. Wolverines appeared to avoid high prey biomass areas near roads due to the presence of wolves. Instead both wolverine and caribou were distributed away from roads and logging.

Topic Area: NASA-MSU Golley-Odum Symposium: Drivers and implications of land use and landcover change

Symposium: Oral session

Time: Thursday, 11:20-11:40, Salon D
Wildlife management and landscape ecology: integrating concepts and practice

Terry Bowyer, Idaho State University
John G. Kie, David K. Person and John W. Connelly

Abstract: We chronicle the use of landscape concepts by the early practitioners of wildlife management, and discuss how ideas such as interspersion and juxtaposition of habitats have influenced wildlife ecology. We track the development of landscape ecology and effects of scale in the wildlife literature over the past 3 decades and examine areas of overlapping concepts between the two disciplines. We use case studies from the published literature to provide examples where similarities in wildlife management and landscape ecology have emerged. We discuss many hypotheses originally developed in the wildlife literature that have become central to the study of landscape ecology. These include the overarching importance of spatial and temporal scales, the relative contributions of proportion of habitat types versus patch arrangement to the well-being of wildlife populations, effects of topography on movements and dispersal of individuals, and the importance of the life-history characteristics of species on ecological processes. Landscape ecologists have developed a complex array of metrics to quantify landscape structure. A more complete understanding of the ecological implications of those metrics is needed for sound wildlife management. Finally, landscape metrics can provide insights into community and ecosystem structure; a challenge for the future is to apply new or existing metrics to ecosystem processes.

Topic Area: Putting theory into practice: application of landscape ecology principles into environmental decision-making

Symposium: Oral session

Time: Tuesday, 10:20-10:40, Salon E
Southwest Regional Gap Analysis Project

Ken Boykin, US Geological Survey
Julie Prior-Magee, John Lowry, Andrea Ernst

Abstract: The Southwest Regional Gap Analysis Project (SWReGAP) is a mapping and assessment of biodiversity for the five-state region encompassing Arizona, Colorado, Nevada, New Mexico, and Utah. It is a multi-institutional cooperative effort coordinated by the U.S. Geological Survey’s National Gap Analysis Program. The primary objective is to use a coordinated mapping approach to create detailed, seamless maps of land cover, habitat for terrestrial vertebrate species, and land ownership and management status, collectively call stewardship mapping. This information is analyzed to identify animal species habitats and natural land cover types that are underrepresented on lands managed for their long term conservation. Regional labs at Utah State University and New Mexico State University coordinated the development of products for land cover mapping, animal habitat modeling, and stewardship for the entire five-state region. Individual state labs worked cooperatively through the regional labs to produce regionally consistent and seamless data sets for the Southwest. This poster will provide an overview of the four main products of SWReGAP: 1) land cover mapping, 2) animal habitat modeling and mapping, 3) stewardship mapping, and 4) gap analysis.

Symposium: Poster Session
Multi-proxy, multi-century, and multi-scale fire and forest histories from tree-ring data

Peter M Brown, Rocky Mountain Tree-Ring Research

Abstract: Absolutely dated, dendrochronologically crossdated fire-scar and tree-recruitment chronologies are being developed both to assist land managers in making scientifically based natural resource management decisions and to provide insights into synoptic climate effects on fire timing and forest dynamics. I describe recent results from several studies in Utah, Colorado, South Dakota, Montana, and New Mexico that use an n-tree density-adapted sampling design to reconstruct integrated spatial and temporal patterns in past fire occurrence and forest dynamics across stands, watersheds, and regions. I also describe a recent study that combined fire-scar data from 238 sites across western North America to document contingent effects of teleconnections with Pacific and Atlantic Ocean forcings on fire occurrences since 1500. These new multi-proxy studies are providing unique insights into how climate affects ecosystem processes and patterns over annual to multi-centennial temporal scales and across multiple spatial scales from stands to regions.

Topic Area: Recent advances and future innovations in multiscale systematic tree-ring reconstruction of historical fire regimes

Symposium: Oral Session

Time: Tuesday, 2:40-3:00, Salon E
Assessing the spatiotemporal pattern of primary production in urban environment using remote sensing data: A case study in Phoenix, USA

Alexander Buyantuyev, Arizona State University
Jianguo Wu

Abstract: Although urbanization is generally thought of as a process that decreases primary production, for desert cities this may not be the case because of highly productive croplands and green spaces. The growth of native desert communities depends strongly on the amount and timing of precipitation, but the growth of urban vegetation is decoupled with precipitation due to human ameliorations. To better understand the Phoenix urban ecosystem in the Sonoran Desert, we attempted to quantify the overall losses and gains of productivity due to urbanization. We used 250m MODIS NDVI to assess the spatiotemporal patterns of primary production and vegetation responses to interpolated climate variables that were correlated with NDVI on several time scales. Our results show that native desert at lower elevations is less productive than upland communities, and that riparian ecosystems encompassing perennial streams are the most productive. Urban vegetation and agricultural lands have intermediate levels of primary production. They are least affected by climatic fluctuations than desert communities. As expected, the primary production of native desert vegetation is tightly coupled with precipitation, but with a time delay of a few months. Our work provides insights into the interactions among vegetation growth, climate variability, and urbanization.

Topic Area: Remote sensing II
Symposium: Oral session
Time: Tuesday, 1:20-1:40, Bonsai
Habitat classification and conservation practice: scale-matching between ecological and statistical models

Nicolette Cagle, Duke University
Dean Urban

Abstract: Habitat classification is a fundamental task in landscape ecology and management, providing the foundation for inventory and monitoring, site prioritization, and integrated assessment. Recently, increasingly available geospatial datasets and more powerful computers have spawned a proliferation of new habitat modeling applications over increasingly large spatial extents. Here we adopt Austin's framework of species distribution modeling as the intersection of ecological, data, and statistical models. From this perspective, we consider that recent trends in habitat modeling have divorced the statistical models from the ecological models underlying the applications, often because the available data drive statistical model selection without sufficient attention to natural history and ecological theory. In particular, the ecological context provided by niche theory, metapopulation theory, and biogeography inform species distribution models at local, landscape, and regional scales, but statistical models are blind to these nuances. We offer guidelines on matching ecological, data, and statistical models at these three scales, emphasizing the exciting capabilities now available in tree-based and other emerging modeling tools.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)

Symposium: Oral session

Time: Tuesday, 4:40-5:00, Salon D
Assessing the potential for rehabilitated aggregate extraction sites to be used as reintroduction sites for species at risk in Ontario: A metapopulation approach

Melissa Cameron, University of Guelph
Robert Brown, Robert Corry

Abstract: The loss of habitat and the resulting extirpation of species at risk is a dominant landscape level process in Southern Ontario, Canada. Protecting existing critical habitat is an important conservation measure, but remnant populations of species at risk may be so isolated from one another that long term population persistence is unlikely without the creation of new habitat. Aggregate extraction sites are common elements in the Ontario landscape, and with the rehabilitation of these sites being required by law, they offer islands of opportunity for species at risk. The purpose of our research was to examine the potential for clusters of rehabilitated extraction sites to be used as reintroduction sites for species at risk, using Eumeces fasciatus (Five-lined Skink), ranked S3 (rare to uncommon) in Ontario, as a model species. Using spatial analysis and meta-population modeling, we have developed a standard methodology to assist in determining the spatial distribution and population structure required to establish a stable metapopulation of a species at risk. We demonstrate the method with an application to active and abandoned aggregate extraction sites in southern Ontario. Targeting abandoned industrial sites for rehabilitation may play a critical role in the protection of species at risk globally.

Topic Area: Conservation planning: restoration

Symposium: Oral session

Time: Friday, 8:20-8:40, Boojum
Rodent community landscape ecology in grassland-shrubland ecotones and gradients in the Chihuahuan Desert

Andrea Campanella, New Mexico State University
Brandon Bestelmeyer, Gary Roemer, Debra Peters

Abstract: It is believed that the abundance and diversity of Chihuahuan Desert rodents increases with shrub encroachment accompanying desertification although grassland specialist species decline with loss of perennial grasses. It has been reported, however, that rodent population responses to spatial variation in habitat are mediated by a complex suite of biotic-abiotic interactions. The consistency of such patterns across a landscape has not been examined. We tested the hypothesis that rodent richness, biomass, and density/abundance were highest in shrub-dominated portions of replicate grassland-shrubland ecotones and across a grassland-shrubland gradient. Rodents were trapped on permanent grids scattered over an area of 200 km2. Mark-recapture procedures were used to estimate population density and the software eCognition to estimate landscape structure using an object-oriented spatial analysis approach. We found that rodent abundance, biomass, and species composition were highly variable and related to the details of vegetation structure across the landscape, rather than being simply positively correlated with shrub cover.

Topic Area: Species distributions: communities

Symposium: Oral session

Time: Thursday, 2:00-2:20, Salons F, G & H
Transect coding in western Canada: Transitioning from use-based to gradient-based regulation in the planning and design of sustainable urban environments

Gian-Carlo Carra, University of Calgary

Abstract: Ecological consciousness, as expressed in terms of sustainability and "triple bottom line" responsibility, is increasingly prevalent in the high-level policy statements that are made by North American municipalities. However, the achievement of sustainable urban spatial patterns generally remains stymied by process frameworks that have been inherited from the previous mechanistic approach. The monocultural homogeneity of the zoning codes that regulate land-use within municipalities represents a significant source of this path dependence. Originally developed to address the social, economic, and ecological issues provoked by the explosive, industrially driven urbanization of the late 19th Century, land-use zoning evolved with the rise of post-war planning bureaucracies into a critical policy enabler of segregated sprawl landscapes. Gradient-based (as opposed to conventional use-based) coding systems that apply locally calibrated transects to regulate the spatial characteristics of and relationships between built landscapes are an emerging policy tool enabling an alternative and ecological approach to the planning and design of sustainable urban environments. Drawing from best practices of this emerging tool, the transition to transect coding is examined within a series of Western Canadian urban landscapes at multiple scales.

Topic Area: Cultural landscapes I

Symposium: Oral session

Time: Thursday, 2:00-2:20, Boojum
Investigating local scale variability in post-wildfire vegetation dynamics for a burned area in Central Arizona

Grant M. Casady, University of Arizona
Willem J.D. van Leeuwen, Dan Neary, Barron J. Orr and Stuart E. Marsh

Abstract: Understanding the dynamics of post-wildfire ecosystem dynamics is critical for developing reasonable expectations for the availability of important societal goods and services provided by forested ecosystems. The vegetation dynamics of a particular burned area are not constant across either space or time, but rather vary with changes in the spatio-temporal availability of resources such as solar insolation and topo-edaphic features, coupled with variations in burn severity across the landscape. This research used seasonally integrated time-series vegetation indices (VI) measured by the Moderate Resolution Imaging Spectroradiometer (MODIS) as a proxy for pre- and post-fire primary productivity at a ponderosa pine dominated site in Central Arizona which burned in May of 2002. The VI data were compared to a number of spatially variable environmental data sets, including topographic metrics, soil data, a burn severity map, and a pre-burn vegetation community map. This comparison introduces a valuable method for enhancing the understanding of post-wildfire vegetation regrowth, and represents a valuable step toward better management of post-burn ecosystems for the enhancement of ecosystem health as well as valued ecosystem services.

Topic Area: Fire & landscape pattern

Symposium: Oral session

Time: Tuesday, 3:40-4:00, Salon E
Evaluating post-wildfire vegetation dynamics across semi-arid sites in Spain, Israel, and the United States

Grant M. Casady, University of Arizona
Wim J.D. van Leeuwen, Jennifer E. Davison, Susana Bautista, Yohay Carmel, Dan Neary and Barron J. Orr

Abstract: Wildfires alter landscape structural and functional processes, and impact the availability of ecosystem goods and services. The investigation of post-wildfire ecosystem dynamics is important in semi-arid regions because of the prolonged recovery period in these regions and recent projections of future increases in wildfire activity in these systems. This study investigates post-fire vegetation dynamics across three semi-arid study areas to determine the degree to which these areas differ in their post-fire response. A satellite based time-series vegetation index was used to monitor post-wildfire vegetation at sites in the US, Spain, and Israel. Regression analysis determined the importance of accounting for between site variations when measuring post-wildfire vegetation trends. Analysis of the response over time of all three sites together showed an increase in the coefficient of determination from 0.322 to 0.844 when differences in site characteristics were accounted for by using a reference site to normalize seasonally integrated NDVI. Differences in the response of the sites could be attributed to differences in attributes such as climate, soils, and management history. This variation was minimized when accounted for by using the response of a nearby reference site to represent an integration of environmental differences between the sites.

Symposium: Poster Session
Biodiversity of Trans-Himalayas with special reference to high altitude wetlands of Ladakh, India

Pankaj Chandan, WWF India

Abstract: Ladakh represents the westernmost extension of the Vast Tibetan Plateau, covering an altitude range from 2700 to 7650 m. Two major mountain chains, the mighty Himalayas and the Karakoram, demarcate its natural borders towards the south and the north respectively, whereas the Zanskar and Ladakh ranges run through it cut by the flow of the Indus. It constitutes over 80% of the Trans-Himalayan Tract in India and is home to a unique assemblage of flora and fauna. The region is also known as cold-desert and is characterized by severe, arid conditions. Temperature may drop to -40.0°C in the long winter months between December and April and may rise to 35.0°C in short summer season in July and August. The vegetation in the region is sparse and productivity peaks only in short summer season. This harsh environment is thus home to only highly adaptable flora and fauna. Several species of mammals are found in the region, e.g. the Blue Sheep (Pseudois nayaur), Ladakh Urial (Ovis orientalis vignii), Tibetan Argali (Ovis ammon hodgsoni), Tibetan Wild Ass (Equus kiang king), Himalayan Marmot (Marmota himalayana), Red Fox (Vulpes vulpes), Tibetan Gazelle (Procarpa picticaudata), Snow Leopard (Uncia uncia), Lynx (Lynx isabellina), Wild Dog (Cuon alpinus laniger), Tibetan Wolf (Canis lupus chanko), Tibetan antelope (Pantholops hodgsoni), and Wild Yak (Bos grunniens). The flora of Ladakh falls under the Alpine and High Alpine zones and is dominated by annual and perennial herbs. The vegetative growth commences at the break of summer when melting snow provides abundant moisture to the alpine plants. The month of August sees the flora in its full bloom but it starts disappearing as soon as September approaches. The mountain slopes, meadows, moraines and pasture lands decorate Ladakh's otherwise barren mountain with a spectacular display of flowers. This wealth of medicinal plants play a very important role in the day to day social and spiritual life of the natives of Ladakh and their traditional "Amchi" system of medicine. Some of the widely used medicinal plants are Podophyllum hexandrum, Aconitum violaceum, Picrorhiza kurrooa, Rheum spiciforme, Hyoscyamus niger, Capparis spinosa, Delphinium brunonianum, Ephedra gerardiana, Hippophae rhamnoides.

Symposium: Poster Session
Patch size affects plant extinction rates during succession in an experimentally fragmented grassland

Cathy D. Collins, University of Kansas
Robert. D. Holt and Bryan L. Fosterx

Abstract: Species colonizations and extinctions drive compositional turnover during succession. Island Biogeography Theory (IBT) predicts that in a fragmented habitat the rate of succession will be a function of patch (island) size and distance from seed sources. In an experimentally fragmented landscape in eastern Kansas, old-field succession progresses more quickly on large fragments near a forest source. We predicted that if succession governs plant extinction in our system, early-succession species will go extinct faster on large patches than small. To test this prediction, we investigated occupancy and abundance patterns across time for early successional species. Here, we show that patch size affects plant extinction patterns. As succession progressed, we observed statistically significant differences in the distribution of abundance across occupied quadrats between large and small habitat fragments. Despite the slower rate of woody encroachment on smaller fragments, many early successional plant species go extinct significantly faster on these small patches.

Topic Area: Species distributions: methods

Symposium: Oral session

Time: Tuesday, 11:40-12:00, Salons F, G & H
Proximate and underlaying causes of deforestation in the Southeast Mexican Tropical Dry Forest

Rogelio O. Corona-Natchez, Universidad Nacional Autonoma de Mexico
Jose L. Palacio-Prieto and Leopoldo Galicia

Abstract: In Mexico the Tropical Dry Forest (TDF) is the most widely distributed tropical ecosystem and it is considered the most endangered, mainly by agriculture and cattle raising. Nevertheless, the deforestation patterns as biophysical factors are well understood in this ecosystem, but understanding of socio-economical factors is lacking. The aim of this study was to analyze the causes of land use and land cover change (LUCC), deforestation, and fragmentation of the Southeast Mexican TDF. The LUCC map was constructed from the interpretation of aerial photographs, SPOT satellite imagery, and field work. Landscape fragmentation parameters were obtained with the FRAGSTATS program (version 3.3). Slash and burn farming was the main proximate cause of TDF deforestation. On the other hand, use of mechanized agriculture has not increased in the last two decades. Moreover, it did not vary spatially over time because it is limited to alluvial plains, where it is not constrained by water, nutrients, or roads. Throughout the tropics, these underlying causes are responsible for high deforestation rates. However, at a local scale, we have observed that tertiary activities, such as tourism, reduce deforestation rates as a result of their higher incomes than primary activities, thereby promoting agricultural land abandonment and secondary forest regrowth. Finally, in Mexico it is important to analyze both the proximate and underlying causes of TDF deforestation in order to develop conservation approaches, promote public politics, and reduce the degradation of this ecosystem.

Symposium: Poster Session
Abstract: Depleted aggregate extraction pits and quarries in Ontario must be rehabilitated by statute (Aggregate Resources Act, Revised Ontario Statute, 1990, Chapter A.8). Intended land covers from rehabilitation include agriculture, housing, open water, golf courses, roads, wetlands, woodlands, and meadows, only a few of which offer relatively high biodiversity. The three professions legally permitted to make rehabilitation plans in Ontario engineers, land surveyors, and landscape architects have an opportunity and responsibility to achieve functional rehabilitated landscapes. Yet biologically diverse land covers such as restored wetland, woodland, meadow, alvar, and prairie habitats are made more ecologically viable by functional connections to nearby ecosystems, not in isolation. Rehabilitating all depleted aggregate sites including some that have been vacant or minimally active for years or decades, may destroy or damage spontaneous vegetation (some of which may be locally important), diminish slope complexity and niche diversity, disturb soil profiles, and introduce non-site-specific soils and invasive plants. In this paper we describe how considerations of landscape context might affect the cultural and ecological consequences of rehabilitation and restoration planning, and we illustrate how an "at-risk" landscape context could make a meaningful contribution to rehabilitation design and planning.

Topic Area: Conservation planning: restoration

Symposium: Oral session

Time: Friday, 8:40-9:00, Boojum
The impact of landscape fragmentation on birds and mammals in the Medicine Bow Mountains, Wyoming USA.

Samuel A Cushman, USDA Forest Service

Abstract: We present a hierarchical analysis of habitat relationships of birds and mammals in the Medicine Bow Mountains of Wyoming and impacts of intensive landscape fragmentation by forest harvest. The study is a controlled landscape-level experiment involving paired watersheds, one of which experienced intensive patch clear cutting and the other was unmanaged. Birds and mammals were sampled annually on 180 plots distributed evenly between the two watersheds for four years pre-treatment and three years post treatment. We assess the influences of pre-treatment habitat factors at three spatial scales on these taxa and evaluate the effects of treatment on their relative abundance. Our results indicate that there are strong differences among taxa and guilds within taxa in terms of the relative importance of habitat factors at different spatial scales and their relative sensitivity to intensive patch clear-cutting.

Topic Area: Species distributions: methods

Symposium: Oral session

Time: Tuesday, 10:00-10:20, Salons F, G & H
Modeling landscape connectivity for elephants in Botswana

Samuel A Cushman, USDA Forest Service
Michael Chase

Abstract: This study used GPS location data and landscape maps of water sources, rivers, vegetation, roads, fences, agricultural areas and settlements to identify corridors, barriers and produce a map of landscape resistance for elephants in northern Botswana. The data set consisted of movement pathways of 12 elephant herds, with locations taken every twenty minutes. These location data are highly autocorrelated over long time periods. This extreme autocorrelation of movement data invalidates most traditional approaches to movement analysis and habitat use. Here we present an analytical approach that uses the patterns of autocorrelation to improve predictions of the factors that influence movement. Each GPS data stream is turned into a polyline describing the pathway the animal has taken. We use fuzzy bridge algorithms to predict the probability of location for all moments in time between acquired fixes. This produces a grid, the values of which correspond to the probability of the wolverine having crossed that cell in its movement. We model cumulative cost across this path-grid with respect to multiple hypotheses of landscape resistance. These multiple hypotheses include a factorial combination of a) elevation, b) slope, c) vegetation, d) water, e) roads and, f) settlements. We identify the hypothesis that corresponds to the minimum of cumulative movement cost. We then randomly overlay the movement grid on the landscape 500 times. We then compute cumulative cost along each "available path" for each resistance hypothesis, and identify the hypothesis that maximizes the difference between cumulative resistance along the actual path and the distribution of cumulative resistances along the "available paths". The result is a statistical test of the relative support for each hypothesis. This allowed us to quantify relative effects of each landscape feature on elephant movement, identify corridors and barriers, and produce an optimal map of landscape resistance to wolverine movement.

Symposium: Poster Session
Corridors increase species richness at large scales

Ellen Damschen, National Center for Ecological Analysis and Synthesis
Nick M. Haddad, John L. Orrock, Joshua J. Tewksbury and Douglas J. Levey

Abstract: Land managers often create reserve networks that incorporate the use of landscape corridors, linear strips of habitat connecting isolated patches, to preserve biodiversity. Most empirical tests of corridors have been limited to individuals and populations, leaving corridor effects on diversity largely unknown, especially at large spatial scales. Additionally, only a handful of studies have examined corridor effects on plants, which may be especially sensitive to the abiotic changes resulting from alterations in patch shape due to dispersal limitation. Using one of the best replicated large-scale habitat fragmentation experiments, I explicitly tested for corridor effects on plant community diversity and composition. My experimental design separated between the three possible ways corridors can affect between-patch processes: by acting as a movement conduit between connected patches ("connectivity effects"), by increasing area alone ("area effects"), and by intercepting organisms moving across the landscape and filtering them into connected patches ("drift fence effects"). Additionally, I test for the importance of within-patch edge effects since corridors increase the amount of edge relative to core habitat in a given patch.

Topic Area: Remote sensing I

Symposium: Oral session

Time: Thursday, 1:20-1:40, Salon E
Vegetation phenology and climate variability in a Sky Island in Arizona

Jennifer Davison, Arizona Remote Sensing Center
Willem J. D. van Leeuwen, Grant Casady and Stuart Marsh

Abstract: Climatic change and variability in the Southwestern US have resulted in prolonged drought events, wildfire disturbances, and shifts in the timing of vegetation life cycles, or phenology. Ecological and socio-economic implications of these shifts in vegetation phenology affect land use and planning, invasions of diseases and non-native species, and provision of ecosystem services. Understanding seasonal and inter-annual vegetation phenological metrics (pheno-metrics: beginning, peak, and duration of growing season, magnitude, seasonality) derived from time series satellite data will allow for monitoring and prediction of responses due to climate changes and trends. MODIS (Moderate Resolution Imaging Spectroradiometer) greenness (NDVI: Normalized Difference Vegetation Index) time-series data (2000-2006) were analyzed with TimeSat, Santa Rita Mountains, in Southeastern Arizona. The resulting pheno-metrics were related to PRISM (Parameter-elevation Regressions on Independent Slopes Model) climate data, topography, and a gap-based vegetation classification, as well as ground-based measurements of precipitation and temperature. Greenness patterns and pheno-metrics responded to intra- and inter-annual climate trends. Visualization of the spatial and temporal patterns in vegetation phenological metrics provides a tool for monitoring seasonal and inter-annual growth and community responses to climatic factors.

Topic Area: Remote sensing I
Symposium: Oral session
Time: Tuesday, 11:40-12:00, Bonsai
Phenological metrics and their response to drought in Arizona: The Santa Rita Mountains

Jennifer Davison, University of Arizona
Willem van Leeuwen, Grant Casady and Stuart Marsh

Abstract: The severity and duration of drought events are increasing in the Southwestern US due to climate change and variability. This trend has ecological and socio-economic implications for ranchers, farmers, tourists, and resource managers as vegetation life-cycle patterns respond to decreasing and sporadic water availability. The use of remotely sensed time-series data can assist in understanding life-cycle, or phenological, changes in vegetation communities at the landscape scale. This project explores the vegetation phenology of the biologically diverse Santa Rita Mountains in Southeastern Arizona. "TimeSat" phenology software was used with MODIS (Moderate Resolution Imaging Spectroradiometer) greenness (NDVI: Normalized Difference Vegetation Index) time-series data to derive phenological metrics such as season start, peak and amplitude, and seasonal NDVI integrals, for each pixel. Pheno-metrics were extracted for the seasons of 2001 through 2005 and compared to monthly PRISM (Parameter-elevation Regressions on Independent Slopes Model) precipitation and temperature data to detect responses to drought and precipitation events. The spatial and temporal patterns in the satellite-based pheno-metrics were closely related to these events. Pheno-metrics can be used to detect landscape-scale spatial and temporal impacts of drought events and to provide a decision support tool for natural resource managers.

Symposium: Poster Session
Modeling the consequences of forest disturbance in multiple ecosystems using MODIS

Kirsten de Beurs, University of Wisconsin – Madison
Philip A. Townsend, Clayton C. Kingdon and Brian R. Sturtevant

Abstract: The analysis of land surface phenology (LSP) provides an important approach to change detection in terrestrial ecosystems. We have developed a new method to estimate the extent and intensity of defoliation by the gypsy moth, spruce budworm and jack-pine budworm based on anomalies in LSP evident in 8-day composites of 250m Terra MODIS Imagery. We first model the seasonal phenology based on the spring trend of the MODIS simple ratio vegetation index (VI, calculated as near infrared / red) by accumulated growing degree days. We then compare the observed phenology with the expected phenology to determine the presence and intensity of defoliation. We found significant defoliation on the regional MODIS scale with diminished seasonal VI between 5-40%. We compared our maps of defoliation against sketch maps from the U.S. Forest Service and Ontario Ministry of Natural Resources and found >70% correspondence with mapped defoliation when spatial errors are taken into account. Additional evaluations employed maps of defoliation derived from Landsat imagery and field measures of defoliation.

Topic Area: NASA-MSU Golley-Odum Symposium: Integrating remote sensing of forest disturbances with models at broad scales

Symposium: Oral session

Time: Tuesday, 11:20-11:40, Salon D
Maximization of Shannon Diversity under energetic constraint explains the partitioning of species richness among vertebrate taxa in North America

David A. Dean, University of New Mexico
Bruce T. Milne

Abstract: North American vertebrate species richness, S, increases monotonically with available energy measured as potential evapotranspiration (PET). Evenness across birds, nonvolant mammals, reptiles, and amphibians increases systematically as PET approaches 2000 mm/yr. The pattern is commensurate with expectations of Boltzmann theory, where probabilities of alternative states (i.e., taxa) become equal as the governing constraint is relaxed. Our goal was to formulate a Boltzmann model to partition species richness into fractions of S for each taxon, subject to the constraint of finite PET. We predicted taxon probabilities and Shannon diversity for a range PET values. Taxon energy demand varied by three orders of magnitude, ranging from 2300 mm/yr for amphibians to a slightly negative value for birds. As PET increased, avian probabilities declined, mammalian probabilities were level at the unconstrained expectation of 1/4, while amphibian and reptilian probabilities approached 1/4 from below. Our model supported three novel conclusions: (a) vertebrate diversity is maximized and in steady-state with energy supplies at broad spatial scales; (b) adjustments in the relative probabilities of taxa with PET occur via changes in species composition, and (c) the partitioning of available energy among taxa is regulated by taxon-specific rate coefficients that are invariant across environments.

Symposium: Poster Session
Rapid Evaluation of Arid Lands (REAL)

Michael N. DeMers, New Mexico State University

Abstract: Geospatial technologies have not proven particularly effective at evaluating arid landscapes because of a heavy reliance on the spectral response of vegetation collected by orbiting satellites. Unfortunately, desert grasslands, especially those that exhibit the patchy response of marginal or fully dysfunctional landscapes, are composed largely of soil background rather than vegetation. I describe a rapid, inexpensive and transferable methodology that has the potential to rank arid rangeland conditions for management. By applying some general principles of Ecological Niche Theory with visual interpretation of simple band-ratioed Landsat TM data we have been able to infer vegetative condition in the Chihuahuan Desert of North America. By first classifying landforms and inferring component soils complexes one can estimate coarse vegetative communities with accuracies approaching 100%. It is a simple step to use these community classifications to develop appropriate triage-like estimates of suggested and sustainable rangeland grazing levels.

Topic Area: Conservation planning:analysis

Symposium: Oral session

Time: Thursday, 1:00-1:20, Boojum
The influence of landscape resource heterogeneity on ungulate distribution

Abbie Dennis-Stewart, University of Calgary
Petr Komers

Abstract: Forested landscapes are a complex mosaic of habitat patches that differ in quality and can be generated by both natural processes and logging activity. The importance of landscape resource heterogeneity on the distribution of ungulate species is generally recognized, though rarely quantified. The influence of a heterogeneous landscape on the distribution of ungulate species was assessed considering eight broad vegetation classes. Landscapes were pre-selected to represent the variable amounts and combinations of the different vegetation types available in the study area. Fecal pellet group data provided an index of ungulate abundance within each sampled landscape. The role of each vegetation type was considered with regard to compensation, supplementation, complementation, and fragmentation models. Evidence of supplementation of preferred habitat was found for moose (Alces alces) and deer (Odocoileus hemionus and Odocoileus virginianus). The result is a species-specific perspective on habitat quality which gives us a better understanding of how generalist species use mosaic landscapes. Single habitat approaches to understanding habitat loss and fragmentation may be missing key information if species are using multiple habitat types in the landscape.

Topic Area: Species distributions: populations

Symposium: Oral session

Time: Thursday, 10:40-11:00, Salons F, G & H
Corridor optimization in fragmented landscapes, or the shortest distance between two points is a crooked line

John DiBari, Sonoran Institute
Justin C. Williams

Abstract: Landscape fragmentation and habitat loss are significant threats to the conservation of six focal species (grizzly bear, wolf, lynx, cougar, wolverine, and caribou) in the Inland Temperate Rainforest (ITR) of British Columbia, Canada and the northwest US. Delineating corridors between habitat patches can help diminish or perhaps reverse the impacts of fragmentation for these species. We use spatial analytical techniques to identify potential corridors and the environmental discontinuities that may exist within them. Because it is important that corridor protection efforts be undertaken in the most efficient and effective way possible, we propose to use network optimization modeling to address the issue of efficient and effective corridor design. Possible models may employ percolation theory, shortest-path optimization, Steiner tree optimization, and cyclic networks to identify robust corridor alternatives in landscapes. Results will provide information about the location and characteristics of corridors in the ITR, as well as the level of resources needed to realize different configurations under different degrees of fragmentation and characterizations of habitat connectivity. These results will be of interest to conservation planners and managers in Yellowstone to Yukon region.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 11:40-12:00, Salon E
Edge detection along the administrative and wilderness boundaries of the Kenai National Wildlife Refuge, Alaska

John N. DiBari, Sonoran Institute
John M. Morton

Abstract: Because administrative boundaries may not coincide with ecological or landscape boundaries, edge-detection methods were used to identify boundary-related issues within a 2 km buffer of the Kenai National Wildlife Refuge's administrative and wilderness boundaries. Areas of dissimilarity or changes in magnitude for landscape characteristics including road density, land cover, and logging units were investigated to determine significance and location of edges created by these characteristics and significance of overlap between edges and administrative boundaries. Fire history data were also used to investigate the area of land burned in black spruce and white/Lutz/Sitka spruce. Significantly contiguous edges were detected for the majority of landscape characteristics. Additionally, overlap analysis indicated significant overlap between edges and administrative boundaries for most characteristics with contiguous edges. Results also indicated interesting patterns regarding the area of land burned in black spruce and white/Lutz/Sitka spruce. Implications suggest a mismatch between the refuge's effective and actual boundary for several landscape characteristics. This research will enable managers to better manage public lands by illustrating boundary-related issues that may affect the refuge's conservation mandates.

Symposium: Poster Session
Historic channel dynamics and implications for future vegetation change along the San Pedro River, Arizona, USA

Mark D. Dixon, University of South Dakota
Tim C. Cowman, S.K. Wilson and W. Carter Johnson

Abstract: Dramatic changes in channel morphology and vegetation accompanied the arroyo phenomenon of the late 19th century on many southwestern desert rivers, including the San Pedro. These changes left a significant imprint on trajectories of vegetation and channel dynamics over subsequent decades. Using historic aerial photography, we analyzed changes in active channel width and rates of lateral channel migration from 1935-2002 on 12 1-km study reaches. Significant channel narrowing (42-93%) occurred at all study sites from 1935 to 2002, with the former channel area converting to riparian forest floodplain. This overall narrowing trend was interrupted by episodes of widening (and subsequent pioneer tree establishment) associated with large fall and winter floods in 1977-79, 1983-84, and (for some sites) 1993. For the 6 study reaches along the upper San Pedro, however, rates of geomorphic change have been very low for the last 20 years as compared to rates along the lower reaches. Based on linked simulations of runoff, channel migration, and vegetation dynamics, we project declines in the area of cottonwood-willow forests along the upper San Pedro over the next 100 years. However, these declines would be minimized under climate scenario projections of increased winter flood frequency and magnitude.

Topic Area: Landscape change: modeling & analysis

Symposium: Oral session

Time: Tuesday, 1:00-1:20, Salons F, G & H
Historic channel, vegetation, and floodplain land cover change on the Missouri National Recreational River in South Dakota, 1892-2006

Mark D. Dixon, University of South Dakota
Tim C. Cowman, S.K. Wilson and W. Carter Johnson

Abstract: The floodplain of the middle Missouri River has changed extensively since viewed by Lewis and Clark in 1804. With the completion of six mainstem dams and reservoirs in the Dakotas and Montana and downstream channelization, flow in the river has been highly regulated over the last 50 years. To quantify historic vegetation and channel changes associated with flow regulation, we digitized historic maps (1892) and aerial photographs (1956, 2006) of the channel and floodplain vegetation of a 59-mile segment of the Missouri National Recreational River (MNRR). Lower rates of channel migration and declines in new riparian forest establishment have accompanied decreased peak flows since the 1950s; while changes in land use in the floodplain, enabled in part by flow stabilization, have led to declines in area of previously established forest. Declining rates of new forest establishment have resulted in a landscape dominated by older forest patches, with a scarcity of young cottonwood and willow patches. Sampling within remnant cottonwood patches suggests increased terrestrialization of the vegetation, likely associated with flow regulation and channel incision. We discuss the implications of these changes in landscape and forest successional trajectories to the future character of the Missouri River within the MNRR.

Symposium: Poster Session
Disturbance as feedback: Disturbances at multiple scales in riparian systems on the Colorado Plateau

Cynthia Dott, Fort Lewis College

Abstract: Riparian ecosystems in canyons of the Colorado Plateau are discrete systems, spanning a range of spatial scales, and impacted by multiple forms of disturbance (floods, arroyo cutting, grazing). In these systems, it is possible not only to assess the scope and impact of on-going disturbance, but also to reconstruct a partial record of historic disturbance regimes and events. Current vegetation structure and composition, flood frequency/intensity data and proxy data for livestock grazing were recorded for two Colorado Plateau canyon systems in southeast Utah. These data, in combination with information on arroyo formation and sediment storage across the Colorado Plateau, make it possible to distinguish different signals in the vegetation, left as a result of the dominance of different forms of disturbance in different parts of the canyon system. An outgrowth of this work is the classification of disturbance as types of feedback loops: 1) Negative feedback: self-correcting disturbance regimes; 2) Positive feedback: self-reinforcing disturbances that lead to a change in equilibrium state; and 3) No feedback: isolated/unpredictable events that are not part of a regular regime. Positive feedbacks caused by human activities are usually best avoided; some understanding of when such situations arise would greatly assist management decisions.

Topic Area: Fire & landscape pattern

Symposium: Oral session

Time: Tuesday, 5:00-5:20, Salon E
When does fine-scale expert opinion improve large-scale regional species distribution models?

C. Ashton Drew, North Carolina State University
Alexa McKerrow and Jaime Collazo

Abstract: Presenting the uncertainty of species-habitat associations and modeled species distributions is essential, especially where these models are used to support conservation and management decisions. By defining and quantifying sources of uncertainty, scientists: (1) communicate the state of scientific understanding, (2) provide a basis for quantitative risk assessment by stakeholders and decision-makers, and (3) identify knowledge gaps with the most impact on model precision and accuracy. We review methods of evaluating, quantifying, and communicating uncertainty within the context of modeling species distributions. We specifically highlight the challenge of quantifying uncertainty in models that rely heavily on expert opinion, a source used when there are insufficient field data or a need for immediate scientific input. We introduce a novel method to account for and communicate the spatially-explicit aspects of variability and uncertainty of experts' opinions. Our method incorporates factors, such the geographic location of an expert's experience (displacement of expertise), the landscape context of an expert's experience (similarity of domain of expertise), and the non-independence of experts' knowledge (network of expertise). While this method cannot reduce an expert's subjectivity, it provides a tool to summarize how the certainties of experts' opinions vary spatially to influence overall uncertainty of model results.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and Modeling Species-Abitat Associations: Challenges Across Landscapes (and Seascape)

Symposium: Oral session

Time: Tuesday, 5:00-5:20, Salon D
An integrative look at wild rice distribution and harvest across state, tribal and treaty ceded lands in Minnesota and Wisconsin

Annette L. Drewes, University of Wisconsin - Madison  
Janet Silbernagel

Abstract: Sustaining cultural landscapes is dependent on understanding the relationships between humans and the natural landscape they interact with. Landscape ecology, in a holistic sense, provides a means to examine spatial characteristics of such a relationship while also capturing patterns of movement and connectivity, information crucial for sustainable management. Wild rice and the declining population that continues to harvest this native grain provide a rich case study for an integrated research approach. Harvesters are spatially and culturally diverse, lakes with wild rice are scattered and declining across a large multi-state region, and management is fragmented across state, tribal, and treaty-ceded boundaries. The goal of this study is to describe the relationships that exist between wild rice harvesters, management regimes influencing harvest and the wild rice lakes necessary for sustaining this cultural landscape. Our work shows that harvester movement is influenced by personal history and purpose for gathering wild rice. Individuals harvesting primarily for their own use show an affinity for one or two local lakes, which are often the lakes they first learned to harvest on. Across management regimes, movement of harvesters is influenced by harvesting regulations including dates, time, location, and access rights to particular beds of wild rice.

Topic Area: Managed landscapes

Symposium: Oral session

Time: Friday, 9:00-9:20, Salon E
Monitoring trends in burn severity: A nationwide baseline of historical burn severity data

Jeff Eidenshink, USGS EROS
Brian Schwind

Abstract: Agency leaders, fire managers, elected officials, and the general public need information regarding the effects of large wildfires. Recently, the Wildland Fire Leadership Council (WFLC), which implements and coordinates National Fire Plan (NFP) and Federal Wildland Fire Management Policies, adopted a strategy to monitor the effectiveness and effects of the National Fire Plan and the Healthy Forests Restoration Act. One component of this strategy is to assess the environmental impacts of large wildland fires and identify the trends of burn severity on all lands across the United States. To that end, WFLC is sponsoring a six year project, Monitoring Trends in Burn Severity (MTBS), which requires the USFS and the USGS to map and assess the burn severity for all large current and historical fires. Landsat imagery and the differenced Normalized Burn Ratio algorithm, will be used to map burn severity of all fires since 1984 greater than 500 acres in the east, and 1000 acres in the west. The MTBS project will generate burn severity data, maps, and reports for each fire. The information will be available to evaluate trends in burn severity and help develop and assess the effectiveness of land management decisions. We will present a status of the MTBS project.

Topic Area: Burn severity mapping: research and applications

Symposium: Oral session

Time: Thursday, 1:00-1:20, Salon D
Subsampling approach to aggregating LiDAR-derived forest structure predictions to the forest stand level

Jeffrey S. Evans, USDA Forest Service, Rocky Mountain Research Station
Andrew T. Hudak

Abstract: LiDAR remote sensing is a powerful resource for modeling forest structure. However, many of the relationships between forest structure and LiDAR are investigated at a plot level, limiting stand level inferences. Landscape-level LiDAR predictions often produce huge volumes of estimated data thus making model validation problematic. Presented is a method for generating a random sample of subplots and aggregating subplot model predictions to the stand level. Based on the autocorrelation of basal area at the landscape level, we assessed the optimal number of subsamples needed to capture within-stand variability, comparable to thresholds used in stand exams. RANDOM FOREST was used to model relationships between LiDAR and field measured basal area, then apply an estimate to the subplots. Using subplot estimates, mean and variance of basal area were calculated within each stand, creating an aggregated stand estimate and an indication of the variation in basal area. Results demonstrate that predictions applied to stand subplots can be used to confidently summarize information at the stand level and provide a controllable sample for model validation. We conclude that LiDAR surveys in association with appropriately designed ground validation plots could augment or largely replace traditional stand exams, for the benefit of forest landscape managers.

Topic Area: Remote sensing I

Symposium: Oral session

Time: Tuesday, 10:40-11:00, Bonsai
The soundscape: a new informative framework to investigate the complexity of landscapes

Almo Farina, Urbino University
Morri Davide

Abstract: The eco-field theory states that the living beings utilize spatial configurations of landscapes as carriers of meaning to intercept specific resources related to the functions performed. According to this theory, it is reasonable to hypothesize that birds use acoustic cues (soundscape) not only for social purposes (territory delimitation, social cohesion etc.), but also to create cognitive templates for landscaping activities. The soundscape, defined as a field of energy gradients, changes properties according to time and spatial characters to the landscape; birds use such informative context through semiotic mechanisms to locate resources. Patterns of the bird soundscape were investigated in a Mediterranean rural area along a 500 m transect, by using a cableway suspended digital audio recorder. According to information theory, to extract from a soundscape the maximum of available information and to better understand the landscape dynamics of bird assemblages, data were processed using different cableway speed protocols. The first results suggest the role of the cableway speed to intercept soundscape information, and confirm also the efficiency of such an approach to describe complex dynamics of bird assemblages.

Topic Area: Theory & quantitative methods

Symposium: Oral session

Time: Tuesday, 11:00-11:20, Boojum
Analyzing spatial and temporal patterns of fire frequency from fire-scar data: lessons learned from a comprehensive field validation in southern Arizona

Calvin Farris, National Park Service
Christopher H. Baisan, Donald A. Falk and Thomas W. Swetnam

Abstract: Fire-scar data have been used extensively to quantify temporal parameters of historical fire regimes but less commonly to quantify spatial parameters. Empirical validation studies are needed to assess the applicability of various fire-scar sampling designs and analytical approaches for spatial analysis. In this study we compared key spatial and temporal fire regime parameters reconstructed from gridded and targeted (subjective) fire-scar data with ground-mapped fire perimeters in a frequently burned wilderness area in southern Arizona. Both datasets exhibited a strong correlation between the proportions of samples scarred each year (annual fire-scar synchrony) and the amount of area-burned from mapped fires. Spatial patterns of fire perimeters interpolated from fire-scar data corresponded very closely with mapped fire perimeters due to the strong spatial coherence of scarred samples across the landscape. Scale- and sample size-dependence of fire-scar data decreased sharply as area-burned increased. Based on these relationships, we reconstructed a 300 year record of fire perimeters in the study area to demonstrate how spatial patterns of fire frequency have varied over time. We will discuss the implications of our validation research on designing and interpreting landscape-scale fire-scar studies.

Topic Area: Recent advances and future innovations in multiscale systematic tree-ring reconstruction of historical fire regimes

Symposium: Oral session

Time: Tuesday, 1:40-2:00, Salon E
Graph analysis of connectivity across gradients in habitat proportion in the Mid-Atlantic region of the United States

Joseph R. Ferrari, University of Maryland Center for Environmental Science
Maile C. Neel and Todd R. Lookingbill

Abstract: Graph analysis provides useful information on habitat connectivity in fragmented landscapes. Changes in graph metrics for organisms with different gap-crossing capabilities has been well documented, as has the effect of losing particular habitat patches such as stepping-stones. Less studied has been the general effect of habitat loss on graph metrics. We explore the variation of two metrics across gradients in habitat proportion, p, for forested landscapes in the Mid-Atlantic region of the United States. Several gap-crossing abilities were chosen as being representative of broad classes of organisms native to this region. The metrics analyzed were the graph diameter, d(G) and F, the ratio of the aggregate area of the largest cluster relative to the area of the largest patch. Graph diameter changed as a function of p in a manner indicative of percolation-type threshold phenomena. Guided by earlier work on multifractal neutral landscapes, the area-based metric F was useful for explaining the behavior of d(G). The combination of metrics provided a regional heuristic classification of landscape connectivity as a function of p for organisms with fixed gap-crossing ability. The regional analysis provided general insights on the consequences of habitat loss on measures of landscape connectivity.

Topic Area: Theory & quantitative methods

Symposium: Oral session

Time: Tuesday, 10:20-10:40, Boojum
The effects of wetland habitat and landscape connectivity on amphibian distributions

William R. Fields, North Carolina State University
Mark S. Bevelhimer and William W. Hargrove

Abstract: Although wetland amphibian communities are believed to be strongly structured along hydroperiod and predator gradients, it is unclear how landscape features that present barriers to amphibian movement or enhance connectivity for fish affect amphibian distributions. We surveyed fish and amphibian communities at over 60 wetland sites at Ft. Stewart, GA. We collected vegetation data at survey sites, and we compiled information on potential barriers to movement and hydrological connections between wetlands in a geographic information system. We then used a model selection approach to test the relative importance of the presence of fish, local wetland habitat, and landscape structure on amphibian distributions. Results from this study help direct future surveys for rare amphibian species and better inform habitat restoration activities for wetland communities.

Symposium: Poster Session
Hydrological sinks in wetland systems: Is amphibian habitat going down the drain?

William R. Fields, North Carolina State University

Abstract: Habitat fragmentation and degradation are two important environmental changes affecting the loss of biodiversity. These processes are strongly affected by spatial processes. However, for amphibians breeding in temporary wetlands there may also be an important temporal component to these processes that relates to the inundation and drying of wetland basins. I explored the effects of these factors with two metapopulation models for a wetland-breeding amphibian and its fish predators to test the relative importance of spatial isolation of ponds and temporal isolation caused by pond drying. I created an artificial landscape based upon a wetland complex in the coastal plain of Georgia that contained both temporary wetland sites used by amphibians for breeding and permanent wetland sites that serve as source populations for fish. First, I populated sites with amphibians at random, set local extinction as a random process, and set colonization as a function of distance from the nearest occupied site. Then I increased the probability of local extinctions for amphibians if sites were colonized with fish. Fish colonization was a function of distance from the nearest permanent wetland and frequency of wetland drying. Sensitivity analyses reveal the importance of temporal and spatial processes to amphibians.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral Presentation

Time: Thursday, 10:40-11:00, Salon E
The role of patch area and habitat edges in fragmented landscapes: definitively distinct or inevitably intertwined?

Robert Fletcher, University of Montana
Leslie Ries, James Battin and Anna Chalfoun

Abstract: Over the past few decades, much research has focused on the effects of patch area and habitat edges in fragmented landscapes. We review and synthesize the literature on area and edge effects to identify whether the ecological processes influenced by patch size and edge are distinct, to summarize evidence for the relative effect of each, and to discuss how estimating the independent effects of each may be accomplished in field studies. Area and edge directly influence ecological processes in distinct ways, yet indirect effects can be similar, making it difficult to isolate the effects of area and edge in nature. Many studies investigating both area and edge have been confounded in their design and/or analysis (i.e., studies did not control for one potential effect while testing for the other). Non-confounded studies have more frequently found support for edge effects, and comparisons between non-confounded and confounded studies suggest that some observed area effects could be explained by edge effects. We argue that by focusing on the fundamental processes directly influenced by area and edge, and by developing more rigorous study designs and analyses that isolate their relative influence, greater insight can be gained in future investigations on habitat loss and fragmentation.

Symposium: Poster Session
Incorporating ecological theory into models of habitat quality: the importance of variation in space and time

Robert J. Fletcher, University of Montana
Jock S. Young, Anna Noson and Richard L. Hutto

Abstract: Understanding species distributions in space and time is essential to ecology, evolution, and conservation biology. There is a growing need for robust habitat models that can adequately predict species distributions across broad spatial scales. Yet the ability to use such models is limited by a number of factors, including a general lack of incorporating ecological theory into modeling approaches. This is unfortunate, because ecological theory can potentially help guide the model building process and could not only improve model predictions but could also provide wider inference regarding habitat quality in heterogeneous landscapes. Here, we outline general predictions from habitat selection and metapopulation theory that can be incorporated into species distribution modeling efforts. These predictions can be incorporated into models by focusing explicitly on spatial and/or temporal variation in habitat use with population density. We then test whether incorporating these predictions into models of bird distribution across the western United States improves model fit (based on external validation) and whether spatial or temporal predictions are more important for improving species distribution models. We argue that much can be gained by incorporating theory into species distribution modeling and that adequate sampling through space and time can provide novel insight for habitat-based conservation strategies.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)Poster Session II

Symposium: Oral Presentation

Time: Tuesday, 2:20-2:40, Salon D
Assessing potential habitat characteristics of urban-adapted lizards in Tucson, Arizona

Heidi Flugstad, University of Arizona
Margaret Livingston

Abstract: With increased urbanization comes loss of habitat and increases in non-native plant species, unnatural water sources (irrigation, pools, sewers), and urban temperatures. Many animal populations are adversely affected by these changes, but some species are able to adapt to and thrive in this altered environment. Two such species of lizards, the Tree Lizard (Urosaurus ornatus) and Desert Spiny Lizard (Sceloporus magister), have been frequently found in the urban matrix of Tucson. Although much research exists on their natural environment, little research has been done on what habitat requirements are needed for lizards in urban areas. This research identified potential habitat characteristics for these two species within urban areas and assessed areas within Tucson for potential habitat for these species. Methods included literature review, land use analysis using GIS, surveys of local herpetologists, and field studies at sites known to support established lizard populations. The results identified key potential habitat characteristics for these species and were used to highlight which locations on the University of Arizona’s campus exhibit the highest potential for lizard habitat. Results included interpretive material, including campus maps with supporting text and graphics, for identified sites on the campus that support potential habitat for these species.

Topic Area: Species in urban landscapes

Symposium: Oral session

Time: Tuesday, 1:20-1:40, Boojum
Landscape Ecology's Legacy and Central Role for Society

Richard Forman, Harvard University

Abstract: In two decades, what has landscape ecology provided for society? Two big things. First, it has developed, with inputs from diverse fields, a set of useful working principles that primarily integrate spatial pattern and ecology at the human scale of landscapes (occasionally regions). Second, landscape ecologists have collaborated with leaders in other fields dealing with land (especially forestry, conservation biology, landscape architecture, transportation, and urban planning) to actively integrate the above principles into solutions, which have created obvious synergies with landscape ecology. Urban regions are a current passion of mine. They keep popping up, with mushrooming populations and urban borders racing outward. Ecologists talk about urban deserts, while urbanists see hinterland out beyond. Effectively providing for natural systems and their human uses at a whole urban-region scale is tractable, and can become a primary rather than a minor goal in planning. I estimated that roughly 50% of the principles needed are from landscape ecology, the others from hydrology, transportation, community development, and more. Spreading cities is one of the four horsemen...along with water scarcity, biodiversity loss, and climate change...and it may catch us first. So, quo vadis, landscape ecology? Quite simply, landscape ecology (not water, economics, transportation, social patterns, bioconservation, or urban planning) is the most promising centerpiece or paradigm I can find for society's future, or a sustainable land. What centerpiece, and what balance of fields, would you use for the future?

Topic Area: Toward a Collective Disciplinary Agenda for Landscape Ecology: Goals and Strategies

Time: Friday, 10:10-10:30
Geostatistical analysis of satellite mapped defoliation intensity: Integrating results and modeling defoliation effects on above-ground biomass

Jane Foster, University of Wisconsin – Madison
Robert M. Scheller, Philip A. Townsend and David J. Mladenoff

Abstract: Development of spatially interactive forest disturbance and succession models requires a thorough understanding of spatial and temporal dynamics of disturbance regimes. Current knowledge of the spatial dynamics of defoliation outbreaks is inadequate. In conjunction with the development of a biomass sensitive defoliation disturbance extension for the model Landis-II, satellite derived maps of defoliation intensity were analyzed for spatial and temporal patterns. Semivariograms were used to analyze spatial autocorrelation in both mapped defoliation intensity and host species abundance for a gypsy moth outbreak that occurred in 2000 and 2001 in the Appalachians of western Maryland. Forest inventory plot data and forest community maps were analyzed to measure autocorrelation in host abundance. Agreement of autocorrelation ranges between defoliation intensity and some oak community types confirms that the distribution of host species plays an important role in patterns of defoliation. Semivariograms also show that the range of autocorrelation in defoliation intensity increased while variance decreased from the first year of an outbreak to the second, consistent with theory that describes insect outbreaks originating in hotspots, then spreading as populations explode. Improved information about the endogenous factors and spatial dependence governing defoliation outbreaks are incorporated into a model of defoliation effects on above-ground biomass.

Topic Area: NASA-MSU Golley-Odum Symposium: Integrating remote sensing of forest disturbances with models at broad scales

Symposium: Oral session

Time: Tuesday, 11:00-11:20, Salon D
Using light interception and in-situ surface reflectance in support of moderate resolution remotely sensed phenology

Mark Friedl, Boston University
Nathan Phillips

Abstract: Time series of vegetation indices derived from remote sensing are increasingly being used to monitor vegetation phenology. However, a variety of factors confound interpretation of remote sensing results. To more fully exploit the power of remote sensing and to improve its utility for studies of landscape-to-regional scale phenology, more and better in-situ information is required for both calibration and validation purposes. In this paper, we present results from analyses of field data collected over the 2006 growing season at Harvard Forest that use light interception and surface reflectance measurements to monitor canopy development. As part of this analysis we compare these high temporal measurements against 8-day composites of the enhanced vegetation index derived from remote sensing (MODIS). The goal of this study is to provide a proof-of-concept for future studies that include more spatially extensive and temporally continuous measurements related to canopy development. In the near future we hope to extend this study to include three additional forested sites in New England, thereby providing a transect that includes a gradient in climate and forest types.

Topic Area: Phenologies as integrative phenomena for landscape research

Symposium: Oral session

Time: Friday, 8:20-8:40, Salon D
Flodding causes on Tabasco, Mexico and their implications

Lilly Gama, Universidad Juarez Autonoma de Tabasco
Adalberto Galindo Alcantara, Carolina Zequeira Larios, Adriana Morales Hernandez, Cristobal Rullan Silva and Hilda Diaz Lopez

Abstract: In Mexico urbanization has been done without proper planning. Ecosystems have been used and threatened in a variety of ways due to grassland and agricultural activities. Government decision makers have to take in account strategies to search for alternatives on vulnerable areas. Tabasco, in the gulf coast of Mexico, is important for its oil exploitation. Because of its climatic and biologic characteristics, it is the most important wetland region of Mexico. The objective of this research was to find out the degree of vulnerability of the area due to floods to propose a land-use strategy. A landscape map based on a geomorphologic classification was configured from 2003. An historical review of the land use was done. Each landscape unit was characterized by the spatial distribution of all its components (vertical relations) and relations with adjacent or neighboring units (horizontal relations). A vulnerability to flood map was constructed taking into account slope, geomorphology, soil, climate and hydrology. This area is located in a vast plateau with frequent flood risk. Oil exploitation infrastructure has caused important impacts especially on the coastal areas. This research proposes a zonification for land use taking in account the degree of vulnerability.

Topic Area: Disturbance effects

Symposium: Oral session

Time: Thursday, 4:40-5:00, Salon D
Modeling the effects of historical and current fire regimes on nutrient cycling in the Lake Tahoe Basin

Sarah L. Ganschow, University of Nevada, Reno
Peter J. Weisberg, Dale W. Johnson and Watkins W. Miller

Abstract: Historical ranges of variability (HRV) for fire regimes and forest structure are increasingly used to inform land management. However, variations in nitrogen (N) cycling, although important for water quality and forest health, are seldom considered in this context. In the Lake Tahoe Basin, 120 years of fire suppression likely increased forest floor N content, which may contribute to lake eutrophication through surface runoff. A non-spatial nutrient cycling model was linked with LANDIS-II to examine spatial and temporal changes in N contents and fluxes under current conditions, within the natural variability in fire regimes and forest structure, and given various management treatments. Under pre-settlement conditions in lower-elevation forests, simulated forest floor accumulations were lower (averaging 100 versus 500 kg N ha-1) and available soil N was higher (55 versus 45 kg N ha-1) than under current conditions. Upper montane forests showed no significant difference between pre- and post-settlement N contents, likely because the fire regime has changed little. Model results suggest that with continued suppression, available N may further decrease due to increased biomass and loss of shade-intolerant N-fixing species. Use of HRV to inform forest management should extend to ecosystem processes, which like forest structure, may respond to altered disturbance regimes.

Topic Area: Simulation models: disturbance

Symposium: Oral session

Time: Thursday, 11:00-11:20, Bonsai
A general method for analysis of multiple resolution landscape imagery

Robert H. Gardner, University of Maryland Center for Environmental Science
Todd L. Lookingbill, Phillip A. Townsend, Joseph R. Ferrari

Abstract: The resolution of satellite imagery must often be increased or decreased to fill data gaps or match preexisting project requirements. A change in resolution introduces systematic errors of size, shape, location, and amount of contiguous land cover types. We developed a general method that allows map resolution to be either increased or decreased while minimizing associated errors. This map renormalization process is illustrated with a series of neutral models and a comparison of SPOT (10 m) and LANDSAT (30 m) imagery for four National Park units within Maryland and Virginia. In all cases this new method of map renormalization was superior to existing procedures used to rescale maps. This new method also is general and efficient and allows diverse sources of imagery to be rescaled and compared.

Topic Area: Remote sensing I

Symposium: Oral session

Time: Tuesday, 11:00-11:20, Bonsai
Identifying disturbance gradients and their implications for biodiversity conservation in tropical rainforests of Northeast India

Sonali Ghosh, Government of Assam, India
P.S. Roy

Abstract: Northeast India is among the top 25 biodiversity hot spots identified in the world. Incorrect land use practices such as unplanned logging, shifting cultivation, monoculture plantations, and hunting are disturbances responsible for widespread environmental degradation. We analyzed such disturbances at a landscape level using RS and GIS tools in Mizoram, Northeast India. With an area of 21081 sq. km, it is a mountainous state with predominance of tropical evergreen, semi-evergreen, and bamboo forests. A vegetation map prepared using satellite images and ground sampling was the principal input for landscape analysis. Various landscape indices such as Fragmentation, Patchiness, Porosity, Juxtaposition, and Interspersion were used as parameters in a GIS domain. Ancillary databases such as road, settlement, and terrain complexity were also used to calculate the Disturbance Index (DI). The DI map, Ecosystem uniqueness, species richness, Biodiversity value, and Terrain complexity were used to generate the Biological Richness (BR) map. The biologically rich areas identified through the study were recommended for bringing under the Protected Area Network and conservation planning.

Topic Area: Remote sensing II

Symposium: Oral session

Time: Tuesday, 1:40-2:00, Bonsai
Predictive vegetation models: A comparison of model combination approaches

Ben Gilmer, West Virginia University
Jennifer Miller

Abstract: The distribution of plants and animals in space and time has long been a focus of many biogeographical and ecological studies. The various approaches for modeling species distributions are rooted in the quantification of the species-environment relationship, where bioclimatic variables are used to explain the distribution of species and communities. Predictive modeling of species distribution has become a widespread tool in the areas of conservation biology, climate change research, land-use and land-cover change assessment, and biodiversity estimates. Although many statistical models are now available, previous model comparison studies have found little difference in prediction accuracy when models were compared using the same data. Therefore, there is a need to explore ways to maximize prediction accuracy with multiple models since comparison studies have found that the best techniques involve combining models. Using a dataset consisting of presence/absence data of four vegetation alliances from the Mojave Desert, CA, and twelve environmental predictor variables, we compare different model combination techniques of four different types of parametric and non-parametric statistical models: classification trees, generalized linear models, neural networks, and multivariate adaptive regression splines. Each technique’s classification accuracy is assessed by using receiver-operating characteristic (ROC) plots.

Topic Area: Species distributions: methods

Symposium: Oral session

Time: Tuesday, 10:20-10:40, Salons F, G & H
Effect of landscape fragmentation on avian diversity in the Edwards Plateau of Texas

Edith Gonzalez Afanador, Universidad Nacional de Colombia
William Grant and Neal Wilkins

Abstract: The effect of landscape fragmentation associated with land parcelization on diversity of avifauna in the Edwards Plateau ecoregion was studied using spatial analysis. Property sizes, landscape structure, and avian diversity were quantified for 31 North American Breeding Bird Survey (BBS) transects, located within the Edwards Plateau ecoregion and contiguous ecoregions. Direct and spatial correlations between these indices were examined using Modified t-Test and Cross Mantel test. The spatial analysis revealed an apparent threshold of habitat fragmentation at a property size of 500 acres. The results showed that property sizes lower than 500 acres produce habitat fragmentation characterized by a significant decrease in mean patch size and proximity among habitat patches. Consequently, avian-diversity (richness) decreased because mean patch size and proximity among habitat patches were related to availability and connectivity of suitable habitat for avian populations. The spatial analysis also made possible the prioritization of ecological subregions of the Edwards Plateau for conservation or restoration based on the threshold of habitat fragmentation and avian Alpha and Beta diversity.

Symposium: Poster Session
The importance of landscape and site factors in grazinglands of the northeastern United States

Sarah C. Goslee, USDA-ARS
Matt A. Sanderson

Abstract: Planned species diversity provides the primary product in agricultural systems. For grazing lands, this is palatable and nutritious forage biomass. Associated diversity contributes many of the additional ecosystem functions needed for sustainable agriculture. Understanding the functional role of associated diversity may contribute to increased farm profitability and ecosystem sustainability by reducing the need for external inputs. Plant community composition is somewhat amenable to modification by selective addition or suppression of species, but may be constrained by site factors beyond the manager's control (e.g., climate, landscape position). Our objective was to identify site factors that constrain species composition, so that this information can be used to develop objective criteria for species selection in managing grazed systems. Inventory data on vegetation, soils, and landscape attributes were collected from 130 pastures on 44 farms from 1998-2005. Stepwise regression was used to identify the variables related to a series of descriptors of plant community composition, including richness and cover of all species, of various functional groups, and of species of particular interest. Few common patterns emerged. Geographic location (latitude and/or longitude) was significant in most cases. Slope and elevation were significant for some descriptors, but aspect was rarely relevant. Soil texture was consistently important, but soil organic matter and nutrient status were not significant in most cases. The difficulty of identifying strong predictor variables suggests that management plays a very strong role in determining the plant community composition of grazing lands.

Topic Area: Managed landscapes

Symposium: Oral session

Time: Friday, 8:00-8:20, Salon E
Saltcedar dominance of Lower Colorado River floodplains: Conceptual model and management implications

Matthew R. Grabau, GeoSystems Analysis, Inc.

Abstract: Riparian ecosystem alteration is of great concern worldwide, and especially in water-limited regions. In the southwestern United States, cottonwood- (Populus fremontii) willow (Salix spp.) forests and transition communities are being replaced by low-diversity communities of saltcedar (Tamarix ramosissima, introduced) and arrowweed (Tessaria sericea). Ecosystem function and native animal species habitat are being greatly altered. Many studies have been conducted on the habitat requirements of key plant species and the effects of these species on the ecosystems (water budget, salinization, and fire regime alteration). However, these concepts have yet to be synthesized to create a conceptual model for riparian corridor succession. We take an ecohydrological approach, incorporating interactions, feedbacks, and thresholds between hydrologic regimes, soil and water properties, and vegetation. A state and transition model is being developed following the framework of Briske et al. (2006, Rangeland Ecology and Management) for historic floodplains of the lower Colorado River. The research suggests that anthropogenic alteration of flow regimes, coupled with invasive species introduction, has resulted in floodplains dominated by positive feedbacks leading toward increasingly degraded systems. Management implications (monitoring requirements, habitat preservation, and restoration) and potential impacts of climate change are addressed.

Topic Area: Simulation models: plants, animals, ecosystems

Symposium: Oral session

Time: Tuesday, 4:00-4:20, Bonsai
Effects of parcelization and land divestiture on forest sustainability in simulated forest landscapes

Eric J. Gustafson, USDA Forest Service, Northern Research Station
Craig Loehle

Abstract: Ownership parcelization of forest land and divestiture of industrial forest land is increasing throughout the U.S. We used a timber harvest simulator and neutral model landscapes to systematically study how parcelization and divestiture affect measures of forest composition and fragmentation, timber production, and public access. Parcelization significantly increased most measures of forest fragmentation, but did not affect measures of forest composition. Parcelization at scales >16 ha did not reduce the volume of wood extracted or the area of land available for public recreation, but it did reduce the patch size of land open for recreational use. The effect of divestiture depends on which owner is divesting, with the owner that has the most unique effect on a given response variable having the greatest influence. The industrial owner that emphasized even-aged silvicultural techniques had the greatest effect on age class characteristics. The industrial owner that converted other forest types to northern hardwood influenced some cover type characteristics. The proportion of non-industrial forest owners had the greatest effect on fragmentation because of conversion of some forest to developed uses. Divestiture also caused a reduction in the volume of wood extracted and reduced the area and patch size of land available for recreation.

Topic Area: Simulation models: plants, animals, ecosystems

Symposium: Oral session

Time: Tuesday, 4:20-4:40, Bonsai
Prediction of plant community structure and forest regeneration after severe fire: a comparison of methodologies

Sandra L. Haire, University of Massachusetts, Amherst
Kevin McGarigal

Abstract: Severe disturbances, including fire, can cause varying trajectories of change across landscapes and through time. Given the likelihood that large severe fires will continue to occur in western landscapes for the foreseeable future, understanding landscape change after severe fire events is of vital importance. Statistical methods used to describe plant communities and successional trajectories have various strengths and weaknesses in terms of their ability to capture important variability. To determine what can be learned using a variety of techniques, we applied Mantel tests, classification trees, generalized additive models, and quantile regression to post-fire plant community data sets. The data were collected at two southwestern U.S. sites that burned in severe fire decades ago. Based on our analyses, we concluded that methods imposing a categorical structure miss important variability that can be described with regression techniques that model varying rates and locations of change in species and community response. Ability to clearly interpret results in terms that are understandable to managers and other audiences is an important consideration in choice of technique, but using maps to display results greatly enhances interpretation.

Topic Area: Disturbance effects

Symposium: Oral session

Time: Thursday, 4:00-4:20, Salon D
Abstract: The PATH model predicts the location of potential corridors of dispersal between patches of habitat by launching virtual 'walkers' from each patch of habitat in the map, and simulating their travel through the poorer intervening matrix. Each walker is imbued with a set of user-specified habitat preferences which make its walking resemble a particular target species. After equal numbers of successful walkers have been launched from all habitat patches, the summed footprints show the most heavily-used pathways of dispersal across the map. The importance of each habitat patch, both as an origin and a destination for dispersers, can be mapped. We used PATH to simulate grizzly bear dispersal corridors across Idaho and Montana. Fine-scale structure in the strength of predicted grizzly corridors suggests management opportunities near Butte and Helena, MT. The PATH model was used to identify potential corridors between 'hubs' identified in eastern Tennessee by the Southeastern Ecological Framework (SEF). Corridors found by PATH were more extensive than the 'linkages' found by SEF between hubs. The Oak Ridge Reservation (ORR) surrounding ORNL was found to be one of the strongest remaining connections between the Cumberlands and the Appalachians, even when the landscape extent was doubled.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 4:20-4:40, Salon E
Mapping Pre-European settlement vegetation at fine resolutions using a hierarchical Bayesian model and GIS

Hong S. He, University of Missouri
Daniel C. Dey, Xiuli Fan, Mevin B. Hooten, John M. Kabrick, Christopher K. Wikle and Zhaofei Fan

Abstract: In the midwestern United States, the General Land Office (GLO) survey records provide the only reasonably accurate data source of forest composition and tree species distribution at the time of pre-European settlement (circa late 1800 to early 1850). However, GLO data have two fundamental limitations: coarse spatial resolutions (the square mile section and half mile distance between quarter corner and section corner) and point data format, which are insufficient to describe vegetation that is continuously distributed over the landscape. Thus, GIS and statistical inference methods to map GLO data and reconstruct historical vegetation are needed. In this study, we applied a hierarchical Bayesian approach that combines species and environment relationships and explicit spatial dependence to map GLO data. We showed that the hierarchical Bayesian approach 1) is effective in predicting historical vegetation distribution, 2) is robust at multiple classification levels (species, genus, and functional groups), 3) can be used to derive vegetation patterns at fine resolutions (e.g. in this study, 120 m) when the corresponding environmental data exist, and 4) is applicable to relatively moderate map sizes (e.g., 792—763 pixels) due to the limitation of computational capacity. Our predictions of historical vegetation from this study provide a quantitative and spatial basis for restoration of natural floodplain vegetation. An important assumption in this approach is that the current environmental covariates can be used as surrogates for the historical environmental covariates, which are often not available. Our study showed that terrain and soil covariates least affected by past natural and anthropogenic alternations can be used as covariates for GLO vegetation mapping.

Topic Area: Spatial analysis: theory & methods

Symposium: Oral session

Time: Thursday, 10:00-12:00, Boojum
Passive microwave products can reveal the land surface phenology of moisture stress in Great Plains landscapes

Geoffrey M. Henebry, South Dakota State University
Marcela Doubkova

Abstract: Precipitation variability has been offered in ecological studies as a key factor for explaining grassland ecosystem structure and function. To understand this forcing it is necessary to study the dynamics of surface moisture in addition to precipitation. Optical vegetation products are restricted for daytime acquisition and cannot provide information on the diel canopy energy and moisture exchanges. Passive microwave remote sensing can sense during both day and night the 'cooler earthlight', the radiation emitted in the longer wavelengths (0.34-4.3 cm) beyond the thermal infrared. Sensitivity of microwave emittance to the moisture status of vegetation has been amply demonstrated in the literature. We demonstrate how retrievals of vegetation water content (VWC) from the Advanced Microwave Scanning Radiometer onboard the Aqua platform (AMSR-E) can provide valuable insights into the dynamics of surface moisture, including rapid responses to precipitation inputs and patterns of dry-down. Of particular interest is the diel difference in the VWC. These data complement optical observations of land surface phenology as retrieved from by the Moderate Resolution Imaging Spectroradiometer (MODIS) also onboard Aqua.

Symposium: Poster Session
Monitoring the phenologies of vegetation moisture using cooler earthlight

Geoffrey M. Henebry, South Dakota State University

Abstract: Land surface phenology (LSP) is a key biogeophysical phenomenon that links the water and carbon cycles with anthropogenic activities, such as land cover land use change, to atmospheric boundary layer processes. LSP thus provides an important approach to change detection in terrestrial ecosystems. While remote sensing of reflected sunlight has proven useful to track LSP dynamics, these observations are restricted to daytime and often obscured by cloud cover. Passive microwave radiometers can sense emitted earthlight through clouds and at night. AMSR-E onboard Aqua provides daily observations of the planet’s vegetation moisture fields during both daytime (∼1:30pm) and nighttime (∼1:30am) at a gridded resolution of 25km. The diel difference in the vegetation water content (ddVWC) may provide a powerful indicator of canopy water stress: ddVWC = (VWC at 1:30) minus (VWC at 13:30). Effects of precipitation events and subsequent drydown on a mature canopy are evident in shifts first toward lower ddVWC values (after the rain) and then rising again (during drydown). ddVWC time series capture changes in root zone soil moisture that result from inputs due to precipitation and/or irrigation and outputs due to evapotranspiration and/or drainage. I illustrate ddVWC dynamics with diverse sites in North America and Eurasia.

Topic Area: Phenologies as integrative phenomena for landscape research

Symposium: Oral Presentation

Time: Friday, 9:40-10:00, Salon D
Detecting the invasive shrub, Lonicera maackii, using Landsat data in SW Ohio

Mary C Henry, Miami University
Julian Resasco, Alison N Maye and David L Gorchov

Abstract: Lonicera maackii (Amur honeysuckle) is an invasive Asian shrub, which has naturalized in the deciduous forests of the Midwest. Using remote sensing to detect forest understory species is difficult, but L. maackii has earlier leaf expansion and later leaf retention than native tree species. In this study, we tested the feasibility of detecting the shrub in a portion of southwest Ohio. Our goals were to determine whether satellite-based remote sensing can distinguish stands of low and high L. maackii density, assess which time of year is optimal for detecting the shrub, and determine which image enhancements are best suited for the task. We obtained Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper (ETM+) data for 14 dates between 1999 and 2006. All images were acquired in spring and fall to capture times when L. maackii is in leaf, but trees are not. We assessed spectral separability and tested for significance differences in mean reflectance between high and low density L. maackii for each date and each image enhancement. Our findings suggest that high and low density stands can be distinguished using Landsat TM and ETM+ data, but only November images are both spectrally separable and indicative of higher levels of green biomass in high density stands.

Topic Area: Remote sensing II

Symposium: Oral session

Time: Tuesday, 1:00-1:20, Bonsai
Quantitative ecoregions of the conterminous United States

Paul Hessburg, USDA Forest Service, Pacific Northwest Research Station
Bill Hargrove, Forrest Hoffman and Brion Salter

Abstract: Ecoregions are often mapped over broad geographic areas to help land managers and ecologists visualize and understand environmental similarities where many complex and interacting environmental variables may be operating. Ecoregionalizations are important for monitoring, sampling, and land conservation designs, niche and climate modeling, and change detection because they partition environmental variance. Here, 36 remotely-sensed variables were selected to represent conditions influential to wildfire fuels production, burning and growing conditions, physiographic setting, fire ignition likelihood, and combinations of these. Variables represented climatic, edaphic, topographic, biological, and physical environment conditions for the conterminous US. We used iterative k-means clustering to group 1 km2 map cells of the US into 3000 ecoregions. With the Euclidean assignment method, the k-means algorithm fit clusters of roughly equal size in data space; large ecoregions shared a similar upper limit on within-group variance and had a similar maximum radius around centroids. Using k-means again, we iteratively re-clustered the initial 3000 centroids into successively smaller groups, for example, from 3000 to 2900, then 2800, 2700, 2600... down to 100 centroids, decreasing each time by 100 centroids; then from 100 to 10 centroids, decreasing each time by 10 centroids; and finally from 10 to 2, decreasing each time by 1 centroid. In a resulting matrix, each of the initial 3000 centroids was assigned the centroid it clustered to for each of 47 analyses. We used presence-absence TWINSPAN analysis and the centroid affiliations of the 3000 ecoregions through all analyses to build a dendrogram of ecoregion similarities. A dendrogram approach enables potential users to select a level of division appropriate for their specific problem.

Topic Area: Landscape change: modeling & analysis

Symposium: Oral session

Time: Tuesday, 1:40-2:00, Salons F, G & H
Recent advances and future innovations in multiscale tree-ring reconstruction of historical fire regimes

Emily Heyerdahl, USDA Forest Service, Rocky Mountain Research Station
Donald A. Falk

Abstract: Early fire history studies in North America were reconstructed generally over small areas (10s to 100s of hectares), and focused on developing fire chronologies to explore local- and regional-scale temporal variation in fire. While such studies continue to contribute valuable insights, in recent years a number of researchers have applied new sampling designs to reconstruct fire history across single (100s to 1000s of hectares) and multiple watersheds, across entire mountain ranges, and at broader regional scales. These more extensive sampling designs have been used to explore multi-scale spatial variation as well as temporal variation in historical fire regimes across landscapes. Moreover, regional networks of multiple fire history sites are now emerging, enabling analysis of the drivers of fire regimes among mountain ranges and across multiple scales. Multiscale analysis can help to separate local control of fire regimes based on patterns of fire spread and fire effects from top-down regulation by climate variation. We illustrate these emerging ideas with data from multiple sites in western North America and elsewhere.

Topic Area: Recent advances and future innovations in multiscale systematic tree-ring reconstruction of historical fire regimes

Symposium: Oral session

Time: Tuesday, 1:00-1:20, Salon E
Keynote: Niche theory and habitat suitability modeling

Alexandre Hirzel, University of Lausanne
Gwenaëlle Le La

Abstract: The ecological niche may be seen as a function relating environmental variables to species fitness, while habitat suitability models (HSM) relate them to the probability of species occurrence. In spite of this obvious parentage, they are but weakly linked. I shall give an quick review of HSM-based studies that address four common niche-theory issues: niche characteristics, species interactions, community ecology and niche evolution. I shall also discuss how the various HSM types are suited to address these issues.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)

Symposium: Oral session

Time: Tuesday, 1:00-1:20, Salon D
Assessing landscape and focal species connectivity in Florida

Thomas Hoctor, University of Florida
Margaret Carr, Paul Zwick and Dave Maehr

Abstract: In 1995, University of Florida staff was contracted by the Florida Department of Environmental Protection to use GIS to delineate the Florida Ecological Greenways Network. We used ESRI's ArcInfo to identify priority landscapes and corridors using least cost path methodology. As part of my dissertation and work for the Florida Fish and Wildlife Conservation Commission, I have also conducted assessments of habitat and connectivity for the Florida black bear (Ursus americanus floridanus). The black bear analysis allowed comparison of least cost path approaches at a landscape scale in the Florida Ecological Greenways Network model to a focal species approach. Though there are limitations with least cost path analysis, this comparison suggests that, in Florida, general landscape-based connectivity analysis results were similar to corridor options for the Florida black bear. The Florida Ecological Greenways Network is a cornerstone of biodiversity and ecosystem service conservation efforts in Florida, and it has recently been updated and prioritized. Though urban and suburban development continues rapidly, revised and new policy efforts are aimed at protecting remaining intact landscapes. In addition, efforts to further refine connectivity and spatially-explicit population risk assessments for the Florida black bear will continue in order to better guide landscape protection.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 4:00-4:20, Salon E
Using the PATH model to predict corridors for Red-Cockaded Woodpecker and Gopher Tortoise near military installations

Forrest Hoffman, Oak Ridge National Laboratory
William W. Hargrove, James Westervelt, William Meyer and Robert Lozar

Abstract: The PATH model launches virtual entities called 'walkers' from habitat patches in a GIS data layer, and simulates their travel through land cover types in the intervening matrix until they reach a different habitat 'island.' Each walker is imbued with a set of user-specified habitat preferences that make its movement behavior resemble that of an individual of a target species, parameterized using guidance from the published literature. We used PATH to predict potential Red-Cockaded Woodpecker corridors connecting evergreen forest patches throughout Georgia. We also predicted how well Gopher Tortoise (GT) habitat patches within the northeastern portion of Fort Benning, GA were connected to off-base habitat patches on public lands to the east. Poorer quality GT habitat within the landscape matrix have lower preference values. Roads and urban areas are the least preferred habitat categories. Contrary to intuition, the strongest potential connection between on- and off-base habitat patches does not directly involve large central 'stepping stone' GT habitat patches, because of the poor quality of the intervening landscape matrix. Establishing even low roadway mortality has a dramatic effect on Gopher Tortoise connectivity, reducing both the strength and number of connections between habitat patches.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 4:40-5:00, Salon E
Relating distance weighted measures of landscapes to water quality: Does distance matter?

Jeffrey W. Hollister, US Environmental Protection Agency
Jane L. Copeland

Abstract: Anthropogenic use in contributing watersheds, as measured by land use/land cover (LULC), impacts the condition of downstream aquatic resources. Some of the current research focuses on how location (i.e. the distance of the land use from the receiving water) impacts the relationship between LULC and water quality. A simple method to account for location is to weight landscape metrics by the distance of the LULC patch from the receiving water. Distance may be defined either as the straight line distance between two points or in a functional sense, such as hydrologic flow paths. We plan to weight landscape metrics with both straight-line and hydrologic distance and compare the differences between them in both estuarine and riverine systems. Additionally, we will compare the relationships between the different weighted metrics and water quality. In riverine systems, we expect hydrologic distance weighted metrics to be more closely associated with water quality than straight-line weighted metrics. We expect little to no difference in associations between the different distance weighted metrics in low-gradient riverine and estuarine systems. The results of this study will have implications for broad scale water quality modeling and will impact our ability to predict the location of impaired water bodies.

Symposium: Poster Session
The state of spatio-temporal statistical modeling in ecology

Mevin Hooten, Utah State University

Abstract: Statistical models for ecological phenomena that propagate in space and time have undergone rapid change over the past decade. The ability to formulate ecological models in a hierarchical space-time framework has enabled researchers to consider much more complex processes. Additionally, it has allowed for the fusion of both physical and statistical process representations, thus recycling well-developed machinery that enables the statistical characterization of highly scientific models. The physical process model allows for scientifically meaningful forecasts, and when considered in a formal probability setting, uncertainty can be accounted for at all levels.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)

Symposium: Oral session

Time: Tuesday, 1:20-1:40, Salon D
Abnormal precipitation patterns provide opportunities to map a non-native perennial grass *Eragrostis lehmanniana* in desert grasslands

Cho-ying Huang, University of Arizona
Erika Geiger

**Abstract:** One of the most significant directional changes in desert grasslands of southern Arizona is the invasion of South African perennial grass *Eragrostis lehmanniana*. Phenology of communities invaded by *E. lehmanniana* is similar to native-plant dominated vegetation, which limits large-scale monitoring of *E. lehmanniana* using remote sensing. However, phenology of these systems may diverge due to climate variability (in this case, extremely wet winters) resulting in greater herbage production in environments dominated by *E. lehmanniana* compared to native vegetation. In October 2000, Fort Huachuca Military Reservation in southeast Arizona received more than 198 mm of rainfall at an elevation of 1,550 m, whereas mean October precipitation at this altitude was 7 mm according to seven normal years (1998-99, 2001-05) of climate records. The relationship between remote sensing vegetation signals and abundance of *E. lehmanniana* during this abnormal period was investigated by comparing the Moderate Resolution Imaging Spectro-radiometer Enhanced Vegetation Index (MODIS-EVI) time-series data with field observations. We found that the difference of EVI between October 2000 and normal years was positively correlated to *E. lehmanniana* biomass. This relationship would facilitate non-native species mapping over vast areas in this dry region.

**Topic Area:** Species distributions: invasives

**Symposium:** Oral session

**Time:** Tuesday, 4:40-5:00, Salons F, G & H
A rigorous assessment of fine-scale spatial variation in immediate post-fire effects

Andrew Hudak, USDA Forest Service, Rocky Mountain Research Station
Sarah A. Lewis, Alistair M.S. Smith, Penelope Morgan, Leigh B. Lentile and Peter R. Robichaud

Abstract: Fire effects on vegetation and soil are highly heterogeneous across scales. Remotely sensed imagery integrates fine-scale post-fire effects within image pixels. This argues for using spectral mixture analysis, which provides scalable measures of pixel cover, to estimate subpixel fractions of char, green and unburnt nonphotosynthetic vegetation. We estimated these three fractional cover components from 30m multispectral Landsat imagery and 4m hyperspectral imagery acquired immediately post-fire over 8 large wildfire complexes in western Montana, southern California, and interior Alaska. We validated these estimates with ocular estimates of these same variables collected at 50 field sites at scales ranging from 2-130m, using nested spatial samples designed for this purpose. Each 130m x 130m field site consisted of nine 9m x 9m plots, each composed of fifteen 1m x 1m subplots. Empirical variograms generated from the field data showed that the degree of spatial dependence was extremely site specific. However, image-derived cover fractions from the same locations more consistently exhibited classical variogram behavior. We found more severely burned areas to be more spatially homogeneous across a wide variety of ecosystems. Most of the landscape pattern in post-fire effects of concern to land managers may be captured at the spatial resolution of Landsat.

Topic Area: Burn severity mapping: research and applications

Symposium: Oral session

Time: Thursday, 2:40-3:00, Salon D
Environmental controls on remotely-sensed Monsoon Asia tropical forest landscape phenology

Alfredo Huete, University of Arizona
Kamel Didan, Piyachat Ratana, Natalia Restrepo-Coupe, Kazuhito Ichii, Samreong Panuthai and Minoru Gamo

Abstract: The phenology of the world's rainforests significantly influence global dynamics of the Earth system through their role in biogeochemical cycling and climate, and as major reservoirs of the planet's biological diversity. Despite their enormous importance, the impact of environmental and human factors on tropical forest functioning and phenology remain poorly understood. Recent neotropical rainforest studies, with flux tower and satellite data, show dry season increases in vegetation photosynthesis resulting from greater seasonal availability of sunlight and avoidance of dry season water stress through root access to deep soil waters. However, a reversal in satellite functional phenology is found in disturbed forests and with forest conversion. In this study we assessed the extent to which the tropical rainforests in Southeast Asia respond similarly as the neotropics to sunlight, moisture, and human controls on seasonal ecosystem functioning. Tropical forest degradation induced by land use pressures is more prominent in Monsoon Asia and deforestation rates are the highest on the planet. The moist rainforest sites near the equator displayed satellite greenness phenologies that were less well coupled with rainfall with higher photosynthesis in the dry. Throughout the region, however, land disturbances resulted in satellite phenology profiles that strongly followed precipitation seasonality.

Topic Area: Phenologies as integrative phenomena for landscape research

Symposium: Oral session

Time: Friday, 8:40-9:00, Salon D
Towards a biodiversity assessment of the Pacific Rim: Predictive large-scale GIS-modeling of brown bear distribution (Canada, Alaska, Russian Far East and Japan) in estuaries using compiled public coastal data and TreeNet

Falk Huettmann, University of Alaska, Fairbanks
Reinhild Graber, and Klaus Pohlmeyer

Abstract: This study developed a predictive model, capable of presenting brown bear (Ursus arctos) populations and density distributions in the Pacific Rim (British Columbia-Canada, Alaska, Russian Far East, Japan). It uses a robust predictive modeling technique (TreeNet, Salford Systems Ltd.) not applied in bear research and the Pacific Rim, to date. As part of a forthcoming biodiversity hotspot description, all major and known estuaries in the Pacific Rim were located and described. Brown bear abundance data (absolute density) was compiled for each estuary from the literature and other sources (expert estimates). This represents currently the best available digital bear data for the Pacific Rim. Freely available estuary habitat data and occurrence of salmon were also used. The quantitative model was further tested for accuracy with additional and available (field) data, reaching up to 94%. From these data and modeling we were able to determine that minimum temperature and human density, as well as ecosystem classes (vegetation types), appear to greatly influence the brown bear distribution and subsequent populations. This model is of interest due to the unique compilation of GIS datasets, the first time application of a boosting model algorithm, quantified bear-habitat associations, and the provision of consistent, quantitative and verified population estimates.

Symposium: Poster Session
Abstract: Predictive Modeling became a global business way beyond the pure scientific value. It gets applied in numerous industries and disciplines. Here I will show lessons learnt from those applications and how they apply to Land- and Seascapes world-wide. Further, I am using Biodiversity modeling to show that progressive software and public online-data allow for progress in sustainable resource management. The 30 reviewed modeling projects use a variety of datasets, modeling philosophies and algorithms from six continents covering small, regional and large extents and over 1000 species, including diseases. It will be shown that accuracy assessment is the key for reliable model building and sound decision-making. However, error metrics need further development and standardisations across modeling-techniques. So far, only a handful of models make use of FRAGSTATS and related approaches. Very few of the reviewed models published in the scientific literature are readily usable for policy. Foremost, the demand for models in the legal community is still lacking and needs to be raised. It can be assumed that modeling will not only affect natural resource management but also global society and democracy. Thus, providing the right tools, public data and methods is a crucial and scientific exercise to pursue and teach at universities.
Spatial patterns of bamboo foraging and recovery in a reintroduction enclosure for a Giant Panda

Vanessa Hull, Michigan State University
Ashton Shortridge, Xiaoping Zhou, Bin Liu, Hemin Zhang and Jianguo Liu

Abstract: Animal reintroductions often involve an acclimation stage, where animals are monitored under semi-wild conditions prior to release. This method was used in the first giant panda reintroduction project, with the establishment of a reintroduction enclosure (400 x 500 m) in the natural habitat in Wolong Nature Reserve, China. This project provides a good opportunity to explore interactions between giant pandas and their principal food source, bamboo, under spatial constraints. We conducted field sampling within the enclosure and in a control region outside of it within 10 x 10 m² plots (n= 726). There was a 61% higher loss of bamboo cover to panda foraging and a 97% higher gain of new bamboo cover after the panda was released inside the enclosure compared to the outside. Simultaneous autoregressive models revealed the significance of bamboo cover, distance to water, and understory forest structure in predicting foraging and recovery. Spatial autocorrelation was a useful index for monitoring panda-bamboo relationships under spatial constraints, since it increased over time in the enclosure as bamboo declined and foraging became more widely distributed. The bamboo was resilient in recovering after intensive foraging, therefore enclosures could be sustainable reintroduction tools for this species under careful monitoring.

Topic Area: Spatial analysis: applications

Symposium: Oral session

Time: Thursday, 4:40-5:00, Salons F, G & H
Landscape heterogeneity and the influence of prescribed fire and thinning on forest regeneration in southern Ohio

Louis R. Iverson, USDA Forest Service, Northern Research Station
Todd Hutchinson, Anantha Prasad and Matthew Peters

Abstract: Regeneration of oak forests throughout the eastern United States is constrained by the absence of fire and minimal light reaching the forest floor. A study was established in 2000 to assess the response of oak regeneration to prescribed fire (in spring 2001 and 2005) in combination with mechanical thinning (late 2000) at two study sites in southern Ohio. Each of the four 20+ ha treatment units (2 thin+burn, 2 controls) was modeled and mapped for long-term moisture regime using the Integrated Moisture Index, and a 50 m grid of sampling points was established throughout the units. Grid points were sampled before and after the treatments were applied; all tree seedlings and saplings, as well as canopy openness, were sampled in 2000, 2001, 2004, and 2006. The thin-and-burn treatment, relative to the control, generally resulted in more light and an increased abundance to oak regeneration. Fires in 2004 created extra heterogeneity by causing various levels of mortality and light across the landscape. The integrated moisture index was related to several of the measured variables: grid points modeled as topographically drier had more light penetration and greater oak regeneration. Several other species also had marked variations in regeneration success, depending on landscape variation in fire intensity and moisture regimes.

Topic Area: Managed landscapes

Symposium: Oral session

Time: Friday, 8:20-8:40, Salon E
Measuring landscape connectivity by incorporating variable barrier strengths of transportation infrastructure into the effective mesh size

Jochen A.G. Jaeger, ETH Zurich, Dept. of Environmental Sciences D-UWIS

Abstract: Data on the degree of landscape fragmentation due to transportation infrastructure (or, alternatively, on the remaining degree of connectivity) are needed for monitoring landscape change and for investigating the effects of fragmentation. For example, the effective mesh size quantifies the connections that do not cross any relevant barriers (Jaeger 2000, Landscape Ecology 15; Moser et al. 2007, Landscape Ecology 22). This method is currently used as one of 24 core indicators in Germany, and in the Indicator System for Monitoring Sustainable Development (MONET) in Switzerland. In order to also take into account the varying degrees of a road's barrier strength which depends on traffic volume, characteristics of the road, and the surrounding landscape, I developed a new method that incorporates variable barrier strengths by additional terms in the formula of the effective mesh size. The talk presents the modified method and gives examples of its application using empirical data on ungulates and amphibians. This new method will probably be widely used in the future as the current lack of quantitative empirical data on barrier strengths as a function of road characteristics and animal behaviour at roads is increasingly addressed by wildlife biologists.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 2:40-3:00, Salon E
Simulating the effects of different harvest patch sizes on patterns of spruce budworm defoliation in a boreal mixed-wood forest

Patrick James, University of Toronto
Marie-Josee Fortin, Brian Sturtevant and Andrew Fall

Abstract: The spruce budworm (SBW) is an endemic defoliating insect pest of the boreal forest that creates complex spatial and temporal patterns of forest mortality. Spatial patterns of defoliation are a result of interactions among insect dispersal, patterns in forest composition, and regionally correlated weather variables. We used a spatially explicit simulation model of a boreal mixed-wood forest in Quebec to investigate the relative roles of each of these factors and how they interact with different harvest patch sizes, succession, and stochastic fires. Specifically, we investigate under what conditions timber harvesting legacies are correlated with patterns of defoliation. Our results indicate that legacies in spatial pattern and species composition left by different harvest patch sizes can affect defoliation through harvest-succession interactions and subsequent changes in the scale of patchiness of preferred host species. However, the strength of the relationship between defoliation and harvest patch size is dependent upon the SBW’s dispersal ability, the degree of assumed spatial autocorrelation in weather attributes, and scale of analysis. This study highlights the potential long term influence of forest management on insect disturbance dynamics and how different factors determine defoliation patterns at different scales.

Topic Area: Disturbance effects

Symposium: Oral session

Time: Thursday, 4:20-4:40, Salon D
Terrestrial carbon flux responses to precipitation in a Sonoran desert vegetation mosaic

G. Darrel Jenerette, University of Arizona
Travis E. Huxman and Russell L. Scott

Abstract: Arid and semi-arid ecosystems are important locations for understanding the responses of terrestrial carbon fluxes to variation in precipitation. Here we present results from analyses describing ecosystem physiological changes and vegetation community shifts in response to changing precipitation regimes. We have developed a terrestrial carbon flux model that describes ecosystem responses to individual precipitation events. Parameters for this model were obtained through inverse analyses of whole ecosystem carbon flux exchanges measured from eddy-covariance towers located in contrasting patch types. We then couple this ecosystem physiological model to a spatially explicit patch-dynamic model of shrub encroachment. Together this coupled modeling approach describes both the short and long-term consequences of altered precipitation within the southeastern Arizona region. Initial modeling results highlight the importance of the distribution of precipitation events in conjunction with changes in the total magnitude of precipitation.

Topic Area: Simulation models: plants, animals, ecosystems

Symposium: Oral session

Time: Tuesday, 3:20-3:40, Bonsai
Maryland's Green Infrastructure Program: Using landscape pattern and process as a guide to government planning

Bill Jenkins, US Environmental Protection Agency

Abstract: The Term "Green Infrastructure (GI)" has a dual meaning. First, it is a strategic, systematic, and science-based approach to land conservation that works at the national, state, regional, and local scales, integrating land and "gray" infrastructure planning, and environmental decision-making that benefits people and ecosystems. Secondly, it is the interconnected land network necessary to maintain ecosystem functions. By identifying these important lands in a scientifically defensible way, planning and regulatory decisions can be both more economically sound and environmentally friendly, supporting healthy livable communities. Furthermore, the GI approach provides a clear strategy for both conservation actions and development activities. Using such an approach, environmental agencies and conservation organizations can work synergistically to minimize costs and maximize the effectiveness of their resource protection and restoration activities, while providing a framework to guide future growth. This presentation will describe how Maryland's GI assessment is being used at the state and local government levels, and how US EPA Region 3 will be using this approach in some of its programs. Recommendations for additional scientific research that will help strengthen the theoretical basis for GI assessments, and for their use in program decision-making will be discussed.

Topic Area: Putting theory into practice: application of landscape ecology principles into environmental decision-making

Symposium: Oral session

Time: Tuesday, 10:40-11:00, Salon E
Predicting high risk areas of gophersnake (*Pituophis catenifer*) mortality on the Upper Snake River Plain, Idaho, USA.

Denim Jochimsen, Washington State University

Abstract: Understanding the complex effects of roads on wildlife becomes increasingly important as they continue to spread across the landscape. Roads cross a range of habitats, and can negatively influence wildlife through mortality inflicted by vehicles and disruption of movement patterns. A growing literature base implicates roads in the decline of amphibian and reptile populations, although these groups are underrepresented in road ecology studies. This research addressed two objectives: (1) describe the spatial pattern of snake mortality along a 183-km survey route in southeastern Idaho and (2) develop a logistic regression model to evaluate the importance of habitat and landscape factors associated with mortality. Using a network K-function, I determined that road mortality was clustered. Using AIC to evaluate the best logistic model, I found that road observations were positively correlated with percent grass cover, percent total vegetative cover, basalt piles, and mean distance to hibernacula. The positive association with grasses, which are mostly invasive cheatgrass and crested wheatgrass, suggests that habitat conversion from sagebrush-dominated areas may be increasing the likelihood of road mortality. Knowledge of predictable movements and their relationship with landscape features could help guide effective mitigation.

Topic Area: Species in urban landscapes

Symposium: Oral session

Time: Tuesday, 1:00-1:20, Boojum
Fuel variability within the landscape-scale of Rocky Mountain Region: Integration of field data, geospatial information, and spatial statistics

Mohammed A. Kalkhan, Colorado State University

Abstract: The integration of remotely sensed data, GIS, and spatial statistics is an effective tool for modeling and mapping coarse-scale and fine-scale ecological variability and for the prediction of fuel loading, variability, and vegetation characteristics. We propose new techniques to conduct fuel-vegetation surveys based on nested-pixel sampling (20 x 20 meters) designs at different landscape scales at Grand Teton National Park, Bridger Teton National Forest (BTNF), Wyoming, and (15 x 15 meters) at Rocky Mountain National Park (ROMO), Colorado, USA. Through geospatial statistical modeling and mapping, fuel loadings will be forecast across the landscape. To predict the fuel parameters and forest characteristics at GRTE/ BTNF, we will use a new geospatial statistics model using spatial autocorrelation and cross-correlation statistics, trend surface analysis, and stepwise regression. This process is based on ordinary least squares (OLS), spatial autoregressive models (SAR), generalized least squares (GLS) estimates, and generalized linear models (GLM). Field data, environmental characteristics, remote sensing, and GIS data will be integrated with spatial statistics to estimate coarse-scale variability in vegetation, fuel parameters, and forest characteristics. Modeling of the spatial continuity of fine-scale variability will be based on binary regression classification trees (RCT), Kriging, and co-Kriging. Semi-variogram models will be selected for the lowest values of AICC statistics when Kriging is used. The geospatial statistical model mapping will be integrated with a fire area simulator model (FARSITE) to predict the potential fire growth and behavior across the landscape under a variety of weather scenarios. Using these methods, we hope to define a new protocol for fuel modeling and mapping within GRTE- BTN. The new approach will also provide a cost-effective tool for identifying areas currently affected or vulnerable to invasion by exotic species as well as assist with other issues of landscape management (i.e., forest fuel loading, wildfire in relation to weeds occupying the landscape, and other factors of concern to resource management teams at GRTE -BTNF and ROMO) Also, this research provides a growing body of knowledge upon which park managers may base decisions that best preserve the parks’ natural richness while allowing us and others to enjoy its beauty.

Topic Area: Spatial analysis: theory & methods

Symposium: Oral session

Time: Thursday, 10:20-10:40, Boojum
Understanding the effects of plot size on scale and patterns of plant species richness: A landscape-scale assessment approach using geospatial information and spatial statistics

Mohammed A. Kalkhan, Colorado State University

Abstract: Monitoring plant diversity in natural landscapes such as forests, rangelands, and wetlands, requires careful measurements of species richness, detecting exotic species invasions, and identifying rare species habitats. Since only a small portion of any landscape can be affordably surveyed, mapping and protecting biodiversity requires extrapolating information from the tiny survey sites to the much larger unsampled area with known precision and accuracy. Often land managers collect field data with multi-scale plots (different plot sizes) across various environmental gradients. However, understanding the effects of plot size, and linking that to scale and patterns of plant diversity remains a difficult challenge for many researchers in landscape ecology and environmental studies. With current advances in computer computational capabilities and the availability of satellite data with high spatial and spectral resolution, these challenges can be addressed and solved. We present a standard approach to investigate the effects of different plot sizes on the scale and patterns of plant species richness and foliar cover with examples from mountain and semi-arid landscape environments. We present diversity indices, spatial autocorrelation, cross correlation, and spatial statistical analyses on field data collected from multi-scale, nested plots of 1-m², 10-m², 100-m², and 1000-m². Our methods integrate field data, geospatial information (e.g., remotely sensed data, geographic information system, and global positioning systems) with geostatistical modeling and mapping approaches. Our study will show results of trend surface models that describe the large-scale spatial variability. Models with small variance, residuals mean square errors, and AICC information were selected. In order to model fine-scale variability, the residuals from the trend surface model were modeled using semi-variogram with Kriging or regression binary classification tree (RBCT) methods. Our techniques that use geospatial quantitative modeling and thematic map products also can be used for ecological and environmental forecasting. Combined, our approach can be used by others to investigate patterns of biodiversity at different scales and to predict patterns and spatial relationship of plant species richness and invasive species.

Symposium: Poster Session
**FIREHARM: a spatially explicit fire hazard model used to map fire severity**

Eva Karau, USDA Forest Service, Rocky Mountain Research Station  
Bob Keane

**Abstract:** FIREHARM is a spatial fire hazard rating model equipped to simulate landscape scale fire effects in two modes. The 'single event' mode outputs fire effects given specific weather and fuel moisture conditions, while the 'temporal mode' maps the probability of severe effects over an 18 year weather record. We ran the model for three large fires in western Montana (Cooney Ridge and Mineral Primm, 2003, and I-90, 2005), and we collected fuel loading and tree inventory measurements to serve as field reference for our model experiment. Our objectives were to: 1. demonstrate the ability of FIREHARM to produce maps of fire effects (fuel consumption, tree mortality and soil heating) under three different weather and fuel moisture scenarios (moderate, dry and very dry), 2. generate probability maps of a fire event occurring in our study areas as a demonstration of the model's temporal mode, 3. investigate the combination of single event and temporal mode output to improve a manager's ability to assess fire severity, and 4. assess the relationship between modeled fire effects and field reference data. We expect results to show that a fire effects model can provide valuable information for landscape scale fire severity assessments.

**Symposium:** Poster Session
Investigating the relationship between the amount and degree of tree cover connectivity and the abundance of selected forest birds in the urban regions across the eastern United States

Sadahisa Kato, University of Massachusetts, Amherst

Abstract: In urban areas, even though greenspaces are often small and fragmented, they have a potential to support important ecological as well as social functions. Thus, strategic planning of urban greenspace is important for those—human and non-human species—that benefit from its services. This study focuses on the composition and configuration of tree cover as part of greenspace in broad metropolitan regions and their effect on the number of individuals of selected forest bird species that could benefit from the increase in tree cover connectivity. By using certain bird species that can act as the indicators of ecological health, the study hopes to claim that their presence suggests an environment that can support related ecological functions. The objective of the study is to investigate the relationship between the amount and degree of tree cover connectivity and the abundance of selected forest bird species (e.g., tanager species (Piranga spp.) and thrush species (Hylocichla spp.)) in metropolitan regions across the eastern United States. Specific questions asked include: Can structural connectivity metrics predict the target breeding bird abundance in the metropolitan regions? Can they be surrogates for functional connectivity metrics? What is the range of connectivity that best supports the breeding birds? Is there a generalizable relationship between the appropriate amount and degree of tree cover connectivity and the breeding bird abundance across different geographic/climatic regions? Percent tree canopy (i.e., cover) data is available as a supplemental data from the National Land Cover Database 2001. Metropolitan statistical areas, as defined by the Office of Management and Budget, are used to define the boundaries of metropolitan regions. The breeding bird abundance data comes from the Breeding Bird Survey. The results will have implications for planning appropriate amount of and degree of connectivity of tree cover for the breeding bird populations in broad metropolitan regions.

Topic Area: Managed landscapes

Symposium: Oral session

Time: Friday, 9:40-10:00, Salon E
Climate change effects on historical range and variability of species composition on two large landscapes in central Utah, USA

Robert E. Keane, USDA Forest Service, Rocky Mountain Research Station
Lisa Holsinger and Katherine Gray

Abstract: Quantifying historical range and variability of landscape composition and structure using simulation modeling is becoming an important means of assessing current landscape condition and prioritizing landscapes for ecosystem restoration. However, most simulated time series are generated using static climate conditions, which fail to account for major changes in future climate. Land managers need to be able to generate reference time series under historical, current, and future climate conditions to effectively prioritize, design, and implement current landscape level restoration treatments. We present a simulation study that generates reference conditions for three climate scenarios (historical and two climate change) and three fire regime scenarios (historical, half historical, and double historical fire frequencies) for two large landscapes in central Utah of the western United States, using the landscape fire succession model LANDSUM. Biophysical settings, critical spatial inputs to LANDSUM, were empirically modeled across the landscape using environmental gradients created from simulated climate from historical and modeled future climate daily weather data summaries. Variation of simulated burned area and dominant vegetation types were compared across climate scenarios to determine departure from current conditions. The implications of changing fire regimes and climates to fire management are discussed.

Topic Area: Simulation models: disturbance

Symposium: Oral session

Time: Thursday, 11:40-12:00, Bonsai
Habitat fragmentation, extinction thresholds and pollinator services in agroecosystems

Timothy H. Keitt, University of Texas at Austin

Abstract: A considerable portion of our global food supply depends critically on the coevolved relationship between flowering plant and insect pollinators. Fruiting of many agriculturally important plant species depends fully or partially on insect pollinators. Native pollinators are an important source of pollination services to many crops. Landscape conversion to agricultural use threatens many pollinator species risking loss of pollinator services and has raised concern over widespread pollination limitation in agroecosystems. Loss of native pollinators may be offset through husbandry of domesticated pollinators, but at the risk of dependence on a pollinator monoculture susceptible to disease or environment change. Understanding the effects of agricultural habitat conversion on the key link between native pollinators and crop production is an important challenge for ecology. Currently, no theory offers an examination of the specific impacts of amount and pattern of habitat conversion on pollinator species in agroecosystems. This paper studies the problem of pollinator limitation in fragmented agricultural landscapes. A pair of models is presented -- one an individual-based simulation and another composed of difference equations that mimic the behavior of the simulation model in the mean-field limit. Bifurcation analysis of the models indicates a cusp at a threshold amount of habitat loss. When pollinators are subsidized by crops, the dynamics are more complex with state-dependent rules for colonization. Some rules of thumb are developed for managing pollinators in agricultural landscapes.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 11:20-11:40, Salon E
Geospatial modeling of fire-size distributions in historical low-severity fire regimes

Lara-Karena Kellogg, University of Washington
Don McKenzie and Narasimhan Larkin

Abstract: Low-severity fires are recorded by fire-scarred trees. These records can provide temporal depth for reconstructing fire history because one tree may record dozens of separate fires over time, thereby providing adequate sample size for estimating fire frequency. Estimates of actual fire perimeters from these point-based records are uncertain, however, because fire boundaries can only be located approximately. We are working toward estimating fire-size distributions without attempting to establish individual fire perimeters. Deconstructing variograms that use a binary distance measure (Sorensen's index) for the similarity of the time-series of fires recorded by pairs of recorder trees can provide estimates of fire size. We link these variograms to fire size distributions by simulating fire size distributions on neutral landscapes and comparing neutral-model variograms to those from real landscapes with respect to functional form. Variograms from real landscapes exhibit power-law behavior that appears to be coupled with topographic controls on fire sizes. In contrast, neutral-model variograms exhibit patterns that represent a mapping (in the mathematical sense) from fire size distributions that initialize the neutral-model simulations. Ideally therefore, an inverse mapping from the power-law formulae for variograms from real landscapes should yield their fire-size distributions. This mapping could be achieved using a theoretical model for the Sorensen variogram, or by brute-force examination of different functions to simulate fire-size distributions. This statistical modeling of fire size provides a robust alternative to empirical and heuristic methods and a means to extrapolate estimates of fire-size distributions to unsampled landscapes.

Symposium: Poster Session
Characterizing the historical range and variability of late-successional forest and fire severity in a large landscape in the interior Pacific Northwest using a landscape fire succession model

Rebecca S.H. Kennedy, USDA Forest Service, Pacific Northwest Research Station
Thomas A. Spies and Michael C. Wimberly

Abstract: Sustaining late-successional forest and associated wildlife habitat is one of the primary goals of the Northwest Forest Plan. It is currently addressed through the implementation of late-successional reserves. In the dry forests of the Pacific Northwest, achieving this goal involves addressing the risk of loss of old forest to stand replacement disturbance. Better information about historical fire regimes and their effects on vegetation patterns may increase the likelihood of success of forest planning efforts and will address planning rule requirements. We characterized the historical range and variation of fire severity and vegetation patterns in a ~ 2 million ha landscape in central Oregon. We used the Landscape Age-Class Dynamics Simulator (LADS 4.4), which we parameterized for the fire regimes and potential vegetation types of the Deschutes National Forest. We developed spatially explicit probability surfaces depicting the likelihood of stand replacement, mixed severity, and non-lethal fire, and the production of late-successional forest and other vegetation types. Some areas of the landscape had higher average likelihood of stand replacement fire, but forest ages and fire severities were spatially and temporally variable. Landscape-level fire patterns reflected the influence of adjacency of forest types on fire spread and resulting vegetation patterns.

Topic Area: Fire & landscape pattern

Symposium: Oral session

Time: Tuesday, 4:20-4:40, Salon E
Mapping yearly forest disturbance and recovery processes in western Oregon, U.S.A.

Robert E. Kennedy, USDA Forest Service, Pacific Northwest Research Station
Todd Schroeder and Warren B. Cohen

Abstract: To relate trends in forest management to the policy and economic forces that affect them, cross-ownership maps are needed of the timing and severity of forest disturbance, as well as the initial rate of vegetation re-establishment after disturbance. Existing change detection analyses have typically been limited to detection of disturbance only, have only been possible at a fairly coarse temporal change intervals, and have only attempted to map presence or absence of disturbance rather than its intensity. Here, we describe a method that capitalizes on the recognition that disturbance has distinctive properties both before and after a disturbance. This results in distinctive temporal trajectories that can be identified statistically more robustly with a temporal stack of imagery than with two dates alone. We apply the method to Landsat TM imagery in western Oregon, U.S.A., and illustrate its ability to characterize year-to-year changes in management practices in public and private lands before, during, and after a period of forest policy change on public lands in the early 1990s.

Topic Area: Remote sensing I

Symposium: Oral session

Time: Tuesday, 11:20-11:40, Bonsai
A microclimate design framework to inform the rehabilitation of aggregate extraction sites

Natasha Kenny, University of Guelph
Robert D. Brown, Robert Corry, Nina Pulver and Raffaele Lafortezza

Abstract: Aggregate extraction sites are common elements in the landscape of Southern Ontario, Canada, and the rehabilitation of these sites offers the opportunity to provide habitat for plants and animals that are at risk. An informed rehabilitation approach can provide substantial benefits to industry, society, and the long-term ecological integrity of the landscape. Microclimate greatly affects the usability and productive capacity of a space, and is largely modifiable, as it is dependent not only on geographic location, but on the specific landscape and topographical characteristics of a site. This study identified the spatial differentiation of microclimatic characteristics of aggregate pits and quarries in Southern Ontario, in order to assist in the development of appropriate rehabilitation plans. The resultant Microclimate Design Framework (MDF) provides critical information regarding the viability of rehabilitating the landscape to support targeted species and ecological communities. The MDF assists in defining prevailing climatic conditions and "microclimatic planning units", which provide vital information regarding the inherent ecological capability and suitability of aggregate extraction sites in Southern Ontario.

Topic Area: Conservation planning: restoration

Symposium: Oral session

Time: Friday, 9:00-9:20, Boojum
Landscape simulation modeling of anthropogenic impacts on pinyon-juniper woodland distribution during early settlement: Nevada Great Basin

Dongwook Ko, University of Nevada, Reno
Peter Weisberg and Ashley Sparrow

Abstract: Pinyon-juniper woodland encroachment has been widely documented throughout the western United States. However, the dynamics involved are confounded by complex causal relationships. In Nevada, intensive livestock overgrazing and harvesting of trees for charcoal to support mining occurred for a brief period during early settlement in the late 19th century. Such activities may have had immense impacts on the distribution of pinyon-juniper woodland. Woodland encroachment may be a result of intensive overgrazing through fire exclusion, or simply a reforestation following harvesting of the trees for charcoal. In order to investigate this issue, we test an approach to address the probability of anthropogenic disturbances, grazing and logging in particular, by using a combination of models based on convection-diffusion, cost-of-movement, and proximity to transportation routes and demand centers. Disturbance probability maps were then used to parameterize a spatially explicit state-and-transition landscape model developed in TELSA (Tool for Exploratory Landscape Scenario Analyses), to evaluate the effects of historical logging and grazing on the changing woodland distribution since late 19th century. Results suggest that although our approach may successfully differentiate the potential anthropogenic impact in a spatially explicit manner, there are challenges to model calibration due to a lack of historical data.

Topic Area: Simulation models: disturbance

Symposium: Oral session

Time: Thursday, 11:20-11:40, Bonsai
What effect do prickly pears (Opuntia spp.) have on the microtopography of the northern Chihuahuan desert?

Nori Koehler, New Mexico State University

Abstract: The objective of this study is to examine the effect of prickly pear (Opuntia spp.) on microtopography in the northern Chihuahuan desert along the base of Mt. Summerford. The study will try to determine the effect of cattle grazing on the formation of prickly pear micromounds. Micromounds formed from perennial grass cover will also be analyzed. There will be at least seven study plots delineated within at least two different sites. One site will have been excluded from cattle grazing for at least 30 years and one site will be currently grazed by cattle. Microtopography will be measured within each 15m x 30m plot for prickly pear and perennial grasses using a modified soil erosion bridge. Vegetation canopy cover will be estimated using a line-intercept along one 30 m side of each plot. Soil samples will be taken from within each micromound measured as well as just downslope within the associated intermound depression. This study would determine the effect of grazing on prickly pear micromounds and whether these mounds may be effecting the spatial distribution of sediment.

Symposium: Poster Session
Using landscape metrics to examine and quantify streamflow disturbances

Richard Koehler, NOAA - NWS

Abstract: Annual, seasonal, and daily discharge patterns determine many of the physical and biological properties of a stream. Natural short- and long-term variations of streamflow are part of the normal processes of a river or stream whereas artificial short- and long-term fluctuations can disrupt the natural processes of a river. It is critical to recognize and identify such artificial fluctuations and disturbances to have a more complete understanding of river systems. Using a raster-based approach allows the visualization and quantification of streamflow characteristics and disturbances through the use of patch analysis and pattern-quantification techniques. This technique permits new insights into hydrologic properties and aquatic ecosystems. The USGS river gauging station for the Colorado River at Lees Ferry, Arizona was used as a demonstration study site. By reformatting time-series data into a dual timescale grid, gradients, disturbances, streamflow patterns and additional attributes can be quantified by using FRAGSTATS to determine metrics for patch, class, and landscape properties of a river's hydrology. Results from the Lees Ferry gauging station for the pre- and post-Glen Canyon Dam period clearly show the effects of reservoir management and power production on streamflow patterns. Landscape metrics allow the quantification of the size, shape and distribution of streamflow patches. Such metrics are not usually obtained with traditional hydrologic analysis methods. The raster-based analysis and visualization approach provides additional tools to scientists studying aquatic ecology and the physical hydrologic environment. The technique has numerous applications and research directions. By identifying new streamflow characteristics, the ability to analyze, enhance, and reproduce flow conditions is increased. This approach also allows hydrologic properties to be put into landscape ecology terms.

Topic Area: Theory & quantitative methods

Symposium: Oral session

Time: Tuesday, 11:20-11:40, Boojum
Using movement behaviors to predict connectivity for rare animals

Daniel Kuefler, North Carolina State University
Nick Haddad

Abstract: Habitat fragmentation and land development on and around military installations provide challenges for the conservation of threatened and endangered species found on those lands. By identifying those land parcels adjacent to installations that best maintain habitat connectivity for multiple species, DoD land managers can mitigate negative impacts on populations while maximizing the utility of money spent on land acquisition. To assist in this regard, we initiated a study at Ft. Bragg, NC, in the spring of 2006. The propose of our study is to develop methods that integrate landscape and animal behavioral approaches to identify lands on and around DoD instillations that provide high connectivity value for multiple species of management concern. Through behavioral observations and experimental releases of marked butterflies, we compared animal movement at habitat boundaries and within four different habitat types that are commonly found across the base. With the resultant movement choices and spatial movement patterns we illustrate how different habitat types affect animal movement.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 3:40-4:00, Salon E
Inga P. La Puma, Rutgers University
and Richard G. Lathrop

Abstract: The Highlands region of northern New Jersey is composed of temperate deciduous and mixed coniferous forest. This area has experienced high development pressure and an accelerating rate of forest conversion to urban land uses. The purpose of our ongoing project in the Highlands is to estimate the loss of forest biomass associated with urban land use conversion. The objective of this portion of the study was to examine the efficacy of kNN techniques using satellite remote sensing and a ground-based forest inventory for estimating forest biomass at a single point in time. 150 forest inventory points were sampled during the 2003 growing season and biomass calculated via diameter-based regressions for North American tree species. We acquired Landsat5 Thematic Mapper images from August 25th, 2003 and September 10th, 2003 of the Highlands area to correspond with sample collection dates. The kNN procedure was utilized via a C++ program available from Andrew Finley at the University of Minnesota (http://blue.fr.umn.edu/downloads.php), which uses a leave-one-out validation module to estimate root mean squared error (RMSE). Number of neighbors (k) and distance decomposition (d) functions were compared with differing baseline datasets from each date. Different datasets were based on varying cloud cover amounts in each image and tested for the best RMSE and k combination. Choosing the correct k, along with the appropriate distance function, was based on 1) selecting the lowest RMSE over a range of k and d combinations (RMSEmin), then 2) choosing the lowest k corresponding to an RMSE within an a priori percentage of RMSEmin (e.g. <.5 %). The most appropriate sample set included points from the September image, resulting in a sample size of n=150 with k=11, d=1 and a RMSE of 111.51 Mg/ha (99574.25 lbs/acre) representing +-54% of the observed sample mean. Post-processing with a 3x3 focal average resulted in an improved relationship of kNN estimated biomass with observed inventory values (R2=.22 to R2=.43). Applying the kNN model to a comparable image from 1995 showed that areas in the Highlands study area that were considered forest in 1995 and converted to either developed or transitional lands by 2001 showed a sum loss of approximately 214.74 Mg/ha (191,587.51 lbs/acre).

Topic Area: Landscape change: modeling & analysis

Symposium: Oral session

Time: Tuesday, 2:00-2:20, Salons F, G & H
Abstract: Forest resources constitute fundamental parts of our living environment as they provide a wide range of important benefits and services to society that go far beyond forest products. From a landscape ecological perspective, such resources can be approached as part of an overall forest landscape whose pattern interacts with ecological processes (e.g. energy flows, nutrient cycling, and flora/fauna dispersal) across dimensions of common time and space. Forest landscapes often consist of complex assemblages of forest and non-forest elements (patches, corridors, and matrix) whose arrangement reflects the magnitude, intensity, and type of human intervention and disturbance. This paper describes some of the cultural patterns inherent in selected forest landscapes of southern Italy and southern Ontario, Canada. It outlines how cultural determinants, such as land tenure systems and silviculture traditions, can affect the way forest landscapes are spatially arranged and the intrinsic heterogeneity associated with them. The results of the study are used to inform guidelines on: (1) how forest landscapes influence cultural values and traditions in Italy and Canada; and (2) how cultural values and traditions underlying human activities may affect the structural and functional attributes of forest and non-forest landscape elements.

Topic Area: Cultural landscapes II

Symposium: Oral session

Time: Friday, 8:40-9:00, Salons F, G & H
Estimating bird density as a function of environmental covariates in Panamanian dry forest fragments

Jesse R. Lasky, University of Texas at Austin
Timothy H. Keitt

Abstract: Different groups of organisms will likely have differential responses to environmental conditions, including those arising from anthropogenic disturbance. In this study we estimated bird density as a function of a variety of environmental factors. We estimated c. 20 individual species' densities. Additionally we combined species of individual guilds to estimate the density of guilds. Environmental covariates used to model density include vegetative, landscape, climate, and disturbance characteristics of sample sites within tropical dry forest fragments in Panama. Birds were distance-sampled from point counts in five fragments of forest ranging from 80 to 1200 ha. Local abundance at each point count was used to fit a Poisson regression model parameterized by the environmental covariates above. Density estimation models were then compared using AIC scores. Models that use environmental characteristics specific to each point count site were preferred over models that use characteristics specified only to the fragment level.

Topic Area: Species distributions: communities

Symposium: Oral session

Time: Thursday, 1:00-1:20, Salons F, G & H
Integrating landscape change and ecosystem modeling of the wildland/urban interface of the New Jersey Pinelands

Richard Lathrop, Rutgers University
Zewei Miao, Ming Xu and Inga LaPuma

Abstract: Wildland fire has an important influence on vegetation composition and structure of the New Jersey Pinelands. Depending on the local fire history, the Pinelands forests are dominated by pitch pine (Pinus rigida) grading into a mixture of oak species in the uplands and swamp hardwoods and white cedar in the lowlands. Suburban/exurban development has created a complex wildland/urban interface (WUI). As part of the U.S. Forest Service LANDFIRE program, we have been investigating the influence of changing vegetation composition on energy, water, and carbon balances. The effects of historical land-use change are being examined using remotely sensed land cover data from 1972-2001. The LANDIS model is being used to estimate future vegetation composition (50 years hence) under a continuation of the existing fire regime and under altered fire regimes due to the potential impact of the WUI. These past and future vegetation cover maps (i.e., LANDIS outputs) have served as input to the WxBGC ecosystem model in a loosely coupled fashion. Initial results suggest that a shift of pine to oak domination will lead to a decrease in total carbon storage but that conclusion is highly qualified due to our present uncertainty in site-specific carbon allocation parameterization.

Topic Area: NASA-MSU Golley-Odum Symposium: Integrating remote sensing of forest disturbances with models at broad scales

Symposium: Oral session

Time: Tuesday, 10:20-10:40, Salon D
A landscape ecological perspective as the basis for land use planning in the New York - New Jersey Highlands

Richard Lathrop, Rutgers University

Abstract: The New York-New Jersey Highlands, a 1.5 million acre area of forested uplands, serve as a natural geographic boundary delimiting the northern edge of the New York City metropolitan region. A landscape ecological perspective has had a long history of informing land use planning and conservation in this region, starting with Benton Mackaye's vision for an Appalachian Trail back in the early 1900's. More recently, landscape ecological principles and techniques have been a critical component in the ongoing New Jersey Highlands regional master planning effort. The stated goals include the maintenance of forest and riparian zone integrity to sustain water availability (both quality and quantity) and connectivity to enhance wildlife habitat. While geospatial tools allowed for the sophisticated analysis of landscape pattern, the ability to integrate and implement the resulting information into the actual land use and development planning process has proved to be considerably more difficult. In this case, many of the difficulties stem from the inability of the scientists to precisely specify the ecological consequences of different levels of development and associated landscape change and the concomitant struggle of policy makers in choosing thresholds of acceptable ecological degradation.

Topic Area: Putting theory into practice: application of landscape ecology principles into environmental decision-making

Symposium: Oral session

Time: Tuesday, 11:00-11:20, Salon E
Predicting bird declines in Amazonian forest fragments

Susan Laurance, National Institute for Amazonian Research
Phillip Stouffer and Sergio Borges

Abstract: Predicting which species are most susceptible to decline in fragmented landscapes is crucial to their long-term conservation. At the Biological Dynamics of Forest Fragments Project, one of the world’s longest-running fragmentation experiments, we examined how six species traits--commonly associated with bird declines--predicted the response of 47 understory bird species to fragmentation. From integrating three independent studies which encompass > 70 000 net hours and ca. 8 800 bird captures, we examined the effects of fragmentation in two ways, first, we identified which set of traits best explained bird abundances three years after fragmentation. Second, using the same six traits we tested the magnitude of the fragmentation response (a ratio of post/pre-fragmentation abundance) for 47 species for the same time period. We found that: (1) foraging guild, natural abundance, and response to forest edges explained more than 60% of the variation in bird abundances three years after fragmentation; (2) other traits such as matrix use, body size and gap crossing ability did not significantly predict fragmentation abundance for the same time period. Our results suggest that rare and/or highly specialized rainforest species that avoid edges are at risk of decline and extinction in fragmented landscapes.

Topic Area: Spatial analysis: theory & methods

Symposium: Oral session

Time: Thursday, 11:20-11:40, Boojum
The role of assumptions in predictions of habitat availability and quality

Edward Laurent, North Carolina State University

Abstract: The utility of any habitat prediction is limited by the assumptions used when modeling a system's components. The failure to state assumptions or the use of improbable assumptions can result in descriptive models that fit the data well but do not adequately describe the system's mechanisms. Such a situation could be detrimental, especially when models are extended to predict species' responses to management strategies. However, knowingly declaring improper assumptions may be helpful if there is also an established framework for testing the validity of assumptions and adjusting model properties accordingly. This approach is common when management decisions must be quickly made on behalf of poorly studied species. I review some common assumptions of habitat availability and quality predictions. In particular, I focus on the assumption that densities of forest bird species are useful indications of habitat quality as defined by vital population rates leading to fledgling success. This broad assumption was tested through a meta-analysis using a new tool developed through the Southeast Gap Analysis Project. The tool uses a tabular format to organize research summaries along with the metadata for study areas. I briefly describe the tool and offer additional approaches for using it to test common assumptions related to species-habitat associations.

Topic Area: Spatial analysis: theory & methods

Symposium: Oral session

Time: Tuesday, 2:00-2:20, Salon D
Projected climate-induced changes in the fauna of U.S. national parks

Joshua J. Lawler, Oregon State University
Sarah L. Shafer, Denis White, Patrick Bartlein and Peter Kareiva

Abstract: Changes in the Earth's climate are predicted to result in shifts in the geographic ranges of many plants and animals. We asked how future climate-induced shifts in species distributions will likely affect ten of the most visited national parks in the United States. We used bioclimatic models to predicted potential climate-induced geographic range shifts for 2,954 species of birds, mammals, and amphibians in the western hemisphere. We built the models with data on current species ranges and a set of 39 bioclimatic variables representing average climatic conditions from 1961-1990. We predicted potential future ranges for 30 different climate-change projections for 2070-2098 based on the output of 10 different general circulation models run for 3 different CO2-emissions scenarios. We then summarized the changes in faunal composition projected for each of the 10 parks based on the 30 climate-change scenarios. Of the parks we analyzed, Yosemite National Park was projected to experience the largest changes in fauna. Eighty percent of the climate-change projections resulted in at least 16% loss of the animals currently in the park. We discuss the implications of these results for park managers and for conservation planning in general.

Topic Area: Species distributions: methods

Symposium: Oral session

Time: Tuesday, 11:20-11:40, Salons F, G & H
Houses as a driver of landscape change

Christopher Lepczyk, University of Wisconsin - Madison

Abstract: Understanding the drivers of landscape change and how to consistently measure them over time are two fundamental challenges facing landscape ecology. While numerous drivers are known, one primary driver of landscape change that can now be measured consistently and accurately over time is housing growth. Housing growth is an easy, inexpensive, and powerful approach to measuring landscape change. Specifically, housing data: 1) do not have the variability in quality and uncertainty often found in remotely sensed data, 2) are reported by political units (e.g., counties) which allow for them to be coupled to socioeconomic data, 3) provide one measure of social influence that is fixed in space (as opposed to people), and, 4) encompasses a suite of associated commercial, industrial, and infrastructural developments that impact the landscape but are less easy to measure. To illustrate the importance of houses and how they can be used as a driver for landscape change we draw upon recent research from a spatiotemporally consistent database of houses from 1940-2030 for the conterminous United States. Specifically, our research demonstrates that housing growth can be used (1) as a driver of habitat change for wildlife in forested landscapes, (2) to estimate hotspots of landscape change, and (3) to estimate ecological impacts across a diversity of landscapes.

Topic Area: NASA-MSU Golley-Odum Symposium: Drivers and implications of land use and landcover change

Symposium: Oral session

Time: Thursday, 10:20-10:40, Salon D
On the importance of dimensionality of space in models of space-mediated population persistence

Bai-Lian Li, University of California, Riverside
Andrew Morozov

Abstract: Spatially explicit models have become widely used in today’s mathematical ecology to study persistence of populations. For the sake of simplicity, population dynamics are often analyzed with 1-D models. An important question is: how adequate such 1-D simplification of 2-D (or 3-D) dynamics is for predicting species persistence. Here we show that dimensionality of the environment can play a critical role in the persistence of predator-prey interactions. We consider 1-D and 2-D dynamics of a predator-prey model with the prey growth damped by the Allee effect. We show that adding a second space coordinate into the 1-D model results in a pronounced increase of size of the domain in the parametric space where predator-prey coexistence becomes possible. This result is due to possibility of formation of a number of 2-D patterns, which are impossible in the 1-D model. The 1-D and the 2-D models exhibit different qualitative responses to variation of system parameters. We show that in ecosystems having a narrow width (e.g. mountain valleys, vegetation patterns along canals in dry areas, etc), extinction of species is more probable compared to ecosystems having a pronounced second dimension. In particular, the width of a long narrow natural reserve should be large enough to guarantee the species survival via formation of 2-D patches.

Topic Area: Theory & quantitative methods

Symposium: Oral session

Time: Tuesday, 10:40-11:00, Boojum
Neural network based commitment and typicality measures in landscape uncertainty analysis

Zhe Li, Clark University

Abstract: Soft classification in remote sensing is used not only for the potential of uncovering the proportional constituents of mixed pixels but also for examination of landscape uncertainty. This paper proposes non-parametric commitment and typicality measures for both the Self-Organizing Map and fuzzy ARTMAP neural network: SOM Commitment (SOM-C), SOM Typicality (SOM-T), ART Commitment (ART-C) and ART Typicality (ART-T). The first case expresses the degree of commitment the classifier has for each land cover class for a specific pixel, and the second case how typical that pixel's reflectances are of the ones upon which the classifier was trained for each class. To evaluate the four proposed approaches, soft classifications of a SPOT HRV image around Westborough, Massachusetts were undertaken. Twelve land use/cover classes were included in the training sites. Conventional Bayesian posterior probability and Mahalanobis typicality soft classifiers were also used as a comparison. Principal Components Analysis was employed to explore the relationship between these different measures. Results indicate that great similarities exist between the SOM-C, ART-C, and the Bayesian posterior probability classifier, and moderate similarities between the SOM-T, ART-T, and the Mahalanobis typicality classifier. ART measures distinguish themselves from the other four by their special features.

Topic Area: Theory & quantitative methods

Symposium: Oral session

Time: Tuesday, 10:00-10:20, Boojum
Self-Organizing Map and Fuzzy ARTMAP neural network based species habitat distribution modeling

Zhe Li, Clark University

Abstract: Modeling spatial distribution of species is of considerable importance in conservation biology. The ability to predict species distribution typicality on existing occurrence records may allow scientists to predict the presence or absence of species in unsampled area. Traditional statistical techniques are widely used when both detailed presence and absence data are available. For most species, however, absence data are not available. The Self-Organizing (SOM) and Fuzzy ARTMAP are two different neural network models but have some characteristics in common. In this paper, two non-parametric typicality measures based upon these two neural network models, i.e., SOM-Typicality and ART-Typicality, are proposed for modeling species geographic distributions with presence-only data. Both the two measures express how typical pixel's reflectances are of the ones upon which the model was trained for each class. To evaluate their performance, a comparative study was undertaken using a montane murine rodent, Micryzomys minutus in South America. A result from commonly used presence-only modeling methods, i.e., Mahalanobis distance classifier was compared with the proposed measurers. Results indicate that the distributions predicted by the SOM-Typicality and ART-Typicality show similarities with each other and both the two measures provided reasonable estimates of species' typicality.

Symposium: Poster Session
Incorporating human interaction variables in a non-parametric decision support system to predict gypsy moth outbreak

Christopher D. Lippitt, San Diego State University
John Rogan, James Toledano, Florencia Sangermano, J. Ronald Eastman, Victor Mastro and Alan Sawyer

Abstract: This research presents a novel methodology for multi-scale spatial data integration in support of pest risk/vulnerability assessment in the United States. Over the last century, invasive species have caused an estimated 97 billion dollars in damage to United States resources. The Gypsy Moth alone costs United States taxpayers an estimated 22+ million dollars per year in damage and mitigation. This research models potential gypsy moth introduction and establishment in uninfested counties of the contiguous United States in order to: (1) improve upon previously developed invasive species infestation risk schemes through the incorporation of socioeconomic factors and (2) assess the capability of an automated artificial neural network to perform accurate predictive modeling in comparison to commonly used techniques (i.e., multi-criteria evaluation and logistic regression). Of the three models assessed, multilayer perceptron provided the most accurate forecast predictions based on validation using 2001-2004 presence/absence data, producing a Relative Operating Characteristic statistic of 0.93, followed by multi-criteria evaluation (0.92) and logistic regression (0.86). Integration of human interaction and biophysical variables allowed production of accurate models that provide insight into the impact of human activities on invasive species propagation. Results suggest that for invasive species for which such an extensive research base is unavailable (e.g., emerald ash borer and Asian long-horned beetle), multi-layer perceptron provides a sound method for the prediction of risk and can provide insight into factors contributing to introduction.

Topic Area: Species distributions: invasives

Symposium: Oral session

Time: Tuesday, 4:20-4:40, Salons F, G & H
Ecological impacts of the Grain-to-Green Program in Wolong Nature Reserve for Giant Pandas (China)

Wei Liu, Michigan State University
Olympia Moy, Xiaodong Chen, Clinton Jenkins, Scott Bearer, Shiqiang Zhou, Jinyan Huang, Hemin Zhang, Zhiyun Ouyang and Jianguo Liu

Abstract: Severe exploitation of China's forests in China has caused catastrophic ecological and economical damages. To recover the degraded forests, the Chinese government has launched several conservation programs, including the “Grain-to-Green” returns of cropland to forested land. This program is believed to benefit wildlife habitat restoration in areas like Wolong Nature Reserve for Giant Pandas in Sichuan Province, China. Since its implementation in Wolong in 2000, about 480 hectares of cropland has been converted to forested land through tree planting. To assess the conditions of the planted trees, we sampled 300 replanted GTG parcels in the reserve in 2003, 2004, and 2006. We also mapped all the GTG parcels inside Wolong with a global positioning system to characterize the spatial patterns of the converted land. Results suggest that the GTG program may have a limited contribution to panda habitat restoration in Wolong due to the monoculture characteristics of the reforestation and the proximity of GTG parcels to human settlements. However, the reforested areas have the potential to supply more than 30% of the total fuelwood needs of local people in the future, which can significantly mitigate the current pressure on the existing panda habitat due to fuelwood collection.

Topic Area: Conservation planning:restoration

Symposium: Oral session

Time: Friday, 9:20-9:40, Boojum
Focused assessment of scale-dependent vegetation pattern

Todd Lookingbill, University of Maryland Center for Environmental Science
Monique Rocca

Abstract: In many situations, ecological processes occur at multiple spatial scales simultaneously, which presents a challenge to modelers projecting species distributions across large geographic extents. These models typically rely upon data from homogeneous plot samples, deliberately avoiding sampling locations of transition and environmental heterogeneity. Locations of fine-scale spatial heterogeneity, however, can be extremely informative of broader-scale vegetation patterns. We provide two example applications where spatially-dependent processes mandate a multi-scale investigation of pattern. In the first, we explore mechanisms of change at a forest community ecotone. We apply a focused spatial sampling scheme that uses coarse-scale information on indirect environmental proxy variables to identify locations on the landscape for directed field sampling of fine-scale ecological relationships. In the second example, we examine the effects of fire on vegetation pattern using a multi-scale sampling protocol followed by wavelet analysis. The value of our intensive focus plots can be best leveraged by statistical techniques such as wavelet analysis that (a) account for spatial autocorrelation in the data, (b) capture patterns across spatial scales, and (c) explore relationships between variables at each spatial scale. By embracing spatial heterogeneity in both the sample design and analysis methods, the two studies incorporate novel sources of variability into species distribution models.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)

Symposium: Oral session

Time: Tuesday, 2:40-3:00, Salon D
Abstract: Like many cities in the Southwest, Tucson, Arizona, was developed on a geometric grid system, with streets aligned with a preset north-south/east-west alignment that paid little heed to the area’s natural features and topography. Through necessity, many of the city’s watercourses were maintained with stormwater control as the primary objective. With continued urban growth, these spaces now present unique opportunities to reclaim natural corridors within the city for recreational use and as habitat support for urban wildlife. This study examined how secondary watercourses could be combined with other greenway features such as primary watercourses, parks, established greenways, and proposed future greenways to create a regional greenway system that connects desirable destinations throughout the city. Maps were created with the secondary watercourses and additional greenway features and destinations, including locations of parks, schools, commercial centers, and civic areas. Using GIS, these maps were analyzed for distances between appropriate destinations, proximity to residential land uses, and locations of appropriate access points. Discussion of results will focus on a proposed master greenway system for secondary and primary watercourses in Tucson, including location of additional amenities, linkages, and access points that will enhance the recreational value of the system.
An ecological framework for fuzzy set accuracy assessment of remote sensing-based land-cover maps

John H. Lowry, Jr., Utah State University
R. Douglas Ramsey and Lisa Langs Stoner

Abstract: The goal of many remote sensing-based land cover mapping projects is to map complex landscape features with high thematic resolution. Complex classification schemes often contain land cover descriptions that do not have clearly defined spectral or ecological breakpoints. Recognizing gradations in land-cover classes may more accurately portray reality, but it also complicates quantitative assessments of map quality based on classical set theory and the traditional error matrix approach. Using fuzzy sets for accuracy assessment provides an effective means to address this problem by recognizing varying levels of set membership for multiple map classes. Fuzzy set assessments also provide metrics for map quality assessment beyond those provided by the traditional error matrix. These metrics include assessments of the frequency, distribution, magnitude, and source of map errors. We approach fuzzy set map accuracy assessment using a systematic framework based on ecological criteria. A primary goal of our method is to incorporate greater objectivity in the error evaluation process, thus allowing multiple map experts to conduct fuzzy set accuracy assessments for multiple maps in a standardized fashion.

Topic Area: Remote sensing I

Symposium: Oral session

Time: Tuesday, 10:20-10:40, Bonsai
Spatial gradients reveal universality classes in the relation between drainage networks and climate

Matthew Luck, University of New Mexico
Bruce Milne

Abstract: At fine scales, climatic inputs of radiation and precipitation are modulated by local topography, including slope, aspect, elevation, and relief, thus climate is correlated with the landscape. In contrast, at coarse regional scales, radiation is controlled by latitudinal differences in incoming energy, while precipitation is affected by interactions among surface properties, global circulation patterns, and positions of continental land masses, which cause climate to be uncorrelated with the landscape. We hypothesize that the crossover from influence by fine to coarse scale is determined by competition between topographic and latitudinal gradients; where the topographic gradient dominates the regional gradient, we expect the distributions of climatic factors to be significantly correlated with the structure of drainage networks. Ratios of the two gradients quantify the relative dominance of scale on basins and reveal that gradients can separate basins into universality classes.

Topic Area: Spatial analysis: theory & methods

Symposium: Oral session

Time: Thursday, 10:40-11:00, Boojum
Redband trout (Oncorhynchus mykiss gairdneri) distribution and longitudinal temperature profiles: Implications across a basin

Luis F. Madrinan, Oregon State University
Seth White, Hiram Li and Guillermo Giannico

Abstract: Coldwater and warm water fishes and the organisms on which they feed respond to thermal heterogeneity and require specific ranges of temperature to survive and reproduce. To understand expressions of habitat heterogeneity in stream systems it is necessary to increase research efforts to understand how multi-scale patterns of stream temperature and habitat quality affect fish community distribution. Our objective was to classify habitat quality for Redband trout (Oncorhynchus mykiss gairdneri) in the south fork of the John Day River (SFJD), Oregon, using a multidisciplinary approach that includes landscape ecology analysis, fish community distribution and abundance, and physiological responses to temperature. Differences in landscape and land use attributes showed that continuous sampling is more useful than site-specific sampling for detecting limiting factors and cumulative effects. We found three principal "hotspots" that are principally associated with water temperature and stream order. Reach analysis (1 to 5 km) was the most appropriate scale to study redband trout distribution patterns in the SFJD. We found that among reaches trout distribution is delimited first by physiological tolerance to temperature and secondly by competition with warm-water fishes.

Topic Area: Species distributions: populations

Symposium: Oral session

Time: Thursday, 11:00-11:20, Salons F, G & H
Assessing forest cover change on Mt. Kenya using multitemporal Landsat data

John K. Maingi, Miami University
Lucy W. Ndegwa

Abstract: Recently, there have been many reports in the Kenyan media of massive destruction of Mt. Kenya Forests. Destructive activities in the forests include illegal logging for timber and charcoal production, forest encroachment for cultivation of marijuana and other crops, forest fires, and livestock grazing. Aerial surveys and visual interpretation of Landsat TM data undertaken between 1999 and 2002 confirmed this trend of continuing deforestation. We use Landsat MSS, TM, and ETM+ data acquired in 1976, 1987, 2000, and 2002 to produce forest maps and quantify change using several change detection techniques. Several landscape metrics were calculated for each map in an attempt to describe changing landscape patterns. Among the change detection techniques used, multitemporal PCA resulted in the highest accuracy (86.9%). Change detection techniques based on vegetation indices including NDVI, SARVI2, KT Greenness, and KT Wetness appeared to capture differences in forest vigor rather than actual biomass changes.

Topic Area: Landscape change: modeling & analysis

Symposium: Oral session

Time: Tuesday, 2:40-3:00, Salons F, G & H
Soil moisture as the determinant of spatial heterogeneity in savanna landscapes: A view across space and time

Tony Rajan Mathew, University of Nottingham

Abstract: Heterogeneity at multiple spatial and temporal scales is a defining savanna characteristic and soil moisture is a key determinant. Field studies, being limited in space and time, cannot adequately explain the processes that are in operation and their interrelationships across hierarchic levels. Closer understanding of the nature of change requires information to be obtained at wider spatio-temporal scales. A multi-scale remote sensing approach is proposed to monitor vegetation dynamics in Kruger National Park (KNP), South Africa, for the time period 1984 to 2002. Landsat images were analysed, involving the use of soil-adjusted vegetation index (SAVI), principal components, and tasselled cap transformations. Spatial heterogeneity was derived from SAVI images using texture measures of variance, skewness, and kurtosis. The hierarchy inherent in natural systems was accounted for by the use of different kernels for the derivation of texture: 3*3 at the micro level, 31*31 at the patch or local level and 61*61 at the landscape level. Information on soil moisture was derived by computing Tasseled Cap Wetness (TCW) and Normalised Difference Water Index (NDWI), which in turn were related with spatial heterogeneity. Results indicate a strong association at the patch scale, but lesser at the micro and the landscape scales.

Topic Area: Remote sensing II

Symposium: Oral session

Time: Tuesday, 2:00-2:20, Bonsai
Landscape approach for forest management in India: a panacea or passion

Pradeep Mathur, Wildlife Institute of India

Abstract: India harbours a variety of ecosystems and associated threatened wildlife. Wildlife protected areas (PAs) amidst human dominated landscapes pose management challenges for wildlife and local communities. Much of the charismatic wildlife (e.g. elephant, lion, tiger, and leopard) exists outside PAs in adjacent managed forests or human-dominated matrix. A landscape approach to planning and management of wildlife resources is being validated. Recent initiatives illustrate that the landscape approach is vital to conservation. This paper highlights some pilot studies across the country. Conservation of the last surviving population of Asiatic lion (Panthera leo persica) in Gir forests seems to be possible by adopting a regional planning approach and management of meta populations. Likewise, the viable populations of prominent endangered vertebrates and representative plant diversity of Terai ecosystem can be ensured in a larger landscape designated as the Terai Conservation Area (TCA). Our study in the Great Himalayan National Park Conservation Area also demonstrated that the traditional practice of transhumance along side conservation of biodiversity is possible only by managing a larger landscape incorporating PAs, MFs, and other lands in the matrix. We also share the experience gained so far and emerging challenges in the adoption and implementation of a landscape approach.

Topic Area: Managed landscapes

Symposium: Oral session

Time: Friday, 8:40-9:00, Salon E
Testing the sensitivity of a rank-based threat assessment index applied to the upper Tennessee River basin, USA

Kimberly M. Mattson, Virginia Tech
Paul L. Angermeier and Emmanuel A. Frimpong

Abstract: Ranking protocols based on multiple risk measures are commonly applied in freshwater conservation planning to compare degrees of human impact. There is currently no consensus on how best to design such protocols or their use in predicting future environmental conditions. Their structural arbitrariness has been scrutinized in the landscape ecology literature, and opinions regarding their utility vary widely. We assessed the sensitivity of a new ecological risk index (ERI), which ranks land/water uses (i.e. threats) by their expected impacts on flow regime, water quality, production pathways, physical habitat structure, and species interactions. We mapped 107 watersheds as incurring low, moderate, or high risk to freshwater biodiversity as a basis for regional conservation planning. We used multivariate analyses to address two objectives: 1) determine if the ERI is sensitive to the choice of threat-frequency categories and 2) verify decision rules for assigning watersheds to risk groups. Cross-tabulation of the risk rankings showed that 38% of the watersheds shifted risk groups when threat-frequency categories were defined by expert opinion versus percentiles. Use of threat-frequency categories based on expert opinion led to ERI scores that were less discriminating. We encourage further validation of risk-ranking tools to enhance their robustness and utility in informing conservation planning.

Topic Area: Conservation planning: analysis

Symposium: Oral session

Time: Thursday, 2:00-2:20, Boojum
**Fire effects on vegetation recovery in the Santa Catalina Mountains**

**Sarah Mattson**, University of Arizona  
**Willem van Leeuwen and Stephen R. Yool**

**Abstract:** Major wildfires (Bullock and Aspen fires in 2002 and 2003 respectively) in the Santa Catalina Mountains north of Tucson, Arizona, affected large tracts of natural vegetation types, including mixed ponderosa pine and fir, mixed oak-conifer, oak-shrub forest and Juniper. These fires killed many trees and burned numerous structures. Estimated severity of these wildfires ranged from low to high based on assessments from the U.S. Forest Service Burned Area Emergency Response (BAER) team. We used data from NASA’s Moderate Resolution Imaging Spectroradiometer (MODIS) to examine the temporal and spatial patterns of pre-wildfire vegetation growth and post-wildfire regeneration. We investigated relationships between BAER fire severity and Normalized Burn Ratio (NBR) fire severity assessments derived from Landsat. The study takes into account such factors as elevation, slope, aspect and post-wildfire treatments. Pre- and post-fire multiyear (2000 through 2006) seasonal greenness signatures and phenological metrics derived from 250m MODIS-NDVI (Normalized Difference Vegetation Index) data are used to assess vegetation recovery for different levels of fire severity. All fire-affected areas are expected to recover from the fires, but might transition to other vegetation cover types.

**Topic Area:** Burn Severity Mapping: Research & Applications  
**Symposium:** Oral session  
**Time:** Thursday, 2:00-2:20, Salon D
Tucson's lost wetland plant species: where are they now?

Kathryn Mauz, University of Arizona

Abstract: By some estimates, up to 90% of riparian vegetation in the deserts of the U.S. southwest has been transformed in the last two centuries by factors including erosion, land use, hydrological manipulation, and species invasions. The river valleys of the Tucson Basin, southern Arizona, historically (1855-1920) supported vibrant riparian ecosystems, including nearly 400 plant species - one-third of which are species allied with wetlands. Nearing the twentieth century, channel entrenchment began a cycle in the Tucson Basin that, combined with hydrological manipulation and urban growth, destroyed these communities and caused local species extirpation. These losses have consequences for regional biogeography and conservation of remaining populations elsewhere. I have examined regional distributions of Tucson's historic wetland-affiliated plant species using herbarium collections from Arizona in a 10-km x 10-km gridded framework. The historic wetland species have been documented in 18% of the grid cells within Arizona (in 1 to 117 cells each), primarily in central and southeastern Arizona, at elevations often significantly higher than Tucson's formerly rich bottomlands. While statewide collections are substantial, their temporal and spatial limitations have indicated a clear analytical need for more systematic, and current, vouchering of wetland plant species in the state and neighboring regions.

Symposium: Poster Session
The effects of land development across a forest composition gradient on Cape Cod, Massachusetts

Stephen McCauley, Clark University

Abstract: This study evaluates the actual distribution of the pine barrens forest community on Cape Cod, Massachusetts relative to its potential distribution as explained by environmental site variables. The pine barrens is a rare community type characterized by pitch pine (Pinus rigida) and scrub oak (Quercus ilicifolia) and adapted to dry well drained soils. A spatially explicit predictive vegetation model was developed to represent the potential distribution of the community across an environmental gradient defined by soil type, precipitation, and terrain variables. The community is threatened by fragmentation and conversion related to the major landscape disturbance in the region, land development. Analysis of Landsat TM and ETM imagery is used to characterize the spatial pattern of land development from the early 1970s to 2000 and to identify land covers that endanger the pine barrens through degradation and competitive exclusion. The study contributes to the development of landscape modeling approaches for habitat conservation in complex human-dominated landscapes.

Topic Area: Species distributions: communities

Symposium: Oral session

Time: Thursday, 2:20-2:40, Salons F, G & H
The Upper Santa Cruz River: A case study for shifting riparian conditions

Amy McCoy, University of Arizona

Abstract: Riparian systems provide invaluable and productive habitat for myriad species and important biophysical services to human populations. The Santa Cruz River riparian corridor is the only river to cross the U.S./Mexico international border twice and is integral to the local and regional ecology, culture, and economy of the Upper Santa Cruz River Valley in the State of Sonora, Mexico and the State of Arizona. Riparian systems are changing at unprecedented rates, however, and there are many contributing factors that commonly impact riparian ecosystems including climate, lowered groundwater tables, and water quality. A recent and sudden vegetation die-off in the Upper Santa Cruz River riparian corridor signals a radical change in ecological conditions in this watershed, and thus provides a timely laboratory in which to study vegetation responses to common agents of change. Die-off conditions were first documented in 2005 and research commenced in early 2006 to analyze streamflow and groundwater conditions and vegetation growth patterns using dendrochronological, remote sensing, and other data analysis techniques. This presentation will outline the research plan of study, current analysis, and expected outcomes.

Topic Area: Landscape change: modeling & analysis

Symposium: Oral session

Time: Tuesday, 2:20-2:40, Salons F, G & H
Multi-scale modeling with spatially explicit fire-scar records in the Pacific Northwest, USA

Don McKenzie, USDA Forest Service, Pacific Wildland Fire Sciences Lab
Amy E. Hessl and Lara-Karena Kellogg

Abstract: The uses of historical fire-scar records depend on the scale and intensity of sampling. The fire history database from eastern Washington State, USA, comprises over 20,000 fire scars from over 2000 trees in 7 watersheds, along a 300-km southwest-to-northeast gradient. Each recorder tree was georeferenced, yielding one of the world's largest spatially explicit records of low-severity fire. The sampling extent and intensity were sufficient to enable standard fire-climate analyses, but the spatial information provided a unique opportunity to identify both fire patterns at multiple spatial scales and the relative influences of climate, topography, and fuels on fire frequency and fire size. We illustrate this with scaling laws in fire frequency and geospatial structures of fire occurrence, using a neutral landscape model of fire history and geostatistical analysis of fire size distributions. Given the effort required to acquire such a massive database, researchers should consider the tradeoff between intensive spatially explicit data collection at discrete locations (watersheds) vs. a more extensive approach designed to capture biophysical gradients. The former enables fine- and mid-scale analyses such as ours, whereas the other might be preferred for regional-scale trend analysis or modeling coarse-scale drivers such as climate.

Topic Area: Recent advances and future innovations in multiscale systematic tree-ring reconstruction of historical fire regimes

Symposium: Oral session

Time: Tuesday, 2:20-2:40, Salon E
Picture Michigan tomorrow: Socioeconomic trends and their impacts on land use and land cover change

Charles McKeown, Michigan State University
Soji Adelaja and Laila Racevskis

Abstract: Many agent-based, simulation and empirical models have been developed across a variety of disciplines to predict the drivers and consequences of land use change. Drivers of land use change identified in the literature are remarkably consistent across disciplines, suggesting that there is an opportunity to create a truly integrated modeling framework that combines economic, spatial and agent-based approaches. This research reports the development of a set of variables hypothesized to drive land use change for Michigan’s 1,800 municipalities. Preliminary results of a system of land demand models that predict demand for residential, industrial, commercial and agricultural land use classes will be reported. Initial data development and econometric specification and estimation of the land demand model form the basis for a modeling framework that bridges the gap between the economics of land demand, the spatial factors that affect land use change and the behavior of agents across the landscape. This integrated framework will be used to predict future land demand and estimate future land use change scenarios for Michigan.

Topic Area: NASA-MSU Golley-Odum Symposium: Drivers and implications of land use and landcover change

Symposium: Oral session

Time: Thursday, 10:40-11:00, Salon D
Predicting connectivity using circuit analysis: theory, algorithms, and applications in population genetics and conservation planning

Brad McRae, NCEAS

Abstract: Models from electronic circuit theory have broad applicability to analyses of ecological connectivity in complex landscapes. The models represent raster landscapes as grids of nodes connected by resistors, with resistance levels corresponding to movement probabilities or costs in different habitat types. Resistance, current, and voltage calculated across the grids can then be related to ecological processes, like individual movement and gene flow, across landscapes. Because the models are based in connections between circuit theory and random walks, they may be more theoretically justified than other analytic connectivity models. I'll review basic circuit theory, discuss relationships between circuit and random walk theories, and describe efficient algorithms that can accommodate millions of raster cells. I'll provide examples of how circuit models can be used to predict animal movement patterns, account for habitat heterogeneity in population genetic studies, and identify important habitat patches and movement corridors for conservation planning.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 11:00-11:20, Salon E
Impacts of woodland expansion on the emerging forest disease Sudden Oak Death

Ross K. Meentemeyer, University of North Carolina  
Brian L. Anacker, Nathan E. Rank and J. Hall Cushman

Abstract: We examine effects of human-related land-cover change on the spread of the infectious forest disease Sudden Oak Death. We hypothesize that oak woodlands in coastal California have increased in density and expanded over the last century due to fire suppression, leading to increased contagion of host vegetation and cooler microclimate facilitating disease establishment. To examine this, we established 102 randomly located field plots across an infected region in northern California. Within a 150 m radius area around each plot, we mapped fine-scale changes in land cover based on 1942 and 2000 aerial photos. We found significant changes, including a 25% increase in woodland area, and 34% and 51% decreases in grassland and chaparral. Mean size of woodland patches increased by 50% while the number of woodland patches decreased by 41%. To examine if landscape changes were associated with disease severity, we sampled host species for symptoms of infection and measured the abundance of woody species within each plot. Plots that experienced woodland expansion had a higher density of inoculum-producing hosts and a higher number of infected individuals. Forest microclimate was significantly cooler in the higher density forests. These results suggest that landscape changes in forest habitat have facilitated disease establishment through increased connectivity of hosts and more suitable forest microclimate conditions.

Topic Area: Spatial analysis: applications  
Symposium: Oral session  
Time: Thursday, 4:00-4:20, Salons F, G & H
Simulation of some consequences of variability in fire interval distributions for landscape composition and structure

Carol Miller, USDA Forest Service, Rocky Mountain Research Station

Abstract: The strategy of allowing natural fires to burn is rapidly gaining momentum in the fire management community and managers need to know the consequences of an increase in area burned by fire. How much fire is enough and how much is too much for meeting land management objectives? These questions were explored for a 43,563 ha landscape in Idaho that typically experiences mixed-severity or stand-replacing fires and has seen a dramatic increase in fire activity during the past 20 years. One concern of land managers is whether the large tree component of the forest can be maintained with these increases in fire disturbance. The landscape simulation model TELSA was used to evaluate the degree to which wildland fire use strategies might affect landscape composition and structure. TELSA is a spatially explicit model that uses state-and-transition rule sets to describe vegetation succession and disturbance dynamics and to simulate changes in vegetation over time. Information about frequency, annual area burned, and size class distributions of fires were derived from a 20th century fire atlas for the northern Rockies and used to define the fire regime parameters for a baseline simulation. In subsequent simulations, model assumptions were varied to adjust both the mean and variance of annual area burned and model output was compared to the baseline. Results suggest that variability in fire intervals and year-to-year variability in area burned have potentially important effects on metrics of landscape structure and texture. Results also suggest that the large tree component of the landscape can be maintained even if dramatic increases in area burned continue.

Topic Area: Fire & landscape pattern

Symposium: Oral session

Time: Tuesday, 4:40-5:00, Salon E
Tree Ringlets: Time- and space-dependent tree growth in Strahler stream networks

Bruce T. Milne, University of New Mexico

Abstract: Fluxes of water and energy are highly interrelated within complex drainage networks. Basin-wide total evapotranspiration, TET, involves exchanges between atmosphere, stream channels, and soil water. Trees 'compete' for precipitation: (a) directly with overland flow and soil evaporation and (b) indirectly with evaporation from channel surfaces and flow out of the basin. TET varies systematically in the Horton-Strahler branching hierarchy of stream networks. From long-term water balance of precipitation and flow, basin-wide TET was estimated for the 1050 km² Whitewater basin, Kansas. A new dendrochronological technique called 'tree ringlets' was used to measure riparian TET on Strahler streams integrated at time scales of 1 to 8 yr. Ringlets indicate that tree growth shifts abruptly as precipitation oscillates across the mean annual precipitation and scales as the 3/4 power of time-scale. At junctions between disparate stream orders, tree ringlets reveal a mixture of hydrological signals from upstream reaches. Vegetation populates the basin at densities that reflect both local and basin-wide water balance. Trees carry imprints of environmental relationships that extend over kilometers of space and years of time due to abiotic and biotic coupling throughout the landscape.

Symposium: Poster Session
Proactive Landscape Research and the Descent from Fossil Fuels

Bruce T. Milne, University of New Mexico

Abstract: In the face of mounting concentrations of greenhouse gases, declining oil supplies, and global change, many environmental professionals can expect to spend the remainder of their careers engaged in concerted efforts to supply society with renewable energy, clean water, and food while protecting habitat, ameliorating the production of greenhouse gases, and managing the proliferation of exotic and pathogenic species. Indeed, all landscapes are connected via the atmosphere; thus landscape ecology should be central to engineering effective greenhouse gas reduction strategies and to the implementation of valid carbon cap and trade systems. With contributions from practitioners, social, political and economic sciences and the arts, landscape ecology could help to alleviate environmental racism and reduce overexploitation of wild lands and endangered habitats. During the descent from fossil fuel, landscape ecology could guide the reinvigoration of local food production and biofuels while maintaining biodiversity. Engagement with commercial media arts and computer scientists could lead to powerful visualization interfaces for simulations, thereby helping stakeholders to participate in scenario-based landscape planning exercises. Strategic research initiatives are needed to guide landscape ecological research in coming decades.

Topic Area: Toward a Collective Disciplinary Agenda for Landscape Ecology: Goals and Strategies

Symposium: Oral session

Time: Friday, 10:50-11:10
Direct and indirect effects of roads on forest birds

Emily S. Minor, University of Maryland Center for Environmental Science
Dean L. Urban

Abstract: Roads have been shown to decrease abundance of many native bird species but it is unclear whether the roads themselves are important (direct effects) or whether the birds are responding to subsequent changes in the surrounding habitat (indirect effects). This research looks at several road-related variables: road proximity, road density, and traffic noise, and their effects on Neotropical migrants in the North Carolina Piedmont. To distinguish between the direct and indirect effects of roads, we performed two separate analyses: a multiple regression that simply included the road variables themselves as predictors, and a second, partial multiple regression that controlled for any local- or landscape-level habitat variables that might have confounded the first analysis. Prior to controlling for habitat, road variables explained between 1-26% of the variability in species abundance and 20% of the variability in species richness. After controlling for habitat, road variables only explained between 0-4% of the variability in abundance and 2% of the variability in richness. We conclude that the altered habitat is more important than the actual roads and suggest that careful planning to minimize changes in surrounding habitat should greatly reduce road effects on native bird communities.

Topic Area: Species in urban landscapes

Symposium: Oral session

Time: Tuesday, 2:20-2:40, Boojum
Using false-rings in riparian trees to reconstruct no-flow disturbance regimes

Kiyomi Morino, University of Arizona

Abstract: Annually, streamflow in semi-arid regions can be highly variable, ranging from no flow to flood. Both extremes constitute disturbances that play important roles in landscape form and function, but comparatively speaking, no-flow disturbance regimes have received little attention. One of the challenges of characterizing spatiotemporal patterns of channel dryness is that stream gages are sparsely distributed. In this study, we propose a solution: use streamside trees as biological stream gages. On the San Pedro River in southeastern Arizona, reaches may dry up in June only to be deluged by floods with the onset of the monsoons in July. Dendrometer data demonstrate a temporary cessation of radial tree growth during the period of seasonal drought. Tree-ring evidence of the observed growth hiatus appears to be manifested as a "false ring" an apparent ring boundary formed within the growing season. Application of this methodology has yielded some important preliminary results. First, false ring position within the tree ring may be different for younger and older trees. Second, previous summer flows may be an important hydroclimatic driver of current no-flow disturbance regimes. Based on these results, we conclude that our understanding of no-flow disturbance regimes could be facilitated by streamside dendrochronology.

Topic Area: Disturbance effects

Symposium: Oral session

Time: Thursday, 5:00-5:20, Salon D
Boreal toad (Bufo boreas boreas) population connectivity in Yellowstone National Park: quantifying matrix resistance and model uncertainty using landscape genetics

Melanie Murphy, Washington State University
Jeffrey S Evans, Charles Peterson and Andrew Storfer

Abstract: Landscape genetics is an emerging discipline that aims to quantify the impact of landscape composition, configuration and matrix quality on population connectivity using genetic markers. The Boreal Toad (Bufo boreas boreas) is a locally abundant, patchily distributed species thought to be in decline throughout most of its range. Recapture rates tend to be low, making demographically based estimates of non-breeding habitat use and population connectivity unreliable. We surveyed Boreal Toad breeding sites throughout Yellowstone National Park and collected microsatellite genotype data (15 loci) from adults and tadpoles (n=953). We then: 1) develop multivariate spatial models of population connectivity for landscape genetics (both network and algorithmic models), 2) identify habitat characteristics that influence Boreal Toad dispersal, and 3) quantify model uncertainty using neutral models and permutation tests. We find that population connectivity is positively influenced by minimum elevation, hierarchical slope position, and moisture among sites. Conversely geometric distance, number of stream crossings, and temperature have a negative impact on population connectivity. The models developed in this study can then be used to predict the impact of landscape change on Boreal Toad population connectivity. Additionally, the analytical methods developed can be applied in any species or system with appropriate landscape and genetic data.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)

Symposium: Oral session

Time: Tuesday, 4:00-4:20, Salon D
Soundscape Ecology: Bioacoustic analysis across anthropogenic disturbance gradients

Brian Napoletano, Purdue University
Jonah Duckles

Abstract: Landscape level analysis provides insight into dynamic ecological systems controlled by multiple interacting processes. The dynamics of these processes interact over multiple temporal and spatial scales. Data to perform studies at both fine spatial (less than 30m) and temporal (less than 1 day) scales is limited. This constraint presents several difficulties to ecologists attempting to relate the landscape to the processes shaping it. To obtain a better understanding of these processes at finer temporal and spatial scales, new techniques must be developed, including the investigation of variables that reflect ecosystem processes at these finer scales. The assemblage of sounds associated with a given study area, referred to as a soundscape, reflect ecological interactions at a spatiotemporal resolution fine enough to assess interactions between individual species assemblages. Because sound signals represent direct measures of biotic activity, they generate virtually no temporal lag between biotic activity and the sensor's ability to detect and measure it. This ability to acquire near-real-time data provides novel insights into the nature of ecosystem dynamics at fine spatial and temporal scales. We use these unique elements of sound to examine the ways in which anthropogenic activity influences the temporal cycles of biological activity. We sample the soundscapes of habitats representing a gradient of anthropogenic activity ranging from rarely impacted grassland, wetland and forest systems to frequently impacted urban centers with similar habitat patches. Sounds are recorded at each site for seven continuous days, and meteorological conditions (temperature, humidity, precipitation and wind speed/direction) are logged once every second. From the recordings, we identify the vocalisations of target species within the samples using Artificial Neural Network operations in concert with digital signal processing tools to give an acoustic picture of the site. The distribution of vocalization events of target species is examined along the time axis to determine patterns of acoustic activity. These activity distributions are then integrated with meteorological data collected at the site, and subsequently across a spatial disturbance gradient, to determine how anthropogenic activity influences the distribution of biological activity. This investigation of human activity at a high spatial and temporal resolution provides unique insight into individual biotic responses to human disturbances.

Topic Area: Cultural landscapes I

Symposium: Oral session

Time: Thursday, 3:40-4:00, Boojum
Historical and current patterns of flowering phenology in the Phoenix metropolitan area

Kaesha Neil, Arizona State University
Jianguo Wu

Abstract: Research of the effects of urbanization on flowering phenology has shown that many spring flowering plants are blooming earlier in urbanized areas than in the surrounding rural areas. Researchers have hypothesized the urban heat island (UHI) effect is the primary cause for these changes. The observational studies suggesting the UHI hypothesis have been conducted in temperate, Mediterranean, and boreal regions of North America, Europe, and Asia where the temperature-photoperiod interaction is widely accepted as the primary trigger of floral development. While moisture and temperature are considered the primary triggers for most arid plants, flowering phenology in arid urban areas has yet to be studied. A preliminary study of Parkinsonia microphylla and Larrea tridentata at different land use types and across an urban-rural gradient in the Phoenix Metropolitan area suggests (1) land use affects spatiotemporal flowering patterns of some plants, (2) both may be sensitive to temperature, and (3) changes in flowering phenology may affect seed production and success. Moreover, historical data from the Arizona State University Herbarium indicates a potentially significant advancement of blooming over time during the last century. These results help improve our understanding of how plants and ecosystems respond to changing environmental conditions induced by urbanization.

Symposium: Poster Session
Putting theory into practice -- Introduction

Matthew Nicholson, US Environmental Protection Agency
Anita T. Morzillo, Christine Mazzarella, K. Bruce Jones and Kevin J. Gutzwiller

Abstract: The science of Landscape Ecology has a rich theoretical basis that continues to expand. While application of this science is clearly taking place, transfer of science into practice is lagging. Furthermore, examples of active management based on basic landscape ecological principles are not commonly described in the literature. Thus, feedback from practitioners to the research community is often lacking. We open this symposium with a review of scientific papers published in the journal Landscape Ecology and evaluate trends in the topics covered over the past two decades with focus on theory and practice. We also share the results of solicitations to professionals within the discipline of Landscape Ecology who replied to our requests for examples of the transfer and successful merger of science of landscape ecology science into practice. Kevin Gutzwiller, editor of "Applying Landscape Ecology in Biological Conservation," will provide a brief overview of some of the scientific constraints that limit applications of landscape ecology in biological conservation, and offer suggestions about how landscape ecologists might reduce such constraints.

Topic Area: Putting theory into practice: application of landscape ecology principles into environmental decision-making

Symposium: Oral session

Time: Tuesday, 10:00-10:20, Salon E
Using population viability models for measuring landscape connectivity

Madhura Niphadkar, San Diego State University
Nathan Schumaker

Abstract: Habitat connectivity for animals has been studied in a number of ways. Structural habitat connectivity is measured by identifying where habitat patches are situated with respect to each other. Functional studies of landscape connectivity look at how a landscape facilitates movement and functioning of an organism. This paper takes an approach of using individual-based modeling for measuring population viability metrics as a surrogate measure to identify connectivity. Individual-based modeling has found less application in geographical analyses, although many spatially explicit approaches to problem-solving exist. Habitat connectivity for animal movements can be measured by metrics such as fluxes through habitats, net gains and losses, or through measures such as viability that show direct impacts on populations of regions. We selected a region with diverse landcover classes and multiple land uses in the Willamette River watershed of Central Oregon for analysis. Three wildlife species were selected for comparative analysis of connected habitats. We then used a spatially explicit population model to measure connectivity over the landscape through the flux of individuals between habitat units. Connectivity was altered by introducing barriers to movement and altering their properties, and the significance of these barriers was measured by examining their impacts on simulated population trends. Results illustrate the significance that movement barrier properties can have on population dynamics, and demonstrate how such impacts can change based on species’ life-history traits. These insights should lead to innovations in developing new functional measures of connectivity.

Topic Area: Spatial analysis: theory & methods

Symposium: Oral session

Time: Thursday, 11:00-11:20, Boojum
Coupling of climate, soil moisture dynamics, and vegetation in a small basin in a semi-arid landscape

Etsuko Nonaka, University of New Mexico

Abstract: Soil moisture is a key factor that synthesizes the effects of climate, soil, and vegetation in semiarid ecosystems. We examine the coupling of these ecosystem components in a small basin (120m x 120m) in central New Mexico, using spatially distributed time-series data collected over years. Soil moisture, soil temperature, and various meteorological data were collected frequently using a data logger, and the locations and sizes of the dominant shrubs were recorded on the ground using a GPS unit. Soil moisture measurements were spatially distributed over the basin. The north- and south-facing slopes have distinct vegetation composition; most of the shrubs occur only on the south-facing slope, and different grass species occur on the slopes. Despite the small size of the basin, the slopes have contrasting environmental conditions especially during winter. We investigate the temporal and spatial correlation in soil moisture dynamics and various environmental variables and examine the relationships between soil moisture dynamics and vegetation pattern.

Symposium: Poster Session
Landscape configuration affects the energy intake rates of foragers: An agent-based approach to optimal foraging in heterogeneous landscapes

Etsuko Nonaka, University of New Mexico
Petter Holme

Abstract: We examined the effects of landscape heterogeneity on success of optimal foragers using a spatially explicit stochastic agent-based simulation model on a 2D lattice. The optimal foraging theory formulates mechanisms with which foragers optimize resource utilization. One of the predictions is the optimal patch leaving time of a forager in patchy landscapes. Charnov introduced an analytical solution, the marginal value theorem (MVT), for the problem; if resource in a patch is depleted as the forager spends time in the patch, it leaves the patch when the instantaneous energy intake rate becomes less than the average energy intake rate for the whole landscape. We focused on how patch clumpiness affects maximum average energy intake rates of foragers in landscapes with random to highly clumped patch configuration. The majority of optimal foraging models are based on differential equations, and spatial complexity cannot be easily incorporated. Including spatial complexity is more straightforward in an agent-based approach. The MVT has been criticized for not reflecting the stochastic nature of foraging, but the results suggest that the predictions from the theorem are not far from the numerical solutions under certain conditions. When the productivity of the landscape is low, the maximum average energy intake rate of the forager was greater in random landscapes than in clumpy landscapes. Patch configuration influences energy intake by foragers, and this finding has implications to energy partitioning by individuals in a population in heterogeneous landscapes. This study demonstrates a basic role of landscape heterogeneity on energetics of optimal foragers.

Symposium: Poster Session
Short-term impacts of large-scale vegetation restoration on shrubsteppe bird species

Russell Norvell, Utah State University

Abstract: Disturbance plays the dominant role in the creation and maintenance of shrubsteppe bird habitats. Active restoration of shrubsteppe areas, primarily for the benefit of declining avian species, is increasingly seen as a viable alternative to the widespread and accelerating drift into monocultural state-basins of annual exotics, a change considered undesirable by humans and anathema to a variety of endemic bird species. With only general guidance available, restoration prescriptions vary considerably, and a given vegetation structure may be either the justification for or target of restoration activities aping beneficial disturbances (i.e., disturbances with endemically scaled durations, intensities and extents). Using a combined BACI and case-control experimental design, we studied the short-term impacts of replicated, large-scale vegetation treatments (mechanical brush cover reductions) designed to improve habitat quality for shrubsteppe associated birds at landscape scales. The local density, territorial density, and nesting success of four focal species were intensively studied for three years. Impacts varied in magnitude, duration, and scale by species, implying restoration prescriptions should be regionally coordinated to compensate for local compromises.

Topic Area: Conservation planning: restoration

Symposium: Oral session

Time: Friday, 8:00-8:20, Boojum
Abstract: Current conservation efforts for the declining boreal toad (Bufo boreas) would be improved if breeding habitat selection needs were better understood. Therefore, in concert with a large-scale toad inventory and monitoring effort in Southeast Alaska in 2005 and 2006, we analyzed landscape connectivity and 18 microhabitat variables associated with toad occurrence and breeding. A geographical information system (GIS) was used to estimate structural, geographical, and functional aspects of connectivity around 469 wetland patches. Connectivity measures were estimated in terms of distance to other habitat, density of potential habitat, and migratory energy costs within a 1.5km radius of each potential habitat site. Data pertaining to both on-site (e.g. pH and percent emergent vegetation) and around-site (e.g. wetland area and elevation) variables were also collected, and multivariate logistic regression performed to determine the group of characteristics that best distinguished between breeding and non-breeding sites. We found that mean Euclidean distance from utilized habitat to the nearest high potential habitat patch and the total energy cost to travel within a 1.5km radius of each site were significantly related to the presence of B. boreas. Furthermore, our results indicate that the combination of higher water temperature and a lower percentage of shallow water in a wetland had the most predictive power in determining toad breeding habitat, suggesting a preference for the warmer shallows of larger, deeper wetlands. Both landscape connectivity and microhabitat characteristics appear to play a role in toad habitat selectivity. Therefore, we recommend that both spatial scales be considered when developing conservation and land use initiatives concerning toad habitat protection in Southeast Alaska.
Connectivity, patch shape, and apparent competition among plants

John Orrock, National Center for Ecological Analysis and Synthesis
Brent J. Danielson

Abstract: The impact of conservation corridors may depend upon how corridors alter the nature of indirect effects. Although corridors have beneficial impacts on bird-dispersed plants by increasing seed deposition, corridors can also affect the foraging behavior of seed predators, leading to greater levels of seed predation on bird-dispersed seeds in connected patches. An unexamined possibility is that, by increasing deposition of bird-dispersed seeds in connected patches, corridors could change how granivores impact seeds that are not dispersed by birds. Specifically, gravity-dispersed seeds could suffer a two-fold blow because corridors increase rodent seed predation and because rodents attracted to high-density patches of bird-dispersed seeds also consume more gravity-dispersed seeds (i.e. short-term apparent competition). We examined how corridors and patch shape affect removal of seeds of two oldfield plant species: one bird-dispersed species and one gravity-dispersed species. Within a large-scale experimental landscape, we established a factorial design that manipulated density of bird-dispersed seeds within experimental exclosures that altered rodent access. Rodent impacts on gravity-dispersed seeds were greater in connected patches where densities of bird-dispersed seeds were increased. As such, corridor-mediated increases in bird-dispersed seeds may have indirect impacts on plant species whose seeds do not benefit from corridor-mediated dispersal.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 1:40-2:00, Salon E
Understanding forest landscape disturbance regimes by simulation modeling: How important are user assumptions?

Ajith H. Perera, Ontario Forest Research Institute
Marc Ouellette

Abstract: As simulation models of forest disturbance regimes proliferate, and their applications become more user friendly and popular, the risk increases that the numerous assumptions associated with simulation modeling may be ignored by both users and modelers. We examined the effect of user and modeler assumptions on simulations of the fire regime in a large (> 6 million ha) boreal forest landscape using the model BFOLDS. Assumptions were tested in a factorial combination: 3 user rule sets for forest fuel type and forest succession; 2 user rule sets for fire and the intensity threshold of stand mortality types; and 3 modeler-assumed spatial patterns of lightning ignitions. All assumptions significantly affected aspatial and spatial characteristics of the simulated fire regime, e.g., fire return interval, burn probability, and fire size-class distribution. Most significant was the effect of user rules for forest fuel types and succession. Given the inevitability of assumptions in simulation modeling and their influence on simulation results, the effects of both user and modeler assumptions must be examined a priori.

Topic Area: Simulation models: disturbance

Symposium: Oral session

Time: Thursday, 10:00-10:20, Bonsai
Measuring direct impacts of attitudes on the environment using household location choices

Marcus Nils Peterson, Michigan State University
Xiaodong Chen and Jianguo Liu

Abstract: Successful efforts to conserve natural resources require understanding the relationship between environmental views and environmental behavior. Most studies assessing this relationship focused on behaviors with indirect environmental linkages (e.g., voting, donations). Choosing the location of one's household provides a direct link between a behavior and environmental views. In this paper we use a case study in Teton Valley, Idaho and Wyoming, to explore the spatio-temporal relationship between environmental views and environmental impacts of homes immigrants chose. We collected environmental view information (using the new ecological paradigm scale [NEP]), spatial coordinates, and type of land cover (in town, in agriculture areas, and in natural areas) information with 416 household surveys. Immigrants choosing to live in natural areas had significantly more environmental views than those choosing to live in agricultural or town areas. Length of residency was negatively related to NEP, so environmental views probably drove home-location choice rather than home location promoting environmental views. This suggests more education and more environmentalist views can lead to the most damaging environmental behaviors. Future efforts to create cognitive linkages between household location choices and environmental views may help alleviate this problem.

Topic Area: Cultural landscapes II

Symposium: Oral session

Time: Friday, 9:20-9:40, Salons F, G & H
Influences of habitat availability and landscape context on anuran community structure along an urban-rural gradient

Finn C. Pillsbury, Iowa State University
James R. Miller

Abstract: Urbanization is an important factor in worldwide amphibian declines, and although recent work has illustrated the influence of broad-scale ecological patterns and processes on amphibian populations, little is known about the factors structuring amphibian communities in urban landscapes. We therefore examined amphibian community responses to wetland habitat availability and landscape characteristics along an urban-rural gradient in central Iowa, a region experiencing rapid suburban growth. Urban density had a significant negative influence on overall anuran abundance and diversity. Every species exhibited a decrease in abundance with increasing urban density, but this pattern was especially pronounced for species requiring post-breeding upland habitats. Anurans most affected by urbanization were those associated with short hydroperiods, early breeding activity, and substantial upland habitat use. We suggest that broad-scale landscape fragmentation is an important factor underlying anuran community structure in this region, possibly due to limitations on the accessibility of otherwise suitable habitat in fragmented urban landscapes. This study underscores the importance of a regional approach to amphibian conservation in urban and urbanizing areas; in fragmented landscapes, a network of interconnected wetland and upland habitats may be more likely to support a successful, diverse anuran community than will isolated sites.

Topic Area: Species in urban landscapes

Symposium: Oral session

Time: Tuesday, 1:40-2:00, Boojum
Using landowner decisions to predict landscape change and alternative futures

Amy Pocewicz, University of Idaho
Max Nielsen-Pincus, Caren S. Goldberg, Melanie H. Johnson, Penelope Morgan, Jo Ellen Force, Lisette P. Waits and Lee Vierling

Abstract: To make informed planning decisions, community leaders, managers, and others must be able to evaluate potential effects of policies on land use change. We modeled landowners’ stated intentions in order to simulate future land use change and effects of two alternative policy scenarios in northern Idaho. This agent-based approach is particularly appropriate for privately owned landscapes, because it reflects the decision-making of the landowners whose individual actions will result in collective landscape change. We modeled relationships between land management decisions, collected from a mail survey of private landowners, and the landscape, using remotely sensed imagery and ownership parcel data. Because many land use change models use remotely sensed images to make predictions based on historical trends, we compared the agent-based model with a historically based model. The agent-based model projected a substantial increase of 31% for rural housing units, along with decreases in forest (11%) and agricultural land (7%). Agent-based projections were within the range of historically based projections. Policies oriented toward increasing enrollment in the Conservation Reserve Program (CRP) resulted in a significant increase in CRP lands, but policies targeting increased forest thinning on private non-industrial lands had little effect, demonstrating the importance of understanding potential effects of targeted land use policies.

Topic Area: Cultural landscapes II

Symposium: Oral session

Time: Friday, 9:00-9:20, Salons F, G & H
Functional landscape connectivity of old-growth reserves in the Tongass National Forest, Alaska

Sanjay Pyare, University of Alaska, Southeast
Winston Smith

Abstract: The cornerstone of the federal conservation strategy for the 17 million acre Tongass National Forest (USA) is a network of small, medium, and large old-growth reserves that are putatively distributed to facilitate dispersal of focal management species, like the northern flying squirrel (Glaucomys sabrinus). We tested the assumption of functional connectivity specifically between small reserves and larger conservation elements in a fragmented landscape (Prince of Wales Island) using a spatially explicit model that yielded estimates of the probability of dispersal among reserves. The model framework we used was a least-cost landscape-resistance model, but unlike most conventional landscape models, we: 1) parameterized the model using resistance estimates derived from animal translocation experiments; 2) validated the model using empirical studies of animal dispersal patterns; and 3) incorporated a key element of animal behavior that is often ignored in such assessments, perceptual range. Results suggest that approximately ½ of all small reserves (n=44) on Prince of Wales Island appear to be effectively linked with other conservation elements, but the other ½ are linked at < 50% probability. Perhaps most critically, 8 reserves have a < 10% probability of supporting dispersal by adult male flying squirrels and these probabilities are uniformly lower for natal dispersers. The conservation strategy for the Tongass is currently under review, and these results suggest that if connectivity is to remain a high conservation priority, the current distribution and boundaries of old-growth reserves in the most heavily fragmented landscapes of the Tongass should be re-evaluated.

Topic Area: Spatial analysis: applications

Symposium: Oral session

Time: Thursday, 3:20-3:40, Salons F, G & H
Historical and contemporary land-use in a grassland landscape

Erin J. Questad, University of Kansas
Bryan L. Foster, Suneeti Jog and Kelly Kindscher

Abstract: Land-use has altered grassland ecosystems through habitat fragmentation, historical and contemporary disturbances, and introductions of exotic species. We studied the alterations to a landscape that was formerly tallgrass prairie, which provided a large-scale and long-term experiment. Community patterns are dependent on spatial scale, and we developed a sampling protocol to capture these patterns.

Topic Area: Species distributions: communities

Symposium: Oral session

Time: Thursday, 2:40-3:00, Salons F, G & H
Evaluating the influence of lure and bait type on track plate visitation by American marten in central Ontario, Canada

Peter A. Quinby, University of Pittsburgh
James Hodson and Michael Henry

Abstract: A standard protocol for assessing the presence of American marten (Martes americana) involves the use of sooted track plates in a symmetrical cluster (usually 6 to 8) to obtain a marten foot print on contact paper. This method treats a track plate array as a single independent sample due to the assumed influence of the chemical lure at a single track plate drawing a marten to it from an adjacent track plate. We assessed the influence of track plate lure on marten attraction from adjacent compared with distant visited track plates and we evaluated the effectiveness of three different bait types for attracting marten onto track plates in the Temagami region of central Ontario. Arrays with a marten detection density of one had the highest frequency, arrays with detection densities of five and six had the lowest frequency, and detection densities of two through four were intermediate in frequency. In addition, within an individual array, marten did not choose track plates based on their spatial proximity. These findings suggest that track plate visitation within an array used for marten detection in our study area is not biased by lure attraction at adjacent track plates. We also found that the jam-lard-fish oil bait was at least as effective as chicken for attracting marten to track plates.

Symposium: Poster Session
Impact of tourism and urbanization in the landscape ecology of Abbottabad

Farah Rafiq, COMSATS Institute of Information Technology
Mushahid Anwar

Abstract: Abbottabad is a beautiful place and a gate way to Karakoram, Himalaya and deadly Hindukush. It is a small neat and clean town in a spacious valley surrounded by green hills. It is a popular summer resort, located at the end of Murree-Abbottabad hill tract at a height of 1,220 meters, noted for its verdant parks, gardens, golf course and pine covered hills. The Karakorams, the enchanting Himalayas and the deadly Hindukush, can also be approached from Abbottabad. Tourist from whole Pakistan would love to visit the area during the months of March to October. However increasing rate of urbanization and tourist activities has badly affected the area. All these enhanced activities fastening the deterioration of the landscape ecology of the region.

Symposium: Poster Session
Habitat fragmentation and roads in the Monarch Butterfly Biosphere Reserve in Mexico, 2000-2006

M. Isabel Ramirez, Universidad Nacional Autonoma de Mexico
Leopoldo Galicia and Raul Zubieta

Abstract: The effectiveness of conservation management in Natural Protected Areas is much in debate. In previous work we have demonstrated that three decrees issued to protect the monarch butterfly overwintering habitat have not been successful. They have not stopped extensive illegal logging, which is of the highest conservation concern. Logging is made possible by roads, but available road cartography was not at fine enough resolution to account for the degree of forest fragmentation in the Reserve. The aim of this work was to generate the fine-scale data needed to perform an accessibility analysis, considering landscape fragmentation between 2000 and 2006 as a function of distance from roads (main, secondary, and tertiary), and of relief and land tenure. Roads and land cover maps were obtained by on-screen visual interpretation of digital aerial photographs mosaics and pan-sharpened Ikonos images, both 1-m resolution, and Landsat imagery. Significant changes in landscape structure and fragmentation over the 6-year period were found, both in core and buffer zones, highly related to the road network. No significant differences were found among land-tenure types nor in relation to topographic relief. The existing road network is dense enough to compromise the viability of the Reserve; tertiary road closures need to be enforced to limit the accessibility of remaining conserved patches of butterfly habitat.

Symposium: Poster Session
Characterizing the phenology of desert annuals

Bradley Reed, US Geological Survey

Abstract: Characterizing the phenology of desert vegetation is difficult using conventional remote sensing approaches as there are often two temporal vegetation signals during a calendar year: one from perennial plants, and a second from the flush of annual plant growth that responds opportunistically to available moisture. In addition to the mixed vegetation signal, difficulties are compounded by sparse vegetation cover and variability in the soil background, which often dominates the vegetation signal. An approach to identify the occurrence of annual vegetation has been developed using MODIS 250m red and near infrared (NIR) reflectance, coupled with vegetation index data over the southwestern U.S. The growth of annuals is defined as occurring when the red reflectance is less than its median reflectance, and NIR reflectance and vegetation index values are higher than their medians. There is strong agreement with results derived with this method and those obtained from higher resolution satellite imagery. The research has potential applications for identifying fine fire fuels, areas of potential dust stabilization and subsequent dust source, and carbon flux over dryland environments.

Topic Area: Phenologies as integrative phenomena for landscape research

Symposium: Oral session

Time: Friday, 9:00-9:20, Salon D
Using landscape variables to predict red-headed woodpecker occurrences in Wisconsin

Christine A. Ribic, USGS Wisconsin Cooperative Wildlife Research Unit; Department of Wildlife Ecology, University of Wisconsin  
Les D. Murray, and Kevin Ellison

Abstract: The red-headed woodpecker (Melanerpes erythrocephalus) has declined because of habitat loss and degradation across its range. Management efforts for this species will benefit from better understanding habitat requirements. We compared habitat and landscape variables at points of woodpecker detections with random points in Wisconsin. Logistic regression was used to differentiate between random points and woodpecker detections based on habitat variables measured at three extents (13, 50, 200 ha). Independent playback surveys were then used to measure red-headed woodpecker occurrence at random points to test the predictive ability of the logistic model. Woodpecker presence/absence at a random point was related to the probability of occurrence calculated from our habitat model. Our model suggested woodpecker presence was positively related to the number of snags and utility poles, the proportion of grazed forest, and the probability of forest/open habitat adjacency, but negatively related to mean forest patch size. However, woodpeckers were detected at 34% of points where woodpeckers were predicted to occur and 33% of points where woodpeckers were predicted to be absent. Thus, although our results show relationships to variables thought to be important components of red-headed woodpecker habitat, the model does not accurately predict woodpecker occurrences in our study area.

Topic Area: Species distributions: populations

Symposium: Oral session

Time: Thursday, 11:20-11:40, Salons F, G & H
Prioritizing forest restoration based on late-seral habitat connectivity

William H Richards, Seattle Public Utilities

Abstract: The 50-year Habitat Conservation Plan for the 90,546-acre Cedar River Municipal Watershed (CRMW) in western Washington State requires thinning on a portion of the 71,000 acres of early-seral forest to facilitate the creation of late-seral forest characteristics. I developed a technique for prioritizing the location of thinning projects based on the connectivity of late-seral forest habitat as it develops over the planning period. Initially, forested areas likely to ecologically benefit from thinning were identified on a watershed landscape derived from forest inventory and airborne sensor (e.g., MASTER) data. Forest growth was then simulated to the end of the planning period for two alternative landscape scenarios based on thinning and not thinning these targeted areas. Habitat connectivity was assessed on these alternative landscapes by simulating the dispersal of late-seral forest dependent wildlife species using the Program to Assist in Tracking Critical Habitat (PATCH). Comparison of the relative successful dispersal activity between landscapes indicated where thinning will provide the greatest benefit to late-seral forest habitat connectivity.

Symposium: Poster Session
Understanding year-to-year inconsistency in bird-landscape relations: the influence of life-history traits and model selection uncertainty

Sam Riffell, Mississippi State University
Kevin Gutzwiller

Abstract: Landscape ecologists often use logistic regression to identify and describe relationships between birds (or other animals) and large-scale habitat features, but modeled relations for a particular species often vary from yr-to-yr. To investigate how population characteristics and life-history traits influence inter-annual consistency, we built bird-landscape models (using logistic regression) for 72 species in the Appalachian Mountains and calculated model consistency over a 5-year period. We first removed effects of model selection uncertainty and model complexity, and these factors explained a large proportion of the variation in model consistency. Model consistency increased slightly with species' abundance, but otherwise population characteristics were not important. Model consistency increased with the degree of diet specialization. Generalists likely can "switch" to different food resources and track yearly variation in resource availability, while specialists more consistently track one (or few) resources. Correctly identifying and modeling landscape relations of generalist species (and species with low abundance) will require data collected over longer time frames. Because uncertainty involved in the model selection process contributed heavily to inter-annual model consistency, continued research about improving model selection techniques and reducing methodological sources of model selection uncertainty may be the most effective way to improve our ability to model animal-landscape relations.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)

Symposium: Oral Session

Time: Tuesday, 3:40-4:00, Salon D
Changes in the diversity and structure of Great Lakes bird communities in response to land cover change

Jay Roberts, Michigan State University
Brian A. Maurer, Robert W. Howe and Peter T. Wolter

Abstract: The rate of land use-land cover (LULC) change in the Great Lakes region outpaces that of population growth. Low-intensity development and road area have increased significantly in the region (1992-2001), while forest and agricultural area declined slightly. These metrics may serve as important environmental indicators for ecosystem health. The link between LULC change and biodiversity is a popular area of study, but the relationship varies regionally. In the northern Great Lakes region anthropogenic activities are moderate. While species richness may be constant or increasing, the populations of many species are declining. These seemingly contrary patterns appear to be a result of the replacement of habitat specialists with generalists. Other community-level investigations in anthropogenically-modified landscapes have shown similar shifts in community composition, despite concurrent increases in richness or diversity. We calculated bird community diversity and composition metrics from long-term National Forest survey databases, and compared these with Breeding Bird Survey (BBS) routes from the same area. We then linked the patterns of community composition and diversity to the amount and type of landscape change. Anthropogenic practices appear to be important, even in this landscape where anthropogenic activities are low relative to urbanized landscapes.

Symposium: Poster Session
Integrating GAP wildlife habitat models with IFMAP, Michigan's forest management decision-support environment

Jay Roberts, Michigan State University
Erica L. Mize, Michael L. Donovan, Brian A. Maurer, Genevieve M. Nesslage and Jennifer J. Skillen

Abstract: One major task of the Michigan Department of Natural Resources (MDNR) is to provide accurate information to policy makers on the impacts of various land use decisions on the state's natural resources. Wildlife resources have typically been evaluated for a limited number of economically important species (game animals or endangered species), but now MNDR personnel are striving to understand how decisions affect all species. The tools currently available to resource management personnel include MIGAP (habitat distribution models), and the Integrated Forest Monitoring, Assessment, and Prescription (IFMAP) geographic decision support environment. We linked these tools to create a geographic decision support environment for management of wildlife habitat. We sampled field sites across the lower peninsula of Michigan to evaluate the wildlife habitat models for birds and small mammals. MIGAP models fail to predict the presence or absence of many wildlife species by grossly overestimating the amount of occupied habitat. MIGAP models rely primarily on land-cover, but for many species the accuracy of habitat distribution models are improved by including more information beyond land-cover (i.e. IFMAP inventory variables). We are currently developing a list of habitat measurements that would improve the ability of wildlife decision support tools to provide accurate information to land use planners.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)

Symposium: Oral session

Time: Tuesday, 4:20-4:40, Salon D
Patch size distributions of post fire landscapes in the Crown of the Continent ecosystem, Montana, USA

Josh Rodriguez, National Center for Landscape Fire Ecology
Carl Seielstad

Abstract: The combination of the effects of fuels, weather, and topography results in a diversity of burning conditions and creates a mosaic of severity patches on the landscape. The post-fire landscape characteristics of eleven fires in the Crown of the Continent Ecosystem (CCE) were investigated using a remote sensing derived method of measuring fire severity patches, and an analysis of patch size distribution. These analyses were used to determine if similarities exist in post-fire landscapes in the study area. The analysis of patch size distribution revealed that each of the fires in the study area exhibited the power-law distribution, and share very similar frequency-area characteristics in terms of patch size, evidenced by the similarity in the $I^2$ coefficient of the frequency-area statistics. This result is significant, as it exposes a previously unknown characteristic of post-fire structure that appears ubiquitous in the CCE. In addition to the wildfires, one prescribed burn was studied and found to exhibit power-law behavior similar to the wildfires. These results allow for novel comparisons between fires in the CCE. These comparisons will be important in monitoring the fire process, and deviations in fire regime due to a variety of factors including management activities, and changing climate conditions.

Topic Area: Burn severity mapping: research and applications

Symposium: Oral session

Time: Thursday, 2:20-2:40, Salon D
Patch dynamics of managed invasive aquatic weeds in the Sacramento-San Joaquin Delta, California

Maria J. Santos, University of California, Davis
Shruti Khanna, Sepalika Rajapakse, Erin Hestir, Margaret Andrew and Susan Ustin

Abstract: Invasive aquatic weeds are agents of change. Since the 1950s invasive weeds have been reported in the Sacramento-San Joaquin delta ecosystem. CDBW has been responsible for monitoring and managing Brazilian waterweed (Egeria densa) and water hyacinth (Eichhornia crassipes), the major invasive species. Most field monitoring programs are prohibitively expensive, requiring the use of sophisticated remote sensing analysis to overcome those limitations. Since 2003, we have been using airborne hyperspectral imagery and classification tree algorithms to derive distribution and cover maps of these two invasive species. We evaluated the rates of change of target invasive species from June to October 2005 and assessed the effectiveness of the control. Brazilian waterweed covered 1293.6 ha in June and 1352.8 ha in October with overall accuracy of 96.4%. Patches were mostly <1 ha and presented a clumped arrangement. Water hyacinth covered 74.6 ha in June and 129.7 ha in October with overall accuracy of 95.4%. Patches were also mostly <1 ha and present a clumped arrangement. Sites treated for Brazilian waterweed and water hyacinth varied from June to October. Treatment effectiveness seems to be constrained by the limitations of herbicide application and by upstream non-treated patches that are a source of offshoots and fragments that allow the re-colonization of sprayed regions.

Topic Area: Species distributions: invasives
Symposium: Oral session
Time: Tuesday, 3:20-3:40, Salons F, G & H
Simulation of fire management and forest successional dynamics in the New Jersey pine barrens: Sensitivity to remotely sensed initial landscape configuration

Robert Scheller, University of Wisconsin - Madison
David J. Mladenoff

Abstract: Extensive rural development and fragmentation occurring in forested areas throughout the United States is changing the frequency and intensity of fire management. As a result, there will be significant alterations in tree species composition and potentially diminished ecosystem functioning. We examined the consequences of altered fire management practices within the New Jersey pine barrens (NJPB). As a result of rural development and fragmentation, the size and frequency of wild fires has declined and the use of prescribed fires is limited to a small portion of the landscape. We assessed the consequences of altered fire regimes and the potential to restore vegetation to pre-colonial conditions by simulating landscape change over the next 50 years. We used LANDIS-II, a stochastic, spatially dynamic forest succession and disturbance model. We compared our simulations of the NJPB with estimates of the pre-colonial landscape. We also tested the sensitivity of our simulations to initial landscape configuration, which was derived from remotely sensed land cover estimates. Classified data are typically used to initialize landscape models and succession and fire are potentially controlled by the initial landscape configuration. Sensitivity tests were constructed by probabilistically reassigning each landscape element based on the classification error matrix. Our simulations indicate that relative to the pre-colonial landscape, the current landscape has changed from a pine-dominated to an oak-dominated state. There are and will continue to be significant departures from pre-colonial tree species assemblages except for isolated areas where prescribed burning remains a viable management option. Our simulations were generally insensitivity to initial configuration, thereby increasing our confidence in the use of such data. In summary, rural development and fragmentation will continue to shift the NJPB to an oak dominated state and options for the restoration of "natural" fire regimes are spatially limited.

Topic Area: NASA-MSU Golley-Odum Symposium: Integrating remote sensing of forest disturbances with models at broad scales

Symposium: Oral session

Time: Tuesday, 10:00-10:20, Salon D
Analysis of landscape characteristics of deer vehicle collisions in Missouri

Jacqueline D. Schneiderman, University of Missouri
Hong S. He and David R. Larsen

Abstract: Increased suburbanization of rural landscapes is leading to a greater number of human-animal interactions. Among these interactions are those between humans and white-tailed deer (Odocoileus virginianus). This is enhanced by a modified landscape, as ample forest edge vegetation provides optimal resources for deer, with little or no predatory pressures to keep populations in check. One of the most dangerous and costly of these interactions is collisions between vehicles and white-tailed deer. Our research focuses on a landscape analysis of deer vehicle collisions in Missouri. We show that collisions are spatially clustered near bridges, riparian corridors, and areas with high forest cover. They also tend to be clustered around the outskirts of cities. GIS was used to plot deer collisions and perform clustering analyses, in conjunction with ancillary data, to identify hotspots and the surrounding landscape characteristics. This study quantifies site and landscape factors that contribute to deer vehicle collisions. This analysis will be useful for mitigation measures that can be implemented in regions that are prone to high deer vehicle collisions. It can also be used as a predictive tool during road planning and assessment stages.

Topic Area: Species in urban landscapes

Symposium: Oral session

Time: Tuesday, 2:00-2:20, Boojum
Spatial and temporal patterns of historic fire regimes in mixed conifer forests in the central Sierra Nevadas

Andrew Scholl, Penn State University

Abstract: Fire is one of the primary disturbances in mixed conifer forests in the Sierra Nevada, but there has been comparatively little research on the spatial and temporal variability of fire regimes across major environmental and compositional gradients and the role it plays in patterning forests. Information of historic fire regime variability is important for resource managers interested in managing resources according to historic processes and conditions. Forest structure data (size, age, composition and spatial pattern) was collected on a systematic sampling grid of 85 plots over 10km² in the mixed conifer zone in Yosemite National Park. Fire scars were collected in 9ha plots centered on each grid point to determine the fire history for the study area. Historic forest structure was reconstructed by subtracting radial growth from each tree core equal to the number of years since the last recorded fire. Analysis of the fire scar data suggests that the area experienced very frequent, low to moderate severity fires. The average fire return interval (FRI) for individual trees was 14 years (range 7-24yrs.), whereas the composite average FRI for the entire study area was 3 years (range 1-42). Mapping of fire extents identified fires ranging in size from single scarred trees to the entire study area.

Topic Area: Fire & landscape pattern

Symposium: Oral session

Time: Tuesday, 3:20-3:40, Salon E
Cross-boundary coordination among private forest owners as a mechanism to moderate landscape and land use change

Lisa Schulte, Iowa State University
Mark Rickenbach, Laura C. Merrick and Rebecca Gass

Abstract: A significant challenge facing conservation on private lands today is forest ownership fragmentation, especially when followed by housing development. Ecological changes associated with exurban development include landscape fragmentation, shifts in landscape composition, shifts or declines in wildlife communities, and declines in water quality. Cross-boundary coordination, where multiple owners or their agent(s) coordinate management practices across properties, has been proposed as a mechanism to moderate landscape and land use change in privately owned landscapes. We quantify the extent to which landscape-level ecological and economic benefits may be accrued through cross-boundary coordination of forest management practices in three landscapes in Wisconsin, USA. Methods are based on existing forest management plans and include spatial analysis of patch distributions, simulation of forest practices, and calculation of net present value over a 20-year horizon. Our results indicate that substantial opportunities for cross-boundary coordination exist and that it can moderate forest fragmentation due to changing ownerships. Economic analysis shows, however, that coordination offers few economic gains on average to the individual land holder, and suggests that policy mechanisms will need to be developed to provide financial incentives for coordinating activities.

Topic Area: NASA-MSU Golley-Odum Symposium: Drivers and implications of land use and landcover change

Symposium: Oral session

Time: Thursday, 10:00-10:20, Salon D
Reconnecting fragmented landscapes for grizzly bears in Alberta, Canada

Barbara L. Schwab, Wilfrid Laurier University
Gordon Stenhouse and Barry Boots

Abstract: Maintaining connections for movement across fragmented landscapes is important for the long-term conservation of wildlife populations. Once considered a continuous population, Alberta’s grizzly bears are now faced with human-induced ecological barriers. Movement patterns are disrupted and home ranges are spatially separated by major Alberta highways resulting in biologically distinct population units. In response, our research focus has shifted from maintaining connectivity to reconnecting landscapes already fragmented by human development. We employed cost-distance modeling within a graph theory framework to identify potential movement corridors (least-cost path edges between high quality habitat patches) across highways. Corridors were ranked in importance based on movement cost, functional distance, and physical location in relation to secure habitat. Resulting linkages were further compared to GPS radio-collar data for both female and male grizzly bears. Our results indicated a strong link between structural connections and the distribution of grizzly bear data demonstrating the possibility of functional corridor use. The graph theory framework proved to be a versatile management tool for modeling landscape connections as well as envisioning linkages capable of reconnecting fragmented environments.

Topic Area: Simulation models: plants, animals, ecosystems

Symposium: Oral session

Time: Tuesday, 3:40-4:00, Bonsai
Spatial distribution of land cover and their influences on watershed condition

Peter E. Schweizer, Ohio University
Glenn R. Matlack

Abstract: Using competing spatial models we examined the influence of spatial distribution of land cover on watershed condition for headwater and small-order streams in the outer coastal plain, MS. Land cover analysis used multi-spectral aerial photography, Landsat5 data, and NAIP images to evaluate the contribution of spatial extent and position of land cover type within catchments on water quality, stream geomorphology, and fish assemblages. Total variation in water quality was greater among catchments with different land cover type than within catchments with similar land cover. Land cover analysis identified impervious surface cover and managed green areas as strongest influences on stream conditions at the reach scale. At the catchment scale the spatial extent of total forest cover was the best predictor of watershed condition. Impervious surfaces, transient land cover, and managed green areas were correlated with creek bed geomorphology and stream hydrology. Fish assemblages varied in their composition. Urbanized catchments showed pauperized species diversity with an increase in cosmopolitan species compared to watersheds with a dominant rural or forest land cover. Results of the study indicate that not only the spatial extent of land cover types but also their spatial distribution within the catchment influence watershed condition.

Topic Area: Spatial analysis: applications

Symposium: Oral session

Time: Thursday, 4:20-4:40, Salons F, G & H
Conservation planning for fish assemblages based on land cover distribution

Peter E. Schweizer, Ohio University
Glenn R. Matlack

Abstract: Landscape dynamics over various spatial scales are integrated by fish assemblage composition. We examined species diversity and abundance pattern of fish assemblages from 27 selected headwater or low-order outer coastal plain streams near Hattiesburg, Mississippi. Non-metric multidimensional scaling (NMDS) identified measures of fish assemblage composition which best described assemblage differences based on richness, diversity and species dominance. Assemblages varied in composition by feeding preference, water column position of dominant species, and tolerance to increased water temperature and silt or sediment deposition. Observed assemblage compositions are likely the result of synergistic processes with nested relationships between landscape structure, land cover, and spatial distribution of land cover. Mosquito fish and sunfishes were the most abundant species in urbanized catchments while minnows, darters, and madtoms contributed to larger species diversity in rural and forested watersheds. Rural and forested catchments with stable land cover exhibited the largest fish species diversity. Results of this study contribute to our understanding of how spatial distribution of land cover influences watershed health as measured by water quality, stream geomorphology, and fish assemblages as biotic indicators of watershed condition, and identified sensitive areas and land cover with potential negative impacts on biotic diversity for consideration of conservation planning.

Symposium: Poster Session
Nitrogen transfer from agroecosystems to forests: White-tailed deer foraging in multiple-use landscapes

Steven W. Seagle, Appalachian State University

Abstract: Herbivores have the potential to transfer nitrogen among component ecosystems within a landscape when: (1) herbivores are numerous, (2) herbivore feeding preferences differ among ecosystems, and (3) herbivore movements among ecosystems facilitate non-random nitrogen deposition. These conditions have been hypothesized for overabundant white-tailed deer (Odocoileus virginianus) that inhabit landscapes of mixed agricultural and forest ecosystems. To test this hypothesis, field sampling of deer dung deposition was carried out at 40 randomly chosen forest sites in Baltimore County, MD, over a 12-month period. This information was used to estimate total nitrogen deposition from both deer dung and urine. Total deer nitrogen deposition for these forest sites varied considerably, but was largely within the hypothesized range of 1.0-15.0 kg N/ha/yr. This variation was partially explained by landscape characteristics specific to the sampling sites. Based on isotopic composition, most of the deposited nitrogen came from agricultural sources. Within this landscape, deer facilitate a transfer of nutrients among ecosystems that may have significant impacts on forest-floor ecosystem processes.

Symposium: Poster Session
Roads as barriers and conduits for connectivity: using multiple taxonomic groups to assess road effects across multiple spatial scales

Daniel Smith, Western Transportation Institute
Reed F. Noss

Abstract: An important objective of conservation planning and reserve design is the provision for functional landscape connectivity. For instance, a well-connected network of reserves might support viable populations or metapopulations of species that might not be supported within single, isolated reserves. Roads present significant obstacles in achieving this objective. Recent research on the ecological effects of roads has demonstrated the range and intensity of impacts to landscapes and biodiversity. Results from three separate studies in Florida are discussed. We employed a broad approach to examine the overall effects of roadways on landscape connectivity for wildlife. Methods included road-kill and track surveys, mark-recapture and telemetry studies, and GIS models. Different taxa (e.g., carnivores, ungulates, selected herptiles, and small mammals) were used to examine effects of roads at multiple scales. This multi-species approach was used to determine presence/absence, movement patterns and landscape use in proximity to roads. Empirical data and landscape models for different taxonomic groups suggest distinctly different types of sensitivity to traffic, roads and road-related habitat fragmentation; hence, they require different conservation planning strategies.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 3:20-3:40, Salon E
The influence of landscape variables on spatial genetic structure of tailed frogs (Ascaphus truei) across old-growth and harvested forests on the Olympic Peninsula, Washington, USA

Stephen Spear, Washington State University
Andrew Storfer

Abstract: The coastal tailed frog (Ascaphus truei) is an endemic, old-growth associated stream amphibian in the Pacific Northwest thought to be especially sensitive to environmental disturbance. Therefore, it has often been assumed that timber harvest reduces population connectivity. However, results from previous studies have produced different conclusions in various landscapes, suggesting that habitat configuration may strongly influence genetic structure. To address this issue, we used a landscape genetic approach to identify key landscape and habitat variables that influence population structure. This study was conducted in old-growth forests of Olympic National Park and managed forests of Olympic National Forest to test if timber harvest altered genetic structure and ecological associations seen in natural landscapes. We used a spatial regression analysis to correlate specific landscape variables relevant to tailed frog ecology with estimates of gene flow. Results indicate that an isolation-by-distance model does not adequately describe genetic structure; instead variables such as drainage, solar radiation, and slope appear to constrain movement. We also present results of a test for significant differences in spatial models of gene flow between the old-growth and harvested forests. Conclusions from this study will provide guidance on managing forests to lower impact on stream amphibian populations.

Topic Area: Species distributions: populations

Symposium: Oral session

Time: Thursday, 10:20-10:40, Salons F, G & H
Image texture and productivity as predictors of bird species richness in the Chihuahuan Desert

Veronique St-Louis, University of Wisconsin - Madison
Anna M. Pidgeon and Volker C. Radeloff

Abstract: The rate at which global biodiversity is declining is cause for growing concern. It is thus becoming increasingly important to map patterns of biodiversity. The use of classified satellite imagery for monitoring biodiversity has limited utility in ecosystems with high within-habitat heterogeneity and broad ecotones. Here, we evaluate the usefulness of image texture and productivity indices from unclassified remotely sensed data for predicting bird species richness in the Chihuahuan Desert of New Mexico. Species richness was estimated from 10-min point counts conducted from 1996 to 1998 at 42 shrub- and grass-dominated plots. Soil-adjusted vegetation index (SAVI) and image texture measures were both calculated from Landsat TM data. Single measures of texture from Landsat TM data predict up to 66% of the variability in bird species richness. The heterogeneity in plant productivity (represented by SAVI values) at a given plot predicts up to 77% of the variability in bird species richness. These results represent a substantial advance in the application of remote sensing for mapping biodiversity.

Topic Area: Remote sensing II

Symposium: Oral session

Time: Tuesday, 2:20-2:40, Bonsai
Simulating landscape level disturbances: Representing all the pieces

Christine Stalling, USDA Forest Service, Rocky Mountain Research Station
Mary Manning and Jim Chew

Abstract: Landscape dynamic simulation modeling is one tool that can provide managers with a method of exploring predominant landscape processes and their variable effects on vegetation change. In order for managers to understand which process, or combination of processes, are the predominant drivers of change on a landscape it is useful to employ a "what-if" landscape dynamic simulation modeling system. SIMPPLLE is structured so that multiple scenarios, representing variable levels and combinations of disturbance events, can interact to attain model behavior that is more relevant to specific landscapes. This concept of representing variations of landscape level processes was applied to a 5th code watershed located in the Flathead River Basin of Montana in an effort to produce an integrated view of the Historic Range of Variation for forest plan revision efforts on USFS, Region One. Documented historic processes include natural fire ignitions (e.g. lightning strikes), ignitions by native Americans, ignitions with the influence of wind-driven events, severe mountain pine beetle (Dendroctonus ponderosae), and variable climate (warmer/drier, cooler/moister) conditions. Comparison of events and spatial and temporal interactions are explored on this landscape.

Topic Area: Simulation models: disturbance

Symposium: Oral session

Time: Thursday, 10:40-11:00, Bonsai
Abstract: Does the spatial configuration of stream reach types influence riparian plant species diversity? We hypothesized that for species in soil seed banks, diversity and density in ephemeral reaches would vary with proximity to a perennial stream reach, and would be lower in ephemeral reaches upstream (vs. downstream) of a perennial reach. We focused on seed banks, because many plants in dynamic arid-region floodplains produce long-lived seeds. The assumption was that wet conditions in the perennial reaches would augment fecundity, and floods would transport seeds into downstream reaches. We placed soil samples into growth chambers and monitored seedling emergence for one year as an indicator of seed density and diversity. Preliminary results for three Arizona rivers show that seed bank species diversity does not vary between perennial and ephemeral reaches, nor between upstream and downstream ephemeral reaches. These results also hold for the hydric subset of species, suggesting that riparian plant seeds are broadly dispersed beyond their point of production. For one river, density of hydric seeds was greater in the downstream (vs. upstream) ephemeral reach, consistent with our hypothesis. Variation among rivers in perennial reach length and distance between wet and dry reaches may contribute to the disparate patterns.

Topic Area: Species distributions: communities

Symposium: Oral session

Time: Thursday, 1:40-2:00, Salons F, G & H
Spatial patterns and controls on fire regimes in mixed conifer forests in California

Alan Taylor, Penn State University
Andrew E. Scholl and Carl N. Skinner

Abstract: Spatial variation in fire regimes is controlled by both physical and disturbance related constraints to fire spread. For example, topographic characteristics such as slope aspect indirectly influence fire regimes by affecting fuel moisture, the type and arrangement of fuels, and the location of barriers to fire spread. Spatial variation is also controlled by the time-dependent process of fuel accumulation. Burns can influence the spatial patterns of subsequent fires by temporarily reducing fuels in a burn patch. Consequently, patterns of burns may be self-organizing and time-dependent because fuels need to accumulate before a burned patch can burn again. Depending on the predominant source of spatial variation spatial patterns of fire regimes may be relatively fixed or shifting. In this paper, we use dense networks of spatially explicit multi-century tree-ring records of fire occurrence in the Klamath Mountains and Yosemite National Park to examine the influence of topography and time-since last fire on spatial patterns of burning prior to fire exclusion.

Topic Area: Recent advances and future innovations in multiscale systematic tree-ring reconstruction of historical fire regimes

Symposium: Oral session

Time: Tuesday, 2:00-2:20, Salon E
Comparing measures of connectivity on landscape networks using the FunConn tools -- as part of Patches, Corridors, and Connectivity

David Theobald, Colorado State University
J. Norman and M. Sherburne

Abstract: Landscape ecology is challenged to develop better understanding of functional connectivity across broad landscapes, and graph-theoretic approaches have emerged as a primary means of analyzing landscape connectivity. We have recently developed a set of GIS-based tools called FunConn that implement graph theory through what we call landscape networks. We use this framework to compare the ability of a range of network-based metrics to characterize landscape connectivity. These suite of metrics include 1st order and beyond-1st order metrics that include both edge and node-weighted values. We compare metrics on both simple, synthetic "caricature" landscapes as well as real-world landscapes.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 2:20-2:40, Salon E
Abstract: Fire regimes are a useful way to classify, describe and categorize the pattern of fire occurrence through time and space and can be described using seven fire regime attributes: seasonality, frequency, size, spatial complexity, intensity, severity and type. Over the last 20 years, assessing different methods for mapping burn severity using remote sensing has been an active area of research with good results. This work uses remote sensing to quantify the fire regime attributes of severity and spatial complexity for a 19-year time period in Yosemite National Park. The differenced Relative Normalized Burn Ratio was chosen to map burn severity for 99 large fires in Yosemite National Park that burned between 1984 and 2003. The resultant burn severity atlas was used to quantify the fire regime attributes of severity and spatial complexity. These current distributions of severity and spatial complexity are compared to historic, theoretical distributions and discussed. In addition, burn severity patches are compared to landscape variables such as slope, aspect, slope position and vegetation type/fire regime type. A better understanding of severity patches on the landscape currently is critical to understanding fire regimes and the effects of fires on communities, wildlife, invasive species, and many other factors.

Topic Area: Burn severity mapping: research and applications

Symposium: Oral session

Time: Thursday, 1:40-2:00, Salon D
Predicting desert tortoise habitat

Kathryn Thomas, US Geological Survey
Leila Gass, Ken Nussear and Todd Esque

Abstract: Wildlife managers must identify suitable habitat for relocation of individuals of the Mojave population of the desert tortoise (Gopherus agassizii), which is listed as "threatened". We applied predictive modeling techniques to develop spatial models of suitable habitat. Extensive tortoise occurrence data was contributed from multiple agencies. We resampled these data to a 1-kilometer resolution grid of tortoise presence cells; 20% was withheld for model evaluation. Environmental data, both existing and project-developed, were similarly resampled. Four predictive modeling strategies were applied: GARP, Biomapper, MaxEnt, and GRASP. Predicted habitat maps were developed using six environmental variables, as determined important by decision tree analysis, and 16 variables determined potentially important by ecologists. Only GRASP requires absence data. We developed two artificial absence data sets; one of randomly assigned absence locations and one with constrained locations. A total of twelve predicted habitat suitability maps were generated with grid cell scores normalized to a 1 to 100 scale. Map evaluation consisted of the receiver operator characteristic (area under curve) and a fuzzy kappa value for each map. Our final challenges consist of the best choice of habitat suitability map or map ensemble and the most appropriate expression of uncertainty in the suitability scores.

Symposium: Poster Session
Bandaging the fragmented habitats: Elephant corridors of India

Sandeep Kumar Tiwari, Wildlife Trust of India
P.S. Easa and V. Menon

Abstract: Fragmentation of wildlife habitats has threatened the long-term conservation of species, especially larger animals like elephants, which require extensive areas for survival. This is one of the causes of increased human-elephant conflict. Strategies to reduce the adverse effect of habitat fragmentation have been widely discussed and one proposed method for moderating the negative effects of habitat fragmentation is the preservation and restoration of biological corridors. Wildlife Trust of India initiated the work of identifying, ground-truthing, and mapping the elephant corridors of the country in 2001 and after three years of extensive work identified 88 elephant corridors - 12 in north-western India, 20 in central India, 14 in northern West Bengal, 22 in north-eastern India and 20 in southern India. About 77.3% of the corridors are regularly used by elephants and 31% of the corridors are of ecologically high priority. About 28.5% of the corridors are one kilometer or below in length, 24% of the corridors are under complete forest cover and only 22.8% of the corridors are without any major settlements. Major threats and Conservation Action Plans for individual corridors have been identified and are being taken up with respective state Governments to secure better elephant conservation and conflict mitigation strategy.

Topic Area: Conservation planning: analysis

Symposium: Oral session

Time: Thursday, 1:20-1:40, Boojum
Clearing forests for pasture is one of the primary causes of deforestation, leaving in its wake a landscape mosaic of scattered forest patches within a sea of introduced grasses. The locally accepted and traditional planting of live fences and leaving isolated trees in pastures are efficient landscape level tools for mediating the effects of forest fragmentation and conserving biodiversity in this managed landscape. The objective of our investigation was to characterize current landscape structure and to model silvopastoral systems' contribution to increasing structural connectivity. We (i) measured landscape metrics, (ii) calculated fragmentation grades at different spatial scales, (iii) quantified the spatial structure of the live fences in the landscape, and (iv) designed connection routes between forest patches of critical conservation value. Our results demonstrate that although Matiguas is a highly fragmented landscape (10% forests) with a 853 m mean functional distance between forest patches >10 ha, live fences form a complex structural network that connect 63% of the patches identified. Our results demonstrate that increasing silvopastoral systems such as live fences in Central American pastoral landscapes can diminish forest isolation and biodiversity loss in the MesoAmerican Biological Corridor in a manner that is readily acceptable by local producers.

**Topic Area:** Conservation planning:analysis

**Symposium:** Oral session

**Time:** Thursday, 1:20-1:40, Boojum
Public interpretation of urban bird habitat design guidelines on a self-guided tour of the University of Arizona campus in Tucson, AZ

Hampton Uzzelle, University of Arizona
Margaret Livingston

Abstract: Negative impacts of urbanization on native bird communities have been widely discussed in the literature. Many of these impacts can be mitigated at the scale of backyards through sensitive landscape design. However, adequate interpretation of current research into language and examples accessible to the public is often lacking. The University of Arizona campus, Tucson, was selected as a location for an interpretive exhibit because of its central, urban location and accessibility. Study methods focused on assessment of vegetation attributes and potential wildlife habitat on campus. Outcomes include: 1) landscape design guidelines focusing on habitat requirements of native species absent from the bird community in central Tucson, 2) an interpretive tour of campus illustrating design guidelines for habitat development, 3) a website (including a downloadable map of the tour) and resources for information on urban habitats, and 4) recommendations to improve the potential bird habitat on campus. It is our intent that this work serve as a model for other communities that are attempting to increase awareness of habitat loss, through interpretation of design strategies that increase potential for native birds to coexist with humans in urban areas.

Symposium: Poster Session
How accurate are fire-scar sampling methods at multiple scales?

Megan van Horne, Northern Arizona University
Peter Z. Fula

Abstract: Fire scars have been used to understand the historical role of fire in ponderosa pine ecosystems, but sampling methods and interpretation of results have been criticized for being statistically invalid, biased, or for leading to exaggerated estimates of fire frequency. We compared targeted sampling, random sampling, and grid-based sampling at different scales to a census of all 1,479 fire-scarred trees in a 1 km2 study site in Northern Arizona. Of these trees, 648 had fire scars that could be cross-dated to the year of occurrence in the 200-year analysis period. Given a sufficient sample size (approximately n=50), we concluded that all tested sampling methods and scales resulted in accurate estimates of the census fire frequency, with mean fire intervals within 1 year of the census mean. Quantifying differences in sampling approaches cannot resolve all the limitations of fire-scar methods, but does strengthen interpretation of these data.

Topic Area: Recent advances and future innovations in multiscale systematic tree-ring reconstruction of historical fire regimes

Symposium: Oral session

Time: Tuesday, 1:20-1:40, Salon E
Remotely sensed monitoring of vegetation phenology before and after disturbance events in Arizona

Wim van Leeuwen, University of Arizona
Grant Casady

Abstract: Drought and wildfire are widespread disturbance events that affect dryland ecosystem functioning and processes and can result in significant land cover change. The inter-annual and seasonal vegetation dynamics before, during, and after drought and wildfire events can be monitored using time series of biweekly composited MODIS NDVI (Moderate Resolution Imaging Spectroradiometer - Normalized Difference Vegetation Index) data. The objective of this research is to examine how satellite based phenological measurements can be used to quantify vegetation recovery after drought and wildfire disturbances. Pairs of wildfire affected sites and nearby non-burned reference sites were chosen to measure the post-disturbance recovery and account for climate variation. All site pairs were chosen in forested uplands in Arizona and were restricted to disturbance events that occurred in 2001 and 2002. Smoothing filters and fitting functions were applied to extract seasonal and inter-annual phenological metrics from the NDVI time series data from 2000 to 2006. The examined phenological metrics included the timing and greenness for the start, peak and end of the growing season as well as proxy measures for the rate of green-up and senescence and annual vegetation productivity. Pre-fire treatments and fire severity markedly affected annual productivity between the selected site pairs. The extracted seasonal metrics were shown to be useful for estimating the rate of post-disturbance recovery and timing of phenological greenness phases. The use of satellite based pheno-metrics shows potential for tracking vegetation cover type dynamics and changes in response to drought and wildfire disturbances.

Topic Area: Phenologies as integrative phenomena for landscape research

Symposium: Oral session

Time: Friday, 9:20-9:40, Salon D
Using the Normalized Burn Ratio to estimate burn severity in boreal Alaska: lessons learned

David Verbyla, University of Alaska, Fairbanks
Karen Murphy, Eric Kasischke and T. Scott Rupp

Abstract: The Normalized Burn Ratio (NBR) is a remotely sensed index that has been applied extensively in the western United States to estimate burn severity from Landsat TM and ETM+ data. NBR has been used in burn severity studies in Alaska with mixed results. Within the boreal region of Alaska confounding factors such as topographic effects due to low sun elevations, wet soils, vegetation effects, and deep organic horizons may be sources of error in estimating burn severity using NBR. The accuracy of NBR in mapping burn severity may be dependent upon spatial scale and level of burn severity. NBR may be a useful index for rapid and reliable mapping of burn perimeters and mapping unburned zones within a burn. However, it should be used with caution in mapping severely burned areas in boreal Alaska.

Topic Area: Burn severity mapping: research and applications

Symposium: Oral session

Time: Thursday, 1:20-1:40, Salon D
Three decades of land change in a flash flood-prone Haitian watershed

Anna Versluis, Clark University

Abstract: The level of deforestation in Haiti is frequently deplored, but there are few land-change studies that actually measure the amount, type, and location of deforestation and other land cover change. Here I present the results of a land-change analysis from one Haitian watershed over the past three decades. This particular watershed has experienced three highly fatal flash flood disasters in the last dozen years, and also is the main watershed feeding the Blanco River in the neighboring Dominican Republic, which was likewise the scene of a recent fatal flood disaster. Common wisdom from both the local and international communities suggests that deforestation in the watershed is a leading driver of these disasters, yet few basin-wide data exist to provide evidence to confirm or refute this understanding. To perform the land change analysis, I use data from Landsat imagery, aerial photographs, archival information, interviews and field research, and I use the combined image processing methods of spectral mixture analysis and classification trees.

Topic Area: Landscape change: modeling & analysis

Symposium: Oral session

Time: Tuesday, 2:40-3:00, Salons F, G & H
Does the spatial pattern of humpback whales in the North Atlantic Ocean provide insight into their population structure?

Vigness Raposa, University of Rhode Island
Kathleen J.

Abstract: The humpback whale (Megaptera novaeangliae) is listed as an endangered species under the U.S. Endangered Species Act and is considered a vulnerable species by the World Conservation Union. Conservation efforts to protect and restore this species are contingent on a thorough understanding of its population structure and the environmental features critical to its survival. Traditionally, one population was defined by the winter breeding ground in the North Atlantic, but recent research suggests there are multiple populations based on summer feeding aggregations. It is not certain, however, that survey effort has had the spatial extent and intensity necessary to adequately define the feeding aggregations. This question can be addressed by examining the spatial patterns of survey effort and of humpback whale sightings. The analyses will show whether humpback whale sightings are truly clumped or whether their spatial pattern is an artifact of the survey effort. If they are found to be clumped, the distances at which they aggregate can clarify the multiple population hypothesis. Once the spatial structure of feeding humpback whales has been elucidated, future work will determine the environmental features that characterize their distribution; identifying key habitat components is critical to the survival of this endangered species.

Topic Area: Spatial analysis: applications

Symposium: Oral session

Time: Thursday, 3:40-4:00, Salons F, G & H
Abstract: Deforestation and Land Use Change/Cover (LUCC) are important drivers on habitat loss and ecosystem fragmentation. The objective of this study was to analyze LUCC and their consequences on fragmentation of Tropical Dry Forest (TDF). The land use/cover map was constructed from the interpretation of multi-temporal Landsat satellite imagery and field work. Fragmentation parameters were obtained with FRAGSTATS. Annual deforestation rate at regional and local scale was 2% and ~ 1%, respectively. At regional scale LUCC are dominated by slash and burn agriculture and livestock, but at local scale deforestation is conducted by introduction of Agave tequilana, a permanent crop in time and space than slash and burn agriculture. This suggest that regional deforestation of TDF is more even, caused by introduction of agriculture and livestock, whereas the introduction of A. tequilana is spatially concentrated due to presence of particularly biophysical and economics conditions. In regional scale the greater number of patches was of agriculture, followed by the livestock; nevertheless spatial distributions of livestock patches were spatially heterogeneous, while agriculture patches was spatially aggregated. The fragmentation pattern on a regional scale is surrounding; while at local scale is intrusive. This information is particularly relevant to create public policies related to resource conservation and sustainable development.

Symposium: Poster Session
Assessing structural and functional connectivity with mathematical morphology

Peter Vogt, EC - DG JRC, IES, LMNH
Robert H. Gardner, Todd R. Lookingbill, Joseph Ferrari and Kurt H. Riitters

Abstract: Connectivity is essential for biological conservation and biodiversity preservation. The identification and mapping of structural elements of the landscape that may also act as functional corridors (i.e., dispersal pathways) is, however, an open issue. New methods based on mathematical morphology provide a generic and flexible way for classifying and mapping spatial patterns and simultaneously comparing these patterns with observed or simulated dispersal events. Morphological image processing routines also identify the importance of different landscape elements, labeling these as core habitat, satellite patches and movement corridors. We illustrate the definition and mapping of connectivity within the structurally complex landscape of the Delmarva peninsula and compare these patterns with the simulated dispersal pattern of the Delmarva fox squirrel. This approach reveals critical links in habitat connectivity which must be maintained to insure the persistence of this threatened species. These morphometric methods are general and robust, providing new insights into pattern-process linkages in multi-habitat landscapes.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 1:00-1:20, Salon E
A hierarchical framework for examining coupled human-biophysical processes in urban ecosystems

Steven Walters, University of Washington
Marina Alberti

Abstract: An understanding of processes and patterns associated with urban growth requires consideration of how human systems interact with natural biophysical systems. Urban ecosystem dynamics can be characterized as emergent properties that result from interactions among human and bio-physical agents. Traditional approaches have focused either on dynamics of human (e.g., economic and sociopolitical) systems with little consideration of linkages to biophysical systems, or on biotic and abiotic processes across landscapes with human behaviors largely represented as external forcings. We present an approach that explicitly considers the feedbacks between human impacts on natural systems and the effects of biophysical dynamics on human-mediated systems. Our particular focus is on land-use and land-cover change resulting from urban development in the Puget Sound region. Our conceptual model, precursor to an agent-based model of coupled human-biophysical systems, incorporates the interconnections among agents and the hierarchical relationships among components and processes that constitute urban ecosystems. This conceptual model allows us to examine alternate equilibrium states and shifts in system resilience as a function of alternate scenarios of change in human and biophysical systems. The goals are to better understand processes associated with urban growth, and to identify possible strategies leading to more resilient, integrative urban ecosystems.

Symposium: Poster Session
Simulation of post-fire vegetation recovery using LANDIS modeling

Y.Q. Wang, University of Rhode Island
Yuyu Zhou, Jian Yang, Zhiliang Zhu, Hong S. He, Don Olhen and David R. Larsen

Abstract: This study is to explore approaches for simulating changes in post-fire vegetation recovery. The Sanford fire site within the Dixie National Forest in central Utah Valley region is the study area. The fire site includes about 78,000 acres of forested land that were burned between June 17th and June 30th of 2002. We selected 18 vegetation species among 15 main ecosystem types in the region and considered topographic and environmental factors in the simulation. We used pre-fire existing vegetation types (EVT) data developed by the LANDFIRE project and the differenced normalized burn ratio (DNBR) data from the joint NPS-USGS national burn severity mapping project to establish the parameters, which include special attributes, land-type maps, establishment coefficients, and initial fire region and intensity. We then employed LANDIS 4.0 for post-fire vegetation recovery simulation with the obtained parameters in a 30-meter spatial resolution. The results include simulated post-fire re-growth of selected tree species and ecosystem distributions at one-year time intervals. The study shows that integration of DNBR and pre-fire EVT data is an effective approach to establish initial conditions for LANDIS modeling.

Topic Area: Simulation models: disturbance

Symposium: Oral session

Time: Thursday, 10:20-10:40, Bonsai
Multi-scale habitat relationships modeling of American Marten in Northern Idaho

Tzeidle N. Wasserman, Western Washington University
David O. Wallin

Abstract: Habitat composition and configuration are important factors influencing population persistence, growth, and genetic diversity of forest carnivores. American marten (Martes americana) are habitat specialists which depend on mature and old-growth forest types in the western United States, and are closely associated with late successional coniferous forests containing complex physical structure. We collected hair samples using non-invasive hair snaring at over 500 locations in the northern panhandle of Idaho, USA during the winter months of 2003, 2004 and 2005. Molecular genetic markers were used to identify samples as marten. Logistic regression was used to predict marten distribution as a function of habitat variables at multiple spatial scales. The habitat variables considered in the models included area and configuration of vegetation cover types, road density, and topography at several scales around each sampling location. Multi-model inference in logistic regression was used to predict suitable marten winter habitat at the landscape-level based on multi-scale environmental data. This analysis indicated that the nature and strength of the relationships between patterns of occupancy and habitat factors was highly sensitive to the scale of analysis. In addition, our results indicate that road density and the amount and configuration of forest cover and openings are important components influencing marten occurrence.

Symposium: Poster Session
Modeling forest composition in contrasting landscapes in the Central Hardwood Region with the integrated moisture index (IMI)

David Welch, Indiana University
Vicky Meretsky, Tom Evans and Burnell Fischer

Abstract: Oak dominance is expected to diminish in forests of the Central Hardwoods Region in the eastern United States. This loss is likely to have consequences for the diversity of trees, plants, and wildlife in these forests. Determining areas likely to maintain suitable oak habitat will aid in conservation efforts addressing these dynamics. Forest communities often vary with moisture differences across a landscape. The integrated moisture index (IMI) is a GIS-based approach that uses slope, aspect, drainage and other factors related to soil moisture to explain forest composition. An alternative IMI includes a more sophisticated drainage algorithm to improve predictive capacity of the model. The ability of these approaches to model forest composition is greater in a less disturbed heavily dissected landscape than in rolling terrain with greater disturbance. Results show that both land-use history and moisture gradients are important factors affecting the models' predictive abilities. The inclusion of soil parameters and better specified solar radiation variables may produce a model that is more sensitive to subtleties related to moisture in a landscape. Disturbance related to land-use history may reduce the importance of moisture gradient as a determinant of forest composition and complicate efforts to predict areas of oak habitat.

Topic Area: Species distributions: methods

Symposium: Oral session

Time: Tuesday, 10:40-11:00, Salons F, G & H
Population viability analysis based on studies of individual behavior

James Westervelt, Army Corps
Bruce MacAllister

Abstract: Long-lived species, such as the Gopher Tortoise in the US Southeast, exist in populations that have persisted over thousands of years. Typical population viability analyses are based on studies of populations over several to many generations. When a generation spans the career of an ecologist, studies of individual behavior and responses are preferred. In this talk we will report on our efforts to simulate a population based on published knowledge of the interactions of individuals with their environment - in light of anticipated habitat patch and connectivity structure. Our approach combines individual-based simulation modeling with GIS-based patch simulations within the context of climate and resulting weather patterns to predict natural population viability.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 10:00-10:20, Salon E
National forests on the edge: Examining residential development in forested landscapes

Eric M. White, USDA Forest Service, Ralph J. Alig and Susan M. Stein

Abstract: Residential development on rural lands threatens to impact the ecosystem services provided by both public and private forests. Rural areas located near public lands, particularly national forest system lands, have experienced amenity-driven migration and some of the greatest increases in residential development in recent years. Using projections of residential housing density, we identified private lands located within 10 miles of national forests and grasslands within the conterminous U.S. that are projected to experience substantial increases in residential development by 2030. Nationally, we project continued increases in the level of residential development on private lands located adjacent to national forest system lands. At the local level, a number of individual national forests were identified as likely to experience increases in residential development on more than 25% of the private lands located around their boundaries. To gain insight into land use change in rural forested areas, we also examine the conditions and trends in some of the factors influencing land use change in multi-county case-study areas identified as likely to experience significant increases in residential development.

Topic Area: Cultural landscapes II

Symposium: Oral session

Time: Friday, 8:00-8:20, Salons F, G & H
Landscape Ecology and Conservation: Melding the Agendas

John Wiens, The Nature Conservancy

Abstract: Every so often, someone or some group attempts to set forth an agenda for their discipline. The disciplines of landscape ecology and conservation, while young, are old enough to have experienced this several times. Such agenda-setting is a useful activity: it highlights key issues in a discipline, helps to focus research and funding on these issues, attracts attention because it is "forward-looking," and may even accelerate progress in understanding and foster wider application of the science to real-world problems. Yet agendas are usually confined to particular disciplines. I argue that landscape ecology and conservation are broadly overlapping and mutually reinforcing disciplines. Consequently, agendas developed by considering the shared issues and approaches may be more powerful, compelling, and productive than those developed in isolation. But where to begin? I suggest that many of the issues in both landscape ecology and conservation revolve around land use and land-use change. Land use is increasingly the prime determinant of all those attributes of landscape structure and function that landscape ecologists measure and analyze, and in many places it is the primary threat to biodiversity conservation and a major constraint on the effectiveness of protected areas. Understanding the socioeconomic and cultural drivers of land use can help practitioners in both disciplines frame their research agendas and develop ways of communicating their knowledge and understanding to those charged with management or decision making.

Topic Area: Toward a Collective Disciplinary Agenda for Landscape Ecology: Goals and Strategies

Symposium: Oral session

Time: Friday, 10:30-10:50
A comparison of statistical models for predicting moose habitat in the Liard Valley, Yukon

Yolanda Wiersma, Memorial University of Newfoundland
Robert F. Florkiewicz and Dean L. Urban

Abstract: Predictive habitat models are potentially useful tools for assisting wildlife managers in decision making in the face of habitat change, particularly over large regions. While predictive habitat models have been widely applied in conservation and ecology, the range of available models is varied. Few studies have constructed a suite of models to test model performance. Here, we used radio-collar moose data together with environment and habitat variables in a GIS analysis to build and test three types of predictive habitat models. We built and compared logistic regression, classification and regression tree (CART), and Mahalanobis distance-based models for moose habitat in the southeast Yukon. We validated our models using independent data, and found that, overall, the logistic regression model minimized error rates. In addition we discuss the contrast between using model selection and ecologically-based hypotheses a priori versus "blind" step-wise statistical procedures. We discuss how these models might perform in different applications and provide suggestions to guide selection of appropriate statistical models.

Topic Area: NASA-MSU Golley-Odum Symposium: Defining and modeling species-habitat associations: challenges across landscapes (and seascapes)

Symposium: Oral session

Time: Tuesday, 3:20-3:40, Salon D
Evaluating habitat use and connectivity using occupancy and density indices

Tammy L. Wilson, Utah State University
Thomas C. Edwards Jr

Abstract: Habitat models are often used to evaluate connectivity especially for habitat specialist species. This method ignores the potential for movement across non-habitat areas. We examine two indices of occupancy in order to evaluate space-use requirements and habitat connectivity for pygmy rabbits in a managed landscape. By doing this we make no assumptions about habitat use and permeability of habitat types. Previous studies have characterized habitat by focusing on areas at or near occupied burrows. These models have limited utility because they have poor sensitivity and underestimate connectivity. Rabbit occupancy and burrow density were recorded in 2006 on a randomly started hexagonal grid. The probability of rabbit occupancy and burrow density were extrapolated to create two surfaces, one representing probability of occupancy and another representing burrow density. If pygmy rabbits frequently remain close to burrows, maps of occupancy will closely resemble maps of burrow density. However, if rabbits are capable of making large movements, burrow density maps will be a poor predictor of occupancy. We use these indices in combination to evaluate habitat connectivity. If maps show high probabilities of rabbit occupancy in areas of low burrow density then connectivity of burrow complexes separated by significant distance may be high.

Symposium: Poster Session
Fuel treatment effectiveness in the United States

Michael C. Wimberly, South Dakota State University
Mark A. Cochrane, Adam Baer, Kari Pabst and Zhi-Liang Zhu

Abstract: The fire situation in the United States is characterized by a growing prevalence of larger and more intense fires that have increasingly severe consequences for affected ecosystems. Fuels management has become the primary strategy for limiting extreme fire behavior, reducing the area affected by wildfire, and minimizing the economic and ecological costs of fire. These activities take a multitude of forms, from prescribed fires to various types of mechanical fuel reduction or combinations of treatments. Although there are numerous examples in which treatments have mitigated the behavior and effects of individual fires, there is a pressing need to systematically evaluate treatment effectiveness across multiple fires in a variety of ecosystems. To accomplish this goal we are utilizing fire atlas information from the Monitoring Trends in Burn Severity (MTBS) project, along with the fuels and topography data from the LANDFIRE project, to undertake a national study of fuel treatment effectiveness. As a pilot study, we analyzed the effects of various fuel treatments on change in the Differenced Normalized Burn Ratio (dNBR) in two 2005 wildfires. Results indicated that dNBR was generally lower in treated than untreated areas, and provided a framework for extending the analysis to a national level.

Symposium: Poster Session
Grassland birds are not viable in the largest tallgrass landscape left in North America

Kimberly A. With, Kansas State University
Anthony W. King and William E. Jensen

Abstract: The Flint Hills of Kansas and Oklahoma comprise nearly 2 million hectares of native grassland, making it the largest tallgrass landscape left in North America. With <5% of the historical tall-grass prairie remaining, the Flint Hills should be an important conservation area for grassland birds. This region is heavily managed for cattle production and other agriculture uses, however. We sought to determine the conservation value of the Flint Hills for several grassland birds through an analysis of regional viability for Dickcissels, Grasshopper Sparrows, and Eastern Meadowlarks. We surveyed populations and monitored nesting success at sites representing the major management practices of the region (intensive early-stocking vs. season-long grazed pasture, hayfields, CRP fields). Daily nest survival rates were used to derive fecundity estimates in an age-structured matrix population model that projected annual population growth rates for each species by management type. These local-scale estimates were translated into a region-wide estimate of viability using Monte Carlo simulations that weighted the contributions of the different management types and bird habitat preferences to produce a probability distribution of viability for each species across the region. Based on trends over two years, Dickcissels are projected to be declining by 20-29%/year, Grasshopper Sparrows by 16-27%/year, and Eastern Meadowlarks by 12-24%/year in the Flint Hills. Current management practices geared toward sustaining the economic viability of this region thus do not support viable populations of these grassland birds, and point to the need for alternative land management options that balance the economics of agricultural production with conservation.

Topic Area: Species distributions: communities

Symposium: Oral session

Time: Thursday, 1:20-1:40, Salons F, G & H
Marketing to wildlife: conjoint measurement in conservation design

Abel Wolman, AGW Consulting, Inc.

Abstract: Field conservation data is often sparse or unavailable. For this reason, many conservation area and corridor designs must be constructed from estimated data consisting of various expert-based scoring, grading, rating, or ranking schemes. Systematic and traditional approaches to conservation design may produce meaningless results when derived from estimated data. The key measurement theory concepts of scale type and meaningfulness are outlined including a brief discussion of the implications of these ideas for conservation design. I describe an alternative form of fundamental measurement called conjoint measurement which involves the joint effects of two or more independent variables on the ordering of a dependent variable. A statistical form of conjoint measurement known as conjoint or tradeoff analysis has been used extensively in marketing and consumer preference research. I indicate how conjoint analysis may provide an alternative approach to generating expert-estimated conservation data. Conjoint analysis may also be deployed for marketing to wildlife. This latter concept is demonstrated for bison in the Greater Yellowstone Ecosystem.

Topic Area: Patches, corridors, and connectivity

Symposium: Oral session

Time: Thursday, 10:20-10:40, Salon E
An integrated approach to map forest conditions in southern Appalachians

Weimin Xi, Texas A&M University
Lei Wang, Andrew G. Birt, Robert N. Coulson, Maria D. Tchakerian, David M. Cairns, Charles W. Lafon, John D. Waldron and Kier D. Klepzig

Abstract: Accurate and continuous forest cover information is essential for a quantitative approach to forest management and restoration. However, in practice, ground-truthed, spatially-explicit forest data is often only available for federally managed lands. Moreover, these areas are often fragmented by parcels of privately owned forest for which reliable data are unavailable. As a result, many analyses are faced with a trade-off between using large, ecologically meaningful spatial scales with missing data, or choosing less relevant spatial scales dictated by the availability and completeness of data. This paper describes efforts to use satellite imagery, DEMs, empirically gathered forest cover information, and knowledge of the relationship between forest cover types and environmental variables to interpolate forest cover in the southern Appalachians. We used a CART based decision support system to model the relationships between the environmental variables and vegetation cover as measured by National Forest vegetation inventories. Our results indicate 70-80% classification accuracy for the pine forest types and up to 50-70% accuracy for the mixed forest types. We used the resulting model to estimate the composition of structure of landcover in areas with missing data. Issues for improving prediction accuracy as well as the utility of ground forest survey data are discussed.

Symposium: Poster Session
Simulating landscape influences on occurrence and spread of forest wildfires in a modern surface fire regime

Jian Yang, University of Missouri
Hong S. He

Abstract: Spatial heterogeneity of abiotic factors, vegetation, and humans affects forest wildfires interactively. To quantitatively study these three types of landscape influences, we integrated spatial statistics and a forest landscape model (LANDIS 4.0) to simulate forest wildfires on a topographic landscape in the Missouri Ozark Highlands. Fire occurrence was modeled as a two-stage process (ignition and initiation). The spatially varying ignition rate and initiation probability were estimated by a wide range of spatial covariates including land cover, topography, roads, municipalities, and ownership using a spatial point process modeling technique. Fire spread was simulated using a minimum travel time method in which effects of fuel, wind, topography, and fire suppression were modeled. A spatially explicit map of burn probability was derived from 1000-replicate simulations. Our results showed that (1) fire occurrences were spatially clustered near (<500m) roads on moderate (<25 degree) slopes and xeric aspects within public land, (2) human activities were a predominant factor in determining fire occurrence patterns, and (3) vegetation and topography strongly affected fire spread hence were still important ingredients in a modern anthropogenic fire regime. The resultant burn probability map can be used in fire risk reduction planning, and the simulation can be linked with other modules (e.g., Succession, Fuel) in LANDIS to address many important ecological questions such as effects of fuel management on wildfire and forest landscape.

Topic Area: NASA-MSU Golley-Odum Symposium: Integrating remote sensing of forest disturbances with models at broad scales

Symposium: Oral session

Time: Tuesday, 10:40-11:00, Salon D

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Simulation of annual net primary production and its response to global change for Leymus Chinensis Steppe in Xilin River Basin in Inner Mongolia, China

Fei Yuan, Arizona State University
Xingguo Han, Jianping Ge and Jianguo Wu

Abstract: Arid and semiarid drylands cover over 40% of the earth land surface, and it is important to understand how global climate change may affect the ecosystem functioning and services of the world’s grasslands and deserts. The main goal of this study was to investigate how the Inner Mongolia Steppe would respond to changes in climatic conditions and elevated CO2. We adopted the CENTURY model to simulate the annual net primary production (ANPP) of the Leymus Chinensis steppe, a dominant community type in the Inner Mongolia Steppe region. The model was evaluated using field observations, and performed reasonably well in predicting the dynamics of ANPP. Our scenario-based simulations indicated that at the current CO2 concentration, an increase in temperature by 2 degrees and in precipitation by 20% together could lead to a 3.18% increase in ANPP. Under the current climate conditions, doubling CO2 concentration could increase ANPP by 12.73%. However, the combination of increase in temperature by up to 4 degrees and decrease in precipitation by up to 20% could reduce ANPP by 2.01-45.56%. While further research is needed, the results from our study help better understand the possible effects of changing climate and CO2 on the Inner Mongolia Grassland.

Symposium: Poster Session

Time: Tuesday 5:30-7:00
Simulating the effects of climate changes on Far East boreal forests

Ningning Zhang, Institute of Atmospheric Physics, CAS
Yan Xiaodong and H.H. Shugart

Abstract: We used the latest MPI GCM model, Echam5, to drive a modified model FAREAST, in order to simulate the response of Russian Far East region boreal forests to climate changes in the future under A1b and B1 scenarios. Results show that tree line will clearly and rapidly move northward and to higher elevation under climate change. Boreal forest over southern Far East and plains area may increase more rapidly than northern and mountain area. However, a higher biomass growing potential of higher latitude and altitude was detected after transient period by our simulation. Larix is still the most important tree species over the Far East region in the future. Tree species such as Abies, Picea, Pinus, Betula, and Quercus increase under climate change in both scenarios. Moreover, forest biodiversity will also increase, especially in the southern Far East. In a control experiment, turning off fire, biomass or forest will not notably change, but the composition will. Scenarios which are highly dependent on human activity in the future may significantly affect the boreal forest of the Far East differently and may cause 2x change in total biomass.

Symposium: Poster Session

Time: Tuesday 5:30-7:00
The Wildland-Urban intermix dynamics in the nine states of southeastern U.S. from 1990 to 2000

Yangjian Zhang, University of Missouri
Hong S. He and Jian Yang

Abstract: The Wildland Urban Intermix (WUI) lies between urban and wildland areas, where housing structures are intermingled with wildland vegetation. The coexistence of permanent structures and wildland vegetation suggests that delineating WUIs is significant for resolving issues in WUI zones, such as reducing fire risk or preventing wildlife habitat fragmentation. Here we identified WUIs throughout the nine states of southeastern USA in 1990 and 2000, using demographic housing density and physical land cover data. In each single year, the states of Georgia and North Carolina had the highest WUI area and the states of Mississippi and Virginia had the lowest. From 1990 to 2000, states of South Carolina and Mississippi have seen the fastest WUI expansion, while North Carolina and Alabama have experienced a WUI reduction, but housing densities in each state have increased. Sensitivity analysis found that WUI areas respond quickly to shifts in vegetation density thresholds and low housing density thresholds, whereas they react slowly to changes in high housing density thresholds. This study further compares the landscape index of WUI in 1990 and that in 2000.

Topic Area: Cultural landscapes II

Symposium: Oral session

Time: Friday, 8:20-8:40, Salons F, G & H
A spatially explicit simulation of wildlife response to human recreation

Patrick Zollner, Purdue University
Esteban Fernandez-Juricic, Matthew Beard, Lynne Westphal, Cherie LeBlanc and Dan Blumstein

Abstract: There is a pressing need to understand how spatial and temporal patterns of human activity influence the use of habitat by wildlife. Outdoor recreational activities are growing and the number of tourists visiting biodiversity hotspots is expected to double by 2020 worldwide. We present a spatially explicit simulation model that compares alternative scenarios of human recreational activities to determine the sensitivity of multiple wildlife species to those activities. In a spatially simplistic scenario we compare the sensitivity of characteristics of the response of wildlife to human activities based upon the range of response shown in empirical studies of 150 bird species. We demonstrate that bird foraging success is most sensitive to the distance at which birds first detect humans and the frequency of human activity but less sensitive to the proximity birds allow humans to reach before flight, the distance birds move when they are disturbed by human activity, and the amount of time birds spend inactive following disturbance by humans. We conclude by discussing the implications of a more sophisticated version of this simulation for conservation planning, as illustrated by scenarios for development of a park in the vicinity of a black crowned night heron rookery in Calumet IL.

Topic Area: Species distributions: populations

Symposium: Oral session

Time: Thursday, 11:40-12:00, Salons F, G & H
Implications of the abundance-occupancy rule: Can atlas data be used to monitor avian population change?

Benjamin Zuckerberg, State University of New York
William F. Porter and Kimberley Corwin

Abstract: Population monitoring represents an essential component of conserving species in disturbed landscapes because extinction and colonization are often the culmination of years of population change. Scientists often collect occupancy data, but little is known about whether these data accurately reflect changes in abundance. New York is the first state to have completed two state-wide Breeding Bird Atlases (BBA). Our objective was to determine if occupancy changes are correlated with changes in relative abundance using two independent data sets: the BBA and the North American Breeding Bird Survey (BBS). The BBA is a comprehensive survey documenting the occupancy of birds in 5,335 5 X 5 km blocks between 1980-85 and 2000-05. Over the same time periods, the BBS collected bird abundance data on 198 roadside routes randomly distributed throughout the state. We found that there is a positive relationship between occupancy and abundance in 1980-1985 (n = 98, r² = 0.61) and 2000-2005 (n = 85, r² = 0.58). We also found that 20 years of occupancy changes were highly correlated, in both direction and magnitude, with changes in abundance (r² = 0.84). Forest generalists showed the greatest increase in occupancy, while the ranges of grassland and urban species showed the greatest decrease. We are currently testing whether species' probabilities of occurrence are negatively related to local extinction probabilities and whether these changes are affected by landscape composition. Our findings suggest that occupancy changes accurately reflect changes in abundance, and that distributional surveys offer a powerful tool for measuring population change.

Topic Area: Species distributions: methods

Symposium: Oral session

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