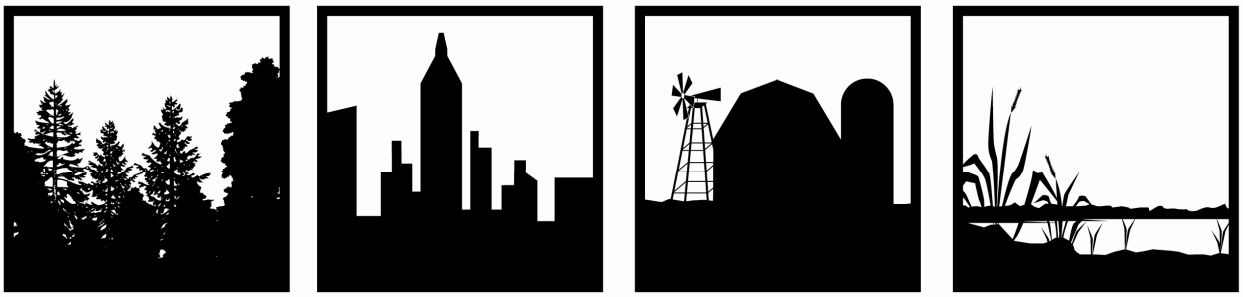

US - IALE

26th Annual Landscape Ecology Symposium
Sustainability in Dynamic Landscapes
Portland, Oregon / April 3 - 7, 2011

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HOW TO USE THE INDEX

The US-IALE 2011 Abstract Book includes abstracts for oral sessions, special symposia and poster presentations. **Abstracts are in numerical order** by "ABSTRACT ID" #, not by author. **The number of the abstract corresponds with [#] listed next to author name or keyword in the respective indices.**
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The first name in the Authors list for each abstract entry indicates the last name of the presenter. Presentation author order follows.

Please consult the Final Program publication distributed at the conference for an up-to-date listing of presentations by session, date, and time.

FULL CONFERENCE SCHEDULE

SUNDAY, APRIL 3

8a-4p	**All Day Workshops:** 1. Landscape Genetics 2. Eco-hydrology 3. GIS Tools for Analyzing Dynamic Landscapes	**Portland State University** *1. Science Building, Room 149* *2. Cramer Hall, Room 287* *3. Science Building, Room 82*
Noon-4p	Executive Committee Meeting	*Alexanders –23rd Floor*
Noon-7p	Conference Registration	*Plaza Foyer – 2nd Floor*
4:30-6:30p	Student Workshop	*Broadway – 2nd Floor*
7-9p	Welcome Social	*Alexanders – 23rd Floor*

MONDAY, APRIL 4

7-8a	Coffee Break	*Plaza Foyer - 2nd floor*
7a-5p	Conference Registration Desk Open	*Plaza Foyer - 2nd floor*
8-9a	Welcome Remarks: Rebecca Kennedy, Program Chair and Dean Urban, US-IALE President Plenary Address: Dr. David Hulse, University of Oregon, Landscape Architecture Program	*Pavilion Ballroom - 2nd Floor*
9-9:20a	Refreshment Break	*Plaza Foyer - 2nd Floor*
9:20a-5p	**Concurrent Sessions:**	

	BROADWAY 1	**BROADWAY 2**	**BROADWAY 3**	**BROADWAY 4**	**GALLERIA 1**	**GALLERIA 3**	**PARLOR B/C**	**STUDIO SUITE**	**FORUM SUITE**	**COUNCIL SUITE**
9:20a-noon	**Symposium 3** HUMANS AND RIVERS	**Symposium** 1 EXPERT KNOWLEDGE	**Symposium 2** CLIMATE CHANGE AND VEGETATION			Fire 1	Wildlife Ecology 1			Landscape Assessment
Noon-1p	Attendee Lunch and Student Mentor Lunch						*Pavilion Ballroom – 2nd Floor*			
1-2p	**Symposium 3** HUMANS AND RIVERS (continued)	**Symposium** 4 ULTRA	**Symposium 2** CLIMATE CHANGE AND VEGETATION (continued)					Arid Landscapes	Biogeography	Forest Landscape Modeling
2-3p	Fire 2									
3-3:30p	Refreshment Break						*Plaza Foyer - 2nd Floor*			
3:20-5p	Conservation Biology 1	**Symposium** 4 ULTRA (continued)	Scaling	**Symposium** 5 MODELING GC LANDSCAPES				Restoration Ecology	Land Use Planning 1	Global Change 1

5:30-7p	Poster Social	*Plaza Foyer - 2nd Floor*
7-9p	NASA-MSU Dinner (by invitation only)	*Pavilion Ballroom - 2nd Floor*
9-11p	Student Social	*Alexanders - 23rd Floor*

TUESDAY, APRIL 5

7-8a	Coffee Break	*Plaza Foyer - 2nd Floor*
7-8a	Landscape Ecology Editorial Board Meeting (invitation only)	*Senate Suite*
7a-5p	Conference Registration Desk Open	*Plaza Foyer - 2nd floor*
8-9a	Plenary Session: Dr. Robert Costanza, Professor of Sustainability and Director of the Institute for Sustainable Solutions, Portland State University	*Pavilion Ballroom - 2nd Floor*
9-9:20a	Refreshment Break	*Plaza Foyer - 2nd Floor*

TUESDAY, APRIL 5 CONTINUED

	BROADWAY 1	BROADWAY 2	BROADWAY 3	BROADWAY 4	GALLERIA 1	GALLERIA 3	PARLOR B/C	STUDIO SUITE	FORUM SUITE	COUNCIL SUITE
9:20a-noon	Symposium 6 RAILROAD LOGGING LEGACIES	Symposium 7 ECOSYSTEM SERVICES	Global Change 2	Conservation Biology 2	Riparian Landscapes	Remote Sensing	Sustainable Management			Landscape Change
1-5p	**Half-Day Field Trips**: 1. Washington Park, Japanese Rose Garden 2. Forest Park, Anderson Old Growth Hike 3. Best of Portland Walking Tour						*Depart from Hilton Main Lobby: Salmon Street between 6th and Broadway*			
6-7p	Cocktail Reception and "We'll Pick Up the Tab" Social						*Plaza Foyer - 2nd Floor*			
7-9p	Conference Banquet						*Pavilion Ballroom - 2nd Floor*			

WEDNESDAY, APRIL 6

7-8a	Coffee Break	*Plaza Foyer - 2nd Floor*
7a-5p	Conference Registration Desk Open	*Plaza Foyer - 2nd floor*
8-9a	Plenary Session: Dr. Larry Robinson, Assistant Secretary of Commerce for Conservation and Management, and NOAA Deputy Administrator	*Pavilion Ballroom - 2nd Floor*
9-9:20a	Refreshment Break	*Plaza Foyer - 2nd Floor*

	BROADWAY 1	BROADWAY 2	BROADWAY 3	BROADWAY 4	GALLERIA 1	GALLERIA 3	PARLOR B/C	STUDIO SUITE	FORUM SUITE	COUNCIL SUITE
9:20a-noon	Symposium 8 HISTORICAL ECOLOGY	Symposium 9 MODELING AND MANAGING	Disturbance 1	Symposium 10 MIXED-SEVERITY FIRE	Fragmentation	Urban Landscapes 1	Conser-vation Biology 3			
Noon-1p	Attendee Lunch						*Pavilion Ballroom - 2nd Floor*			
	BROADWAY 1	**BROADWAY 2**	**BROADWAY 3**	**BROADWAY 4**	**GALLERIA 1**	**GALLERIA 3**	**PARLOR B/C**	**STUDIO SUITE**	**FORUM SUITE**	**COUNCIL SUITE**
1-1:40p	Symposium 8 HISTORICAL ECOLOGY (continued)	Symposium 9 MODELING AND MANAGING (continued)	Disturbance 2	Symposium 10 MIXED-SEVERITY FIRE (continued)				Carbon	Spatial Analysis	Urban Landscapes 2
1:40-2p	Forest Ecology			Disturbance 3						
2-3p										
3-3:30p	Refreshment Break						*Plaza Foyer - 2nd Floor*			
3:20-5p	Global Change 3	Landscape Genetics	Disturbance 4	Wildlife Ecology 2					Spatial Analysis (continued)	Land Use Planning 2

THURSDAY, APRIL 7

8a-5p	**Full-Day Field Trips:** **1.** ULTRA: A Comparison of the Urban Ecology of Portland Oregon and Vancouver Washington **2.** Mt. Hood Alpine Adventure **3.**Tour of the Oregon Coast	*Depart from Hilton Main Lobby:/Salmon Street between 6th and Broadway*

ABSTRACTS

1. Spatial transferability of California fire regimes supplements sparse Oregon data
Authors: Newman, Erica Newman, University of California, Berkeley; Eric Waller, University of California, Berkeley; Max Moritz, University of California, Berkeley
Poster #68 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The distribution of wildfire across California and Oregon is regulated by the interplay of environmental and anthropogenic factors. Spatial distribution models, in combination with fire management records, newly available MODIS satellite fire observation data, and spatially explicit climate data, can be used to model and map the climatic niche of fire, determine the landscape-level driving factors of fire in California and Oregon, and generate predictive models for the probable climate-driven distribution of wildfire. Predictive fire-models are critical for a variety of policy, ecological, and human welfare goals. We use the MaxEnt spatial distribution modeling tool in combination with BIOCLIM long-term climate normals and derived water-balance metrics (generated for this project) to produce spatially explicit maps of relative wildfire probabilities with 1 km2 resolution. We investigate spatial transferability of a suite of California-based fire models to similar climatic regions in Oregon, which has only incomplete, spatially biased data. We then compare predicted fire return intervals within test regions for various common ecosystem types in northern California and Oregon based on 20- and 50-year average burn rates in California, and discuss model uncertainty.
Keywords: wildfire, pyrogeography, MaxEnt, Oregon, fire return intervals

2. Jaguar habitat and its connectivity in Yucatan, Mexico
Authors: Gomez Garcia, Paola Gomez Garcia, McGill University; Cuauhtemoc Chavez, National Autonomous University of Mexico; Gerardo Ceballos, National Autonomous University of Mexico; Sylvie De Blois, McGill University
Poster #65 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Over the last decade, many efforts have been deployed by conservation biologists to describe the geographical distribution of jaguars (Panthera onca), and to expand the knowledge of this endangered species. An specific conservation effort was the determination of Jaguar Conservation Units (JCU) across jaguars current distribution range. In the Yucatan Peninsula area (south-east Mexico) 6 regions have been determined as JCU. However, in a dynamic landscape such as the peninsula conversion of tropical forest to agricultural land and the construction of infrastructure such as roads and villages greatly affect how species move in a landscape; therefore, it becomes of great importance to provide objective, spatially-explicit habitat information for the management of the jaguar and elaborate rules for network and connectivity that would to fulfill realistic conservation needs. Using information from jaguar surveys, environmental variables and habitat modeling, I first identified potential suitable habitat patches for the jaguar using Maximum Entropy (MAXENT), and classify them in terms of such disturbance by means of GIS tools. Then measure structural connectivity between critical habitat patches, using a cost path approach. The identification of potentially suitable habitat patches at the landscape level will be useful to orient future jaguar surveys and, coupled with information on land management, will help determine whether land practices in the critical patches are compatible with jaguar conservation.
Keywords: suitable habitat, connectivity, jaguar, Yucatan, MaxEnt

3. Anthropogenic influences on macro-level mammal occupancy in the Appalachian Trail corridor
Authors: Erb, Peter Erb, University of Colorado - Boulder; William McShea, Smithsonian Conservation Biology Institute
Poster #1 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Anthropogenic effects on wildlife are typically assessed at the local level, but how such studies might generalize to other areas or spatial scales is difficult to determine. Macro-level occupancy studies are thus needed in order to assess impacts of multiple disturbance factors that might themselves vary over different geographic scales. Here we provide an exemplar study system that accounts for anthropogenic effects on multispecies mammal occupancy and distribution within the Appalachian Trail (AT) corridor that extends across a broad section of the eastern United States. Utilizing camera traps and a large volunteer network we were able to sample 447 sites along a 1024 km section of the AT to assess the effects of available habitat, hunting, recreation, and roads on eight different mammal species. Occupancy modeling revealed the importance of available habitat to all species except deer. Hunting was the second strongest predictor of occupancy for four mammal species, negatively influencing bears, bobcats, and deer, while positively influencing opossums. Modeling also indicated an avoidance of high trail use areas by deer and bears. Roads had the lowest predictive power on species occupancy in the corridor and were only significant for coyotes and deer. Our study represents broad-scale integration of local-scale anthropogenic pattern data. The resulting occupancy trends found at this regional scale stress the importance of including anthropogenic influences in future distribution modeling. Management should consider these human impacts and their potential combined influence on wildlife persistence with the AT corridor.
Keywords: Occupancy modeling, Mammal, Camera trap, Citizen science, Anthropogenic effects

4. Brown-headed Cowbirds are associated more with edge density within a small extent than with edge density within a large extent
Authors: Walker, Melanie Walker, Baylor University; Amy Liu, Baylor University; Tracy Pinney, Baylor University; Kevin Gutzwiller, Baylor University
Poster #2 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The Brown-headed Cowbird (Molothrus ater) parasitizes nests near vegetation edges in agricultural and woodland landscapes. Brown-headed Cowbirds are a conservation concern due to their potential influence on the reproductive success of other bird species. We hypothesized that cowbird presence was more associated with woodland edge density than with the density of other edge types, and that cowbird presence was more related to edge density within a small spatial extent than within a large extent. We studied birds at 75 study sites in the Oaks and Prairies region of Texas during the middle of the cowbird breeding season. We used logistic regression to relate cowbird presence to edge density for four cover types (woodland, grassland, agriculture, and developed area) within a small extent (1.8 km radius) and within a large extent (24.1 km radius). The densities of agricultural edge and woodland edge within the small extent were positively related to cowbird presence; woodland edge density appeared to have a slightly greater influence than did agricultural edge density. Edge density variables measured at the large extent were not related to cowbird presence. Our results suggest that woodland and agricultural edges have greater influences on cowbird presence than do grassland and development edges, and that densities of woodland and agricultural edges within smaller extents have greater influence on cowbird presence than do densities of these edge types within large extents. Conservationists should be cognizant that different edge types, and edge densities within multiple spatial extents, may have different relative influences on cowbird presence.
Keywords: Population ecology, Brown-headed Cowbird, Multiple spatial extents

5. Threshold responses of grassland breeding birds to landscape composition and configuration
Authors: Jarzyna, Marta Jarzyna, Michigan State University; William Porter, Michigan State University
Poster #3 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Understanding species habitat requirements is vital in developing effective conservation strategies. Identifying ecological thresholds in species responses to landscape change has proven an effective tool in recognizing species-specific habitat requirements. The majority of ecological threshold studies of avian communities have focused on forest species, but it is grassland-nesting bird species that have experienced the most significant population reductions in recent decades. Furthermore, few studies have attempted to quantify the response of grassland-nesting species to changes in land-cover, despite seemingly concurrent declines in bird populations with the observed decrease in agricultural and open land acreage. Using the New York State Breeding Bird Atlas, we tested for changes in occurrence of 10 grassland bird species as a function of composition and configuration of suitable habitat. Our goal was to investigate whether grassland birds exhibit thresholds in their responses to changes in land-cover and if they respond mainly to habitat loss or to changes in habitat configuration resulting from this loss. We used the National Land Cover Data to identify suitable habitat and conducted landscape analysis to quantify habitat amount and configuration. The binomial nonparametric change-point test and segmented logistic regression were used for modeling the relationship between the probability of species occurrence and suitable land-cover. Predictor variables included sampling effort and a suite of land-cover indices quantifying habitat composition and configuration. We found that most grassland birds exhibit thresholds in their responses to land cover change and that those thresholds are associated mainly with habitat composition rather than habitat configuration.
Keywords: Ecological threshold, Habitat loss, Habitat fragmentation, Grassland birds, Land cover analysis

6. Discharge or temperature? Exploring connections between hydrology and coho salmon run-timing and spawning in multiple subbasins
Authors: LovellFord, Rachel LovellFord, Oregon State University, Water Resources Science Program; Rebecca Flitcroft, US Forest Service, Pacific Northwest Research Station; Mary Santelmann and Sarah Lewis, Oregon State University, Department of Geosciences
Poster #4 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Pacific salmon life-history evolved within the complex and dynamic hydrogeomorphic setting of the Pacific Rim. Coho salmon (Oncorhynchus kisutch) are one of several species of Pacific Salmon found in coastal draining basins of the Pacific Northwest. Long-term resilience of coho populations has been attributed to diverse life histories the includes a range of conditions for run timing, in-stream juvenile movement, timing of smoltification and the use of diverse freshwater and saline habitats. In recent years, several populations of coho salmon were listed as threatened under the US Endangered Species Act. Along the Oregon coast, population declines have been linked to a variety of environmental changes from global to stream scales, including natural and anthropogenic effects. The decline in quality and quantity of in-stream habitat is a critical consideration and has been found by some to be more strongly correlated with salmonid population status than other environmental factors (Keffer 2008). Increasing our understanding of the connections between life-history stages and stream conditions can only improve conservation and restoration efforts. This study will explore linkages between coho salmon run timing and hydrologic conditions including hydrographs and temperature records. Analysis of adult coho salmon spawners will include two aspects of migration and movement. Analysis of adult coho movement through Winchester Dam on the North Umpqua River will give insight into migration triggers for coho in the mainstem of large rivers. Discharge and temperature along with bed condition, and water quality metrics such as TSS, pH and conductivity will be collected at spawning sites in the headwaters of four subbasins will begin to answer questions

regarding the relationship between flow and spawning. A variety of hydrologic analysis techniques will be used.
Keywords: Salmon, Hydrology, Run-timing

7. Predicting species-habitat relationships: The importance of considering the scale of effect and shape of species response
Authors: Martin, Amanda Martin, Carleton University; Lenore Fahrig, Carleton University
Poster #5 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Wildlife research and management often use habitat models to determine species habitat requirements and identify locations for conservation efforts. Published habitat models have largely relied on the relatively arbitrary, a priori selection of a spatial scale and a single modeling framework. We hypothesized that use of empirical data to select an appropriate scale of effect for each individual predictor variable should improve predictive accuracy over models assuming a single scale of effect. Furthermore, as different modeling frameworks make different assumptions regarding the shape of the species response to predictor variables, some methods should produce better predictions than others. To test these hypotheses we built single- and multi-scale models to relate measures of landscape composition and configuration to presence-absence data from the striped skunk (Mephitis mephitis) and raccoon (Procyon lotor) using three regression-based methods: generalized linear models, classification and regression trees, and generalized additive models. Predictive accuracy was assessed for an independent data set using Receiver Operating Characteristic (ROC) analysis, and models were compared by evaluating for statistical differences in the area under the ROC curve. Multi-scale models had greater predictive power relative to single-scale models, and the predictive accuracy varied depending on the method used to build the model. Our results suggest that predictions from habitat models can be improved by including predictor variables at their empirically determined best scale of effect and by investigation of the data using multiple modeling frameworks.
Keywords: Predictive habitat modeling, Spatial scale, Regression analysis, Model comparison, Receiver operating characteristic analysis

8. Monitoring impacts of African elephants on habitat use and species interactions of large herbivores in Botswana
Authors: Fullman, Timothy Fullman, University of Florida
Poster #6 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Southern Africa is home to the world's largest population of African elephants (Loxodonta africana). While this natural treasure serves as the basis for a booming tourism industry, generating jobs and revenue for local communities, there are concerns that with over 200,000 individuals in the region, elephants may be negatively affecting vegetation and other large herbivores, threatening the area's ecological integrity. Lying at the heart of the Kavango-Zambezi Trans Frontier Conservation Area, which spans five countries with a total area of 220,000 sq km, Chobe National Park provides an ideal place to generate understanding about the impacts of elephants that will be applicable across southern Africa. This project uses distribution models and spatial statistics to investigate the biotic mechanisms by which elephants may influence other large herbivores, ultimately affecting species diversity and ecosystem resilience. Mechanisms considered include vegetation modification, interference competition, and facilitation of highly competitive species. A better understanding of the influence of elephants on other species will enable more effective management decisions in an area where biodiversity conservation is essential for economic growth and local livelihoods.
Keywords: Elephant, Community ecology, Africa, Distribution models, Spatial statistics

9. Modeling vegetation cover to predict greater sage-grouse nesting habitat in Lava Beds National Monument
Authors: Stangler, William Stangler, Department of Geography; University of South Carolina

Poster #7 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Significant attention has been paid to understanding and mapping habitats for the greater sage-grouse (Centrocercus urophasianus) due to its status as a candidate for federal protection. Existing sage-grouse literature has tied suitable nesting habitat to cover of sagebrush and herbaceous plants and other environmental constraints. The purpose of this project is to predict potential sage-grouse nesting habitat within Lava Beds National Monument as a function of vegetation cover, elevation, slope and the time since the area was burned by a wildfire. This research and the resulting species distribution model is a combination of GIS applications, statistical analysis and field measurements.
Keywords: Sage-grouse, Species distribution modeling, Geographic Information Systems, Shrub-steppe ecosystem

10. Independent effects of compositional and configurational landscape heterogeneity on bee species richness and abundance at roadside sites in Eastern Ontario, Canada
Authors: Feagan, Sean Feagan, GLEL - Carleton University; Lenore Fahrig, GLEL - Carleton University
Poster #8 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: One goal of contemporary pollinator ecology is to determine the landscape factors that affect pollinator assemblages. However, most studies have only considered the effect of habitat amount in the land landscape. We hypothesize that landscape heterogeneity, independent of the amount of habitat, also affects pollinator assemblages through the processes of landscape supplementation and complementation. We used a focal point design to test the effects of landscape heterogeneity on the abundance and richness of a temperate bee assemblage. We selected 40 study landscapes throughout an agricultural region of Eastern Ontario using protocol to allow us to estimate the independent effects of compositional and configurational heterogeneity both, independently of habitat amount. We estimated bee richness and abundance via pan traps at roadside verges at the centre of each landscape. We predicted that bee richness and abundance would be highest at sites with high surrounding compositional and configurational heterogeneity (measured by Simpson's diversity index and patch density, respectively). We detected positive effects of landscape heterogeneity on bee species assemblages independent of habitat amount. Our results contribute to the understanding of the factors that determine bee diversity, with implications for pollinator conservation and management.
Keywords: Pollinator, Heterogeneity, Complementation, Supplementation, Bee

11. Does dispersal drive extinction risk for lizards in a 25 year fragmentation experiment?
Authors: Tarsi, Kika Tarsi, University of Colorado-Boulder; Kendi Davies, University of Colorado-Boulder
Poster #9 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: According to metapopulation theory, species with higher dispersal rates are expected to persist longer in fragmented landscapes because they are better adapted to balance local extinction and colonization events. Yet, despite a well-developed theoretical foundation for this relationship, experimental support for these ideas is lacking, primarily due to the logistical difficulties inherent in measuring dispersal in natural populations. However, contemporary advancements in molecular techniques (i.e. assignment testing) now offer powerful tools for obtaining indirect estimates of dispersal through population genetic structure. Coupling these techniques with metapopulation models, this study will test the prediction that species with lower dispersal rates have a greater risk of local and metapopulation extinction than those with higher dispersal rates when examined 25 years after the experimental fragmentation of their habitat. I will use an established, long-term, large-scale fragmentation experiment in Australia to determine how dispersal rates affect metapopulation persistence time for five sympatric lizard species. Understanding this relationship will allow me to

develop spatially explicit metapopulation viability models to predict extinction probability for fragmented populations, using an understanding of dispersal previously unattainable. As fragmentation continues to threaten biodiversity, it becomes increasingly important to understand the processes driving extinction in fragmented landscapes. This study will provide insight into the influence of connectivity on population persistence to determine if conservation measures restoring dispersal routes will aid in the struggle against biodiversity loss.
Keywords: Habitat fragmentation, Dispersal, Extinction risk, Lizards, Wog Wog experiment

12. Modeling bird habitat in the Walker River Basin of Nevada using LIDAR: a comparative analysis
Authors: Dilts, Thomas Dilts, University of Nevada Reno; Peter Weisberg, University of Nevada Reno; Elisabeth Ammon, Great Basin Bird Observatory; Jock Young, Great Basin Bird Observatory; Wesley Newton, United States Geological Survey
Poster #10 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Scientists have long modeled bird habitat using variables collected in the field, however, prediction of habitat has been hampered because of limitations in the extrapolation of plot level variables. LIDAR offers the potential to greatly improve bird habitat modeling for a number of reasons. These reasons include the complete spatial coverage that makes it easy to apply models over large landscapes, accurate measurements in difficult to reach places, such as in the upper canopy, and improved vertical and horizontal resolution of vegetation structure information. Although the use of LIDAR-derived vegetation structure variables are becoming more common, no study has ascertained which aspects of LIDAR data are likely to result in the greatest improvement in predictive models. This study compares three potential benefits of using LIDAR data and their effects on bird habitat models in the Walker River Basin. First we compare the advantages of using within-canopy structural data to variables that can be derived from a simple canopy height model. Second we assess whether variables derived at multiple spatial scales confer advantages over a single fixed scale. Third we assess the effect of increased horizontal resolution on the derivation accurate categorical vegetation maps compared to traditional digitized vegetation maps. The results of this study will help provide a roadmap" for future habitat modeling studies using LIDAR-derived data."
Keywords: Model, Bird, Habitat, LiDAR, Species distribution models

13. Reproductive rate and body size predict road impacts on mammal abundance
Authors: Rytwinski, Trina Rytwinski, Carleton University; Lenore Fahrig, Carleton University
Poster #11 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Over the last 100 years, North America's landscapes have become increasingly fragmented by roads. Several hypotheses have been suggested for predicting the types of species whose populations should be most negatively affected by roads. For instance, mobile species should be more negatively affected by road mortality than less mobile species because they interact with roads more often, and species with lower reproductive rates and longer generation times should be more susceptible to road effects because they will be less able to rebound quickly from population declines. Taken together, these hypotheses suggest that, in general, larger species should be more affected by road networks than smaller species because larger species generally have lower reproductive rates, longer generation times, and are more mobile than smaller species. We tested these hypotheses by estimating relative abundances of 13 mammal species across landscapes ranging in road density within eastern Ontario, Canada. For each species, we quantified the relationship between road density and relative abundance. We then tested three cross-species predictions, that the slope of the relationship between road density and abundance should become increasingly negative with: (a) decreasing annual reproductive rate; (b) increasing home range area (an indicator of movement range) and; (c) increasing body size. All three predictions were supported in univariate models, with R2 values of 0.68, 0.50, and 0.52 respectively. The best overall model contained both reproductive

rate and body size (R2=0.77). Our results suggest that priority should be placed on mitigating road effects on large mammals with low reproductive rates.
Keywords: Landscape fragmentation, Road density, Population abundance, Road mitigation, Landscape structure

14. Spatial monitoring of forest landscape dynamics with permanent plots, Landsat time series, and nearest-neighbor imputation
Authors: Ohmann, Janet Ohmann, US Forest Service; Matthew Gregory, Oregon State University; Heather Roberts, Oregon State University; Robert Kennedy, Oregon State University; Warren Cohen, US Forest Service
Poster #14 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The Northwest Forest Plan, which aims to conserve late-successional and old-growth forests (LSOG) and associated species, significantly reduced harvesting of older forests on federal land in the Pacific Northwest. For Effectiveness Monitoring of the Plan, we tested the feasibility of integrating field plot data with Landsat time series to map forest change using gradient nearest neighbor imputation (GNN). Landsat data were developed from a trajectory-based, pixel-level method that detects subtle changes from growth and disturbance and reduces noise from sun angle and seasonality. Reference data were from 17,000 permanent plots measured from 1993 to 2008. We modeled detailed forest attributes across 23 million ha for two imagery dates, 1996 and 2006. Forest attribute data associated with GNN map pixels were classified as LSOG or not-LSOG at each model date, then 'subtracted' to map LSOG change. There was no net change in LSOG on nonfederal lands over the period, whereas there was a slight net loss of LSOG from federal lands. LSOG losses were mostly from wildfires, and were partially offset by ingrowth, but patterns varied geographically. Although LSOG change at the pixel scale was noisy, net change aggregated over larger landscapes was reasonable and was corroborated by remeasured plots. Independent model validation, through expert interpretation of Landsat time series and aerial photography, showed that LSOG loss was reliably mapped in areas of moderate to severe disturbance. LSOG gain (ingrowth) could not be reliably modeled over such a short period. Ongoing methods enhancements should improve capabilities for mapping more subtle changes.
Keywords: Landscape change, KNN, Old growth, Northwest Forest Plan, Pacific Northwest

15. Mapping displacement vectors for forest age class composition and configuration change in Western Oregon from 1988 to 2008
Authors: Braaten, Justin Braaten, Department of Forest Ecosystems and Society, Oregon State University; Robert Kennedy, Department of Forest Ecosystems and Society, Oregon State University; Zhiqiang Yang, Department of Forest Ecosystems and Society, Oregon State University; Warren Cohen, US Forest Service, Pacific Northwest Research Station; Eric Pfaff, Department of Forest Ecosystems and Society, Oregon State University
Poster #15 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Forest structure is an important driver of ecosystem processes and biological diversity. With the profound influence of anthropogenic activity on western forests, it is important to monitor the change in composition and configuration of forest structure through time in a spatially explicit way. In this study, we use forest age as a surrogate for structure and map the direction and magnitude of change in composition and configuration of western Oregon forest age classes from 1988 to 2008. 1988 forest age was established from a combination of existing maps (Cohen et al. 2001 and Law et al. 2006) and each successive year thereafter was updated using a cascade approach, whereby forest disturbances identified in Landsat imagery from a trajectory-based change detection algorithm (Kennedy et al. 2010) were used to update the 1988 map for each yearly step of the time series. Displacement vectors for forest age class composition and configuration change between time intervals were mapped by classifying the two dimensional feature space of the difference in

landscape metrics calculated from a moving window analysis that represent forest age class area (X) and a measure of configuration (Y) into classes that described whether the components experienced a gain or loss, whether the difference was high or low relative to the distribution of the population, and whether the contribution to the change from each component was even, high, or low. The classified feature space was then transformed back to a spatially explicit map. The mapped classes of composition and configuration change were organized into a logical hierarchy so that specific questions can be asked of the data and displayed or subset in a way that most effectively answers them.
Keywords:

16. Spatial distribution of American marten (Martes americana in relation to environmental change dynamics on the Kenai Peninsula, Alaska
Authors: Baltensperger, Andrew Baltensperger, University of Alaska Fairbanks; John Morton, Kenai National Wildlife Refuge; Falk Huettmann, University of Alaska Fairbanks
Poster #17 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: American marten (Martes americana) have always been considered rare on the Kenai National Wildlife Refuge (KENWR) Lowlands in Alaska, despite the persistence of a large, widely-distributed population in the Chugach Mountains. Lower densities on the Lowlands have commonly been attributed to shallow snow and poor habitat conditions that may not be conducive to supporting stable marten populations. Environmental conditions have been changing rapidly on the Kenai Peninsula, and while population levels in the Lowlands remain small, new data indicate that their distribution has been expanding over the past 10 years. Our goal was to estimate changes in the distribution of marten on the KENWR during the past century and correlate perceived shifts with changing environmental conditions. We compiled historic museum and trapping records over the past century and compared them to contemporary detections of marten from aerial digital videography and telemetry studies. Georeferenced locations of marten were used as training data in RandomForestsTM (Salford Systems, Inc.) to create two spatially-continuous ecological niche models (historic and contemporary) for marten across the Kenai Peninsula. Detections and distributions were correlated with spatially explicit landscape processes related to climate change: fire history and spruce bark beetle (Dendroctonus rufipennis) damage. We used historic snow records at Kenai snow stations to describe changes in maximum snow depths over the past 70 years. We also tabulated the number of days that marten were exposed to stressful thermodynamic conditions. In addition, we offer projections regarding the effects of changing environmental conditions on future marten distribution on the Kenai Peninsula.
Keywords: American marten, Spatial modeling, Climate change, Distribution, Kenai Peninsula

17. Environmental correlates of malaria risk in a highland region of Ethiopia
Authors: Midekisa, Alemayehu Midekisa, Geographic Information Science Center of Excellence, South Dakota State University; Hiwot Teka, Anti-Malaria Association, Addis Ababa, Ethiopia; Gabriel Senay, Geographic Information Science Center of Excellence, South Dakota State University; Geoffrey Henebry, Geographic Information Science Center of Excellence, South Dakota State University; Michael Wimberly, Geographic Information Science Center of Excellence, South Dakota State University
Poster #18 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Malaria is a major health problem in most sub-Saharan Africa countries, including Ethiopia. Mosquito populations and malaria risk are affected by environmental drivers, including rainfall, temperature and humidity. These environmental factors can be measured using earth observing satellites. Currently, the availability of up-to-date and reliable satellite data will offer new opportunities for novel application of epidemiological risk monitoring and disease forecasting. This study examined the relationship between remotely sensed climate variables and temporal patterns of malaria cases

for 15 sites in the Amhara region, Ethiopia. Rainfall data were acquired from the Tropical Rainfall Measuring Mission (TRMM) with 0.25 degree spatial resolution. Land Surface Temperature (LST), Normalized Difference Vegetation Index (NDVI), and Enhanced Vegetation Index (EVI) were derived from MODIS 8 day and 16 day composites with a 1 km spatial resolution. Actual evapotranspiration (ETa) was modeled using the simplified surface energy balance method. Malaria case data were acquired from the Anti Malaria Association (AMA), Ethiopia. We used cross correlation to estimate the lag period between environmental predictors and malaria cases. Results indicate that malaria cases exhibited seasonality, inter-annual variability, and spatial variability within the study sites. We found lagged relationships between remotely sensed climate variables and temporal patterns of malaria cases. Malaria cases were significantly correlated at lags of 1-2 months with rainfall LST, vegetation indices, and ETa. These preliminary results will serve as a starting point for future modeling efforts to develop a Malaria Early Warning System for the Amhara region, Ethiopia.
Keywords:

18. Integrating electro-optical and LiDAR data to characterize conifer forest conditions
Authors: Friesen, Beverly Friesen, U.S. Geological Survey; Stacy Curry, U.S. Geological Survey; Chris Cole, Parallel, Inc.
Offered Presentations: Disturbance 4 - Wednesday (2011-04-06): 16:40 - 17:00 - Broadway 3
Abstract: Colorado has experienced widespread conifer mortality during the past several years, much of which has been attributed to the Mountain Pine Beetle (Dendroctonus ponderosae) epidemic. Grand County, Colorado, which has experienced Lodgepole pine (Pinus contorta) die-off, exemplifies this phenomenon. This conifer mortality may precipitate changes in forest composition and species distribution at the stand to landscape scale. The U.S. Geological Survey (USGS) is integrating electro-optical, namely Civil Air Patrol's Airborne Real-time Cueing Hyperspectral Enhanced Reconnaissance (ARCHER) imagery, and discrete return LiDAR data to characterize conifer forest distribution, health, and structure within two micro-study areas in Grand County. The ARCHER imagery is being used to produce a fine-scale forest inventory to identify living and dead conifer cover, including red and gray mortality stages, in these two study areas. We coincidentally collected in-situ vegetation information to perform spectral analysis, classification, and validation. We are employing a suite of vegetation indicesâ€"Normalized Difference Vegetation Index (NDVI), Greenness, and conifer mortality stageâ€"which are optimized to take advantage of the ARCHER instrument's discrete spectral resolution. The imagery and derived vegetation indices are being used in conjunction with the LiDAR data to quantify understory cover and structural attributes: tree height, canopy cover, Leaf Area Index (LAI), and biomass. This study is important in that its synergistic approach may produce superior results to those using active or passive sensors alone.
Keywords: Forest, Remote sensing, LiDAR, Beetle, Grand County

19. Quantifying the regional variation in forest ecosystem light-use efficiency using airborne remote sensing data
Authors: Serbin, Shawn Serbin, University of Wisconsin - Madison; Philip Townsend, University of Wisconsin - Madison
Poster #20 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Forests are a globally important resource, playing a critical role in the terrestrial carbon cycle and influencing climate through the exchange of mass and energy with the atmosphere, as well as providing other significant ecological and economic services. In order to better understand the continued role of forest ecosystems in the functioning of the terrestrial biosphere detailed assessments of carbon and nutrient cycling are needed along forest successional trajectories, across climate regions, and in response to ephemeral disturbances. Remote sensing approaches offer great potential to estimate the landscape- to regional-scale productivity in the world's forests, as well as other critical constituents related forest carbon cycling and ecosystem function, including nitrogen

concentration, pigments, water content, morphology, and structure. In this project, we are utilizing imaging spectroscopy (i.e. hyperspectral) data in conjunction with extensive field measurements to derive spatially explicit estimates of light-use efficiency (LUE, Îµ), a key component in remote sensing of productivity, based on forest functional properties (i.e. chemistry and leaf morphology) and canopy architecture. Preliminary results show strong predictions of canopy chemistry, morphology and resulting LUE across diverse forest types. This data is being used in a diagnostic model framework driven by data from the MODerate resolution Imaging Spectrometer (MODIS) sensor to quantify regional variability in net primary productivity (NPP) in the Upper Great Lakes region. This research is furthering our understanding of ecosystem responses to global change by testing the links between forest ecosystem processes and mechanisms that can be remotely sensed, thereby advancing large-scale modeling abilities.
Keywords: Imaging spectroscopy, Foliar nitrogen, Leaf morphology, Light-use efficiency, Remote sensing

20. Detection of Amazonian black earth sites using hyperspectral satellite imagery on regional and landscape levels
Authors: Palace, Michael Palace, Complex System Rearch Center - UNH; Mark Bush, Department of Biological Sciences, Florida Institute of Technology; Eduardo Neves, Universidade de Sao Paulo; Bobby Braswell, Atmospheric and Environmental Research, Inc.; Stephen Hagen, Applied GeoSolutions
Poster #21 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The pre-Columbian indigenous population estimates of the Amazon Basin lowlands are highly uncertain and the subject of considerable controversy. One of the archaeological sources used in reconstruction of Amazonian societies are Amazonian black earths (ABE) or in Portuguese, terra preta soils. The immense size of Amazonia, remoteness of many areas, forest vegetation, and lack of archaeological field surveys, make remote sensing beneficial to archaeological studies in this region. Remote sensing allows for comparison and analysis of vegetation across vast areas. Previous research has shown that hyperspectral image data can detect vegetation canopy chemistry differences, associated with soil nutrients and chemistry. We conducted a preliminary analysis that indicates nine portions of the spectrum where the three ABE sites are completely separable from the three non-ABE sites. The wealth of site locations from research done by co-authors and others provide a unique opportunity to develop algorithms for the classification of ABE and non-ABE sites. The large data volumes stemming from the 155 bands of hyperspectral data along with a great number of site sample points will produce a reliable relationship useful for statistical discrimination. The distribution and number of ABE sites provides information useful for both archaeological research and has consequences for the interpretation of Amazonian forest ecology. Knowledge of the disturbance history of the Amazonian forest provides a context and framework for the placement of all environmental research in the region.
Keywords: Indigenous, Tropical, Amazon, Remote sensing, Terra preta

21. Amplifying the temporal domain: Annual forest change patterns in the forests of the Northwest Forest Plan
Authors: Kennedy, Robert Kennedy, Oregon State University; Zhiqiang Yang, Oregon State University; Warren Cohen, US Forest Service; Eric Pfaff, Oregon State University; Justin Braaten, Oregon State University
Poster #23 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Process has long been inferred from pattern using landscape-level maps derived from satellite imagery, but until recently such maps have been either static or, if dynamic, produced at coarse temporal grains. New analytical tools based on Landsat Thematic Mapper imagery provide the opportunity to more directly track processes of change at appropriate temporal scales. We created

annual-resolution maps of forest dynamics within the range of the Northern Spotted Owl, an endangered species negatively affected by removal of established forests by both harvest and other disturbance agents. These maps of forest disturbance and regrowth for more than 18 million ha of forest land (of >23 m ha on all lands) were created through application of the LandTrendr temporal segmentation algorithms (Kennedy et al. 2010), previously described for individual pixels only but here developed into a mapping mode, and validated using the TimeSync tool (Cohen et al. 2010) for dense time-series TM data stacks. We then examine how rates and types of disturbance change at a yearly time step and how those patterns diverge for public and private forest management regimes. We further examine how regrowth from disturbance varies by environmental and forest management drivers.
Keywords: Disturbance, Forest, Remote sensing, Management, Time series

22. Examining the spatial and temporal ecology of vector-borne Lyme disease in New Hampshire
Authors: Czarnecki, Christina Czarnecki, University of New Hampshire; Michael Palace, University of New Hampshire; Ernst Linder, University of New Hampshire; Peter Ingraham, Applied Geosolutions; Chengwei Yuan, University of New Hampshire
Poster #24 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Vector-borne diseases have proven particularly difficult to study due to the association with host life cycles and behavior. Temporal and spatial variability of both vector-borne pathogens and host species insert additional complexity for study and management practices. Our research integrates earth observations and infectious disease ecology for the study of vector-born Lyme disease in southern New Hampshire, through the collection of field data, associating vegetation structural properties with host and tick habitats, and using the spatial and temporal information derived from remote sensing products to drive statistical eco-epidemiological models. Thirty field sites in eight vegetation types were established for data and specimen collection. Biometric properties of vegetation and weather data were collected at all sites. Ticks were identified and tested for Borrelia burgdorferi. We attempted to model the number of ticks found in a Poisson Regression (with logistic link function) by selecting important predictor variables from a list of candidate variables, including ticks found and disease incidence. The strongest indicators of tick abundance are forest edge density, forest patchiness, and barometric pressure. Disease incidence was harder to predict due to the limited number of test samples, but exploratory analysis reveals that soil moisture and forest patch size may be indicators. This spatially comprehensive data is used to drive and parameterize a spatially explicit hierarchical eco-epidemiological model that is capable of exploratory analysis of human Lyme disease cases and can possibly predict and estimate Lyme disease risk.
Keywords: Remote sensing, Lyme disease, Eco-epidemiology

23. Urbanization and exotic species invasions: interacting drivers of biodiversity loss
Authors: Stephens Davis, Amy Stephens Davis, UNC Charlotte; Ross Meentemeyer, UNC Charlotte
Poster #25 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Urbanization has devastating consequences for biodiversity due to habitat destruction. Additionally, invasions by exotic species also threaten biodiversity through competitive displacement. Although there is theoretical support linking urbanization to invasive spread, we are lacking the empirical data necessary to confirm this potential link. We hypothesize that urbanization is driving native plant declines by negatively influencing native richness via anthropogenic disturbance and fragmentation while facilitating invasions by exotic species. Additionally, not all development has occurred via the same landscape change trajectory, thus historical factors such as agricultural land use legacy may have confounding effects on the relationship between urbanization and plant diversity patterns. To test this, we are using structural equation modeling to assess the fit of conceptual path models specified a priori to empirical data, thus allowing us to distinguish direct and indirect effects of urbanization, landscape legacy, and exotic species invasions on native diversity. We selected the

evolving Charlotte, NC metropolitan area, which has been recently transformed by rampant development for our study system. To parameterize our models, we collected data on woody species diversity and resource availability from 180 plots across 40 upland hardwood forests located along an urban-to-rural gradient and quantified landscape change from 1938-2007 at each plot in a GIS. Our results will aid the implementation of sustainable development policies that accommodate growth while minimizing negative impacts to biodiversity. This is especially relevant in the southeastern U.S. where dramatic growth is anticipated and whose forests support some of the most biologically diverse communities in the world.
Keywords: Urban-rural gradient, Plant diversity patterns, Invasive species

24. Are lichens responding to urban air quality at a landscape scale?
Authors: Coffey, Heather Coffey, Carleton University; Lenore Fahrig, Carleton University
Poster #26 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Lichen diversity is related to air quality at a regional scale, increasing with distance to city centres. Here we ask whether lichens respond to air quality at smaller scales across a city, in landscapes up to 1km around sites. We hypothesized that other processes - differences in humidity and colonization pressure - might obscure relationships between lichens and air quality at these scales. We sampled lichen cover and diversity at 84 sites across urban Ottawa, Canada. We tested the independent effects of air pollution, humidity, and colonization pressure at multiple scales. We predicted lichens would respond negatively to traffic levels, as the principal source of air pollution within the city. We predicted lichens would respond positively to humidity, measured directly in the focal patch. Finally, we predicted lichens would respond positively to vegetative colonization pressure, measured as the treed (habitat) area around sites. Lichens did not respond to traffic levels, suggesting that air pollution is not affecting Ottawa's lichens at scales up to 1km around sites. Lichen diversity responded positively to humidity; the cover of individual species is either limited by, or independent of, humidity. Lichens did not respond to treed area, indicating that colonization pressure exerts a negligible influence on urban lichens. Additionally, the abundance of Candelaria concolour was a strong predictor of the diversity metric, making it an ideal indicator of lichen diversity values within the city. These results suggest that lichen relevÃ©es are not sufficiently precise to reveal urban air quality patterns due to traffic within urban Ottawa.
Keywords: Urban ecology, Greenspace, Bioindication, Land use, Soil sealing

25. Ecosystem service provision by forests embedded in urban landscapes: an NSF ULTRA-Ex project
Authors: Dorning, Monica Dorning, The University of North Carolina at Charlotte; Ross Meentemeyer, The University of North Carolina at Charlotte
Poster #27 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Complex interactions between social and ecological systems govern the health and function of remnant forest ecosystems in urban landscapes. The effects of urban landscape configuration on forest health and ecosystem service provision are understudied and the mechanisms underlying these relationships are unknown. Additionally, the metrics used to quantify urban land use patterns and ecosystem responses are often oversimplified. In this study, we improve upon existing quantification methods while assessing forest health and ecosystem service provision along a gradient of urbanization defined by numerous measures of urban form including housing and population densities, land use, vegetation structure, management intensity, and degree of imperviousness. Field measurements are being taken in over 500 plots across 100 forested parcels that vary in size from 2 to 30 hectares to document biodiversity, canopy stress, carbon sequestration, primary production, and air pollutant filtration. We are using multilevel statistical analysis to reveal the functions of individual tree species, aggregate function of the forest stand, and implications for regional forest health. Unraveling the relationships between land use intensity and ecosystem service

provision will lay the foundation for linking patterns to processes in urban landscapes. Cities are supporting an increasing proportion of the human population, and with proper planning remnant urban forests can perform vital ecological functions that reduce the need for expensive surrogates, improve quality of life, and foster sustainable relationships between humans and the ecosystems they depend upon.
Keywords: Ecosystem services, Urban ecology

26. Understanding urban forest structure of residential landscapes in the Seattle metropolitan urban(izing) region
Authors: Puruncajas, Karis Puruncajas, University of Washington
Poster #28 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Urban vegetation and natural spaces provide residents with daily connections to nature and local ecosystem services. Since the majority of U.S. residents are urbanites, the impact on and need for urban natural spaces are ever increasing. Vegetative communities are significantly altered by urbanization: impervious surfaces limit growing space, while chronic stress and land management alter abundance and composition. Because residential lands constitute the majority of metropolitan areas, household management activities can substantially affect ecosystem services. Previous assessments have failed to adequately represent the heterogeneity of the environment (variety of land uses, level of urban intensity). This project aimed to understand how household behaviors across a gradient of urbanization influence vegetation function and therefore provision of ecosystem services. My research objectives were to quantify vegetative spatial patterns on residential lands, assess household land management preferences and behaviors and quantify resultant aboveground carbon storage. I surveyed 100 residential parcels (stratified by land cover derived from LandSat imagery) to characterize residential forest structure across the urban gradient. I utilized allometric equations to estimate carbon storage. I mailed a questionnaire to each surveyed home, to compare the observed patterns to reported land management practices and preferences. I expect that carbon storage increases in suburban areas due to lot size; however once land cover is taken into account these same areas will still exhibit high variability due to differential preferences for large homes, turf grass and small, ornamental trees. This project will advance knowledge about residential land management and help urban planners achieve sustainability goals.
Keywords: Urban, Ecosystem services, Forest, Carbon, Household behavior

27. Assessing spatiotemporal dynamics of plant communities in urban landscapes: Phoenix, Arizona, USA
Authors: Ripplinger, Julie Ripplinger, Arizona State University; Janet Franklin, Arizona State University
Poster #29 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: More than half of the global human population now lives in urban areas, despite the fact that only 2.8% of the earth's surface is urbanized. Consequently, urban ecosystems have emerged as an important study system for understanding complex social-ecological systems. Yet, we have an incomplete picture of spatiotemporal components and drivers of urban resilience, and we are unable to anticipate transitions across critical thresholds. Building on theoretical work developed primarily in natural systems and considerable efforts by Central-Arizona Phoenix Long Term Ecological Research (CAP LTER) projects, we are exploring spatiotemporal dynamics of plant communities in urban and surrounding desert sites in the rapidly urbanizing Phoenix metropolitan area. CAP LTER inventoried plant communities at 200 randomly selected sites in 2000 and 2005. Previous analyses of these data detected associations between both environmental and socioeconomic factors (e.g. land use) and plant diversity and composition based on single survey years. We have detected changes in species frequency and abundance between 2000 and 2005. For example, dominant cactus species decrease in frequency from 2000 to 2005, while frequency of dominant tree and shrub species remain relatively

constant. We hypothesize that changes in relationships are related to environmental and socioeconomic factors but that their relative impact differs in urban, desert, and agricultural sites. This work is a preliminary step to identifying thresholds of change and discerning the applicability of ecological resilience theory in urban landscapes, which will contribute to our understanding of threshold behaviors in coupled human-natural systems.
Keywords: Urban ecology, Coupled human natural systems, Vegetation dynamics, Sustainable cities, Resilience

28. Walkability and environmental justice: an appraisal of Greenville County, SC
Authors: Davis, Reece Lyerly, Furman University; Molly McGee, Furman University; Brooke Stallings, Furman University; Amelie Davis, Furman University
Poster #30 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: This study assesses the walkability of neighborhoods in Greenville SC at two scales from an environmental justice perspective.
Keywords: Scale, Environmental justice, Walkability, Survey, GIS

29. Using Bayesian Belief Networks to Model Future Land Uses in Maine
Authors: Meyer, Spencer Meyer, University of Maine; Robert Lilieholm, University of Maine; Christopher Cronan, University of Maine; Michelle Johnson, University of Maine; Jon McCloskey, University of Maine
Poster #31 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The Lower Penobscot River Watershed of Maine (LPRW) is home to a significant regional interface between small, connected communities and the vast, undeveloped expanses of the Maine landscape. Parts of the LPRW have been identified as nationally significant areas that will likely experience further forest fragmentation in the coming years (Forests on the Edge 2005). Since 2000, 77% of Maine's population growth has occurred outside of traditional centers (Brookings 2006). The intrinsic land suitability for the often competing land uses of development, forestry, conservation and agriculture is not well understood. This project initiated development of a stakeholder-derived, decision-support system for identifying targets for future conservation, human development activities, and working forest and agricultural lands in the state of Maine. We use small, stakeholder workshops to gather expert opinion and then Bayesian belief networks (BBN) to integrate stakeholder values with empirical spatial data to 1) develop land use suitability maps that identify areas of potential conflict among land uses and 2) assess alternative futures scenarios to analyze potential impacts of various land use and population changes. The results of this project will be used to inform conservation efforts, economic development strategies and community and landscape planning across multiple spatial scales.
Keywords: Bayesian belief networks, Land use, Conservation, Forest fragmentation, Land suitability

30. Examining land cover influences on fish species richness in the Arkansas-White-Red river basin using path analysis
Authors: Shi, Lin Shi, Knox College; Yetta Jagger, Oak Ridge National Laboratory; Peter Schweizer, Oak Ridge National Laboratory
Poster #32 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Bioenergy crops are a promising contribution to future energy needs but large-scale production of bioenergy feedstocks may alter landscapes and affect aquatic ecosystems. The linkages between the landscape and aquatic biota must be better understood if we are to accurately predict environmental consequences of landscape change. Our analyses explored how different land cover types may affect fish species richness in the Arkansas-White-Red River Basin using path analysis. We developed four path models of increasing complexity to describe relationships between land cover types, water attributes, and fish diversity. We then assembled data for 173 watersheds in

our study area. We log-transformed our variables and verified the approximate multivariate normality, as required by the method. We used the sem package in R to compare models and test goodness-of-fit (GOF) statistics. Our results suggest that: (a) percent of forest has a strong positive association with flow and sediment loadings; (b) increasing sediment loadings and total phosphorous level coincide with greater percentage of agricultural land; and (c) higher fish species richness corresponds with elevated flow and higher nitrate loadings. Our results indicate that, within our study region, landscape characteristics have strong indirect influences on fish species richness. However, a subset of GOF indices was violated for two models. Future efforts will focus on resampling methods for comparing models, and on how to incorporate latent variables. We hope such adjustments can help better predict how fish species richness is likely to change in response to partial displacement of current land cover types by bioenergy crops.
Keywords: Fish richness, Modeling, Path analysis, Landscape change, Path analysis

31. Disentangling the effects of wetland loss and urban development on wetland plant and benthic invertebrate diversity
Authors: Patenaude, Theresa Patenaude, Carleton University; Lenore Fahrig, Carleton University
Poster #33 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Wetland plants and benthic macroinvertebrates are commonly used as indicators of human disturbance to wetlands. Two common landscape-scale disturbances are wetland loss and urban development in the landscape surrounding wetlands. Determining the relative effects of these two disturbances is important for developing policies for mitigating effects of human activities on wetlands. However, it is difficult to distinguish between these two effects due to the fact that they are often highly correlated: landscapes with high urban development often have low wetland coverage. We anticipated that species most affected by urbanization would be those which were physiologically sensitive to pollution, whereas species most sensitive to wetland loss would be those with limited dispersal capabilities. We evaluated the independent and relative effects of urbanization and wetland amount on wetland quality. We sampled plants and benthic macroinvertebrates in 20 wetlands in Eastern Ontario, Canada, which we selected to avoid the usual correlation between amount of wetland habitat and urban development (measured as amount of impervious surface) within the surrounding 1-km radius landscapes. Our results suggest that both urban development and wetland area in the surrounding landscape have independent effects on wetland quality. This implies that policies aimed at mitigating impacts of urbanization on wetlands through improvements to water quality will not be entirely successful; such mitigation measures should also include wetland restoration.
Keywords: Habitat loss, Urbanization, Ecological integrity, Macrophytes, Benthic invertebrates

32. Evaluating watershed-scale effects of agricultural land use and Best Management Practices on water quality in Spring Creek
Authors: Piechnik, Denise Piechnik, Penn State University - PSIEE; Sarah Goslee, USDA - ARS
Poster #34 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Landscape changes complicate assessing improvements in water quality due to conservation-based agricultural best management practices (BMPs) such as cattle crossings and buffer strips. Water quality was monitored before and after BMP installation in the Spring Creek Watershed (Centre Co. PA, Chesapeake Bay Watershed). Conservation BMPs were applied to 91% and 61% of the agricultural streambank within two subwatersheds (BMP1 and BMP2). A forested reference subwatershed (REF) remained unmodified. Land use determined from 2006 digital photography was 30% agriculture, 40% forested, and 30% developed. The effects of BMPs on water quality were evaluated using a hierarchical generalized linear modeling approach. Potential causal factors (land use, area of drainage, soil type, and presence of BMPs) that provided the best fitting models to the water quality response variables (N, P, pH, temperature, total suspended solids, and

storm discharge) were determined at multiple scales: watershed, subwatershed, and reach. BMPs did not predict nutrient concentrations despite reducing overall sediment. Drainage area at the stream reach and the subwatershed scales was significantly related to water quality. Land use and soil type were uninformative. Evaluating water quality at the watershed scale requires correction for emergent effects of land use change.
Keywords: Pasture, Landuse, Stream, Genearlized linear model

33. Spatial relationships between current conservation efforts and ecosystem service capacity
Authors: Villamagna, Amy Villamagna, University of Maryland; Nick Niazi, University of Maryland; Lauryn Cannon, University of Maryland; Paul Angermeier, University of Maryland
Poster #35 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Ecosystem services (ES), the benefits derived from ecosystems, have stepped into the conservation spotlight causing many to ask: how well do current conservation efforts protect or enhance the ecosystems that provide services? While provisioning services like crop or timber production tend to be protected by socioeconomic demand, regulating and cultural services are often overlooked and therefore may benefit from greater attention in conservation areas. We examined the spatial relationships between land currently managed by federal, state, county, and municipal entities within the North Carolina portion of the Albemarle-Pamlico basin to assess their potential to protect and enhance regulating and cultural services. We estimated the biophysical capacity of the landscape to provide water purification (regulating) and bird-watching (cultural) services using several publicly available geospatial layers and published estimates of land cover-based sediment and nitrogen removal efficiencies. We used species richness data from the North Carolina Gap Assessment to provide the biological basis for bird-watching capacity and overlaid the resulting maps with current managed lands to evaluate distributional patterns. We ranked managed areas based on their water purification and bird-watching objectives (4= not a priority to 1= primary priority) and compared these to measures of ES capacity and other ES-related landscape measures (i.e. total stream length). By examining bird hotspots (>70 species) across the basin we found significantly more hotspots outside of managed areas than within in the number outside. Overall, we found evidence suggesting that opportunities to enhance regulating and cultural services exist inside and outside of currently managed lands within the Albemarle-Pamlico basin.
Keywords: Ecosystem services, Regulating services, Water purification, Cultural services, Bird watching

34. Gradient nearest neighbor forest vegetation maps for landscape analysis and planning
Authors: Roberts, Heather Roberts, Oregon State University; Janet Ohmann, US Forest Service; Matthew Gregory, Oregon State University; Emilie Henderson, Institute for Natural Resources
Poster #36 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The gradient nearest neighbor (GNN) method combines field plot data with satellite imagery and other spatially explicit data (e.g. climate and topography) to produce detailed vegetation maps spanning large, multi-ownership regions. GNN is an imputation modeling technique that produces maps where each pixel is associated with the field plot that has the most similar spectral and environmental characteristics. Consequently, each pixel can be linked to the entire suite of measured and derived attributes from its nearest-neighbor plot, allowing users to map the distribution of any single plot attribute (or combination of attributes) across the landscape. The GNN models are useful as input for other types of models, including habitat suitability, fuels and fire risk, biomass and carbon, and landscape scenario models for evaluating alternative futures. We have produced GNN models that cover all of Washington and Oregon and large sections of northern California, central Colorado, and western Montana. The GNN models, accuracy assessment reports, and metadata are publicly available for download. We present four examples to illustrate possible applications of the GNN models: to map the distribution of selected forest attributes across Oregon, evaluate alternative forest

policy effects on biodiversity in the Oregon coast range, assess the risk of sudden oak death establishment in western Oregon, and quantify changes in late-successional and old-growth forests and habitat suitability for northern spotted owls and marbled murrelets in the Northwest Forest Plan area. In the future, we plan to provide periodically updated maps that account for disturbance (e.g. fire, insects, harvest) and regrowth.
Keywords: Pacific Northwest, Regional scale mapping, Landscape models, Imputation, Remote sensing

35. An analysis of the human-environmental factors which drive forest fragmentation in Massachusetts and implications for future development and conservation
Authors: Wright, Timothy Wright, Clark University; John Rogan, Clark University; Dominik Kulakowsko, Clark University; Rachel Riemann, US Forest Service; Kurt Riitters, USD forest service
Poster #37 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The conversion of natural landscapes to human land use is the largest driver of land-cover change and biodiversity loss in New England. Forest fragmentation occurs when large contiguous areas of forest become dissected into smaller patches separated by other human land-uses, such as new residential development or logging operations, and can compromise the integrity of native forest ecosystems. Massachusetts is a unique place to study land conversion and fragmentation because many of the land-use and development policies are controlled at the town level. To study fragmentation a methodology called morphological spatial pattern analysis (MSPA) was used to characterize the structure of forests in Massachusetts based on a year 2000 land-cover map. MSPA classifies the spatial pattern of each forest pixel into one of seven mutually exclusive categories: core, edge, perforated, loop, bridge, branch, and islet. The resulting MSPA map of forest structure was used to develop fragmentation indicators for each town in Massachusetts. The following indictors were chosen to reflect the many dimensions of fragmentation; the proportion of core and edge forest, the amount of perforation, the degree of isolated patches, the potential connectivity, and the ratio of core to edge habitat. The indicators of fragmentation are statistically compared to town information, such as zoning, percent of forested land, amount of protected land, land ownership, demographics, and development policy. A GIS analysis will be conducted to identify clusters of highly fragmented towns and examine how the drivers of fragmentation vary spatially though the use of geographically weighted regression analysis.
Keywords: Forest fragmentation, Massachusetts, Spatial pattern analysis (MSPA), Town-level policy, Regional landscape monitoring

36. Quantifying the impact of changes in crop area on ET regime in the US corn belt via phenology modeling and data assimilation
Authors: Kovalskyy, Geoffrey Henebry, South Dakota State University
Poster #38 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Recent fluctuations in food and fuel prices have induced substantial shifts in the crop area dedicated to corn and soybeans, potentially changing regional evapotranspiration (ET) regime across a large swath of the conterminous US. This study evaluates the effects of recent crop cover changes on actual evapotranspiration (ETa) dynamics in the US corn and soybean belts. We show the extent and significance of changes in ETa dynamics over ten growing seasons (2000-2009). Consequences of this regional land cover / land use change are quantified based on the seasonalities of evapotranspiration, canopy dynamics, and growing season metrics. Using daily forcings from the National Land Data Assimilation System (NLDAS), the operational VegET model (Senay 2008) was coupled to the Event Driven Phenology Model (EDPM) in this experiment to produce image time series of canopy characteristics and ETa together with growing season metrics. Crop cover proportions were obtained from MODIS-derived crop continuous fields (Chang et al. 2007). We demonstrate a new technique that uses phenological profiles to identify land cover transitions from

crops to grassland and vice versa. Working from the Seasonal Kendall test (de Beurs & Henebry 2008), this new method tracks the trajectories of canopy and evapotranspiration trends during particular periods in the growing season. We focus on trajectories that indicate the two transitions and assess their significance and spatial distribution within the study area. Our investigation shows that ongoing changes in cropping patterns have produced significant shifts in ETa dynamics over the past decade.
Keywords: Phenology, Land cover change, Evapotranspiration

37. The Appalachian Trail goes geospatial
Authors: Clark, Y.Q. Wang, University of Rhode Island, Department of Natural Resources; John Clark, University of Rhode Island, Department of Natural Resources; Roland Duhaime, University of Rhode Island, Department of Natural Resources; Fu Luo, University of Rhode Island, Department of Natural Resources; Chris Damon, University of Rhode Island, Department of Natural Resources
Poster #39 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Appalachian National Scenic Trail (A.T.) is a 2,175 mile long footpath that crosses 14 states in the eastern United States and intersects 8 National Forests; 6 units of National Parks; more than 70 State Park, Forest, and Game Management units; and 287 local jurisdictions. The A.T. and its surrounding protected lands support forested ecosystems that hold some of the greatest biological diversity in the country. The high elevation setting of the A.T. and its protected corridor provide an ideal barometer for early detection of undesirable changes in the natural resources of the eastern U.S. due to development encroachment, recreational misuse, acid precipitation, invasions of exotic species, and climate change. This poster presentation will introduce a NASA-funded project that integrates multiplatform remote sensing data, Terrestrial Observation and Prediction System modeling, in situ measurements from the A.T. MEGA-Transect partners, and geospatial data from different sources for the development of a decision support system to assist monitoring, reporting, and forecasting of the ecological conditions of the A.T. and surrounding landscapes. We will describe our current project efforts in remote sensing data preparation, Internet-based mapping and visualizations.
Keywords: Decision support, Mega-transect, Reporting, Monitoring, Forecasting

38. Nearest neighbor vegetation maps for landscape analysis and conservation planning: are they good enough, and how will I know?
Authors: Gregory, Matthew Gregory, Oregon State University; Janet Ohmann, Pacific Northwest Research Station, US Forest Service; Heather Roberts, Oregon State University; Rachel Riemann, Forest Inventory and Analysis, US Forest Service
Poster #40 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Nearest neighbor (NN) methods for predictive vegetation mapping are becoming increasingly popular in ecological applications in part because of their ability to simultaneously predict multiple forest attributes while maintaining reasonable covariance structures between variables. NN maps have been used in a variety of applications including small-area estimation of forest attributes, as input to vegetation dynamics models, and to characterize fire and disease risks across multi-ownership landscapes. The use of any NN map in subsequent analysis or modeling, however, should be predicated on the ability to characterize the errors and uncertainty present in the initial map. Additionally, users of NN maps should have accuracy information which aids in determining the appropriate spatial analysis unit at which to use these data. Recently, three new accuracy assessment protocols have been introduced for evaluating how well NN maps perform at a range of spatial scales for any mapped attribute. The protocols address different measures of map accuracy, including precision and bias, species community distance metrics, and spatial depictions of inventory plot-based confidence intervals. We demonstrate the accuracy protocols for a multi-state study area in the US Pacific Northwest, as part of Northwest Forest Plan Effectiveness Monitoring. We apply the

protocols to determine map accuracy for stand-level variables that characterize late-successional and old-growth forests. In addition, we compare the effect of prediction made from single versus multiple nearest neighbors (k) on these assessment measures. Information gleaned from this analysis can be used to provide insight into appropriate spatial analysis units and values of k.
Keywords: Accuracy protocols, Nearest neighbor, Northwest Forest Plan, Predictive vegetation modeling, Mid-scale assessment

39. Quantifying resistance of landscape characteristics to gene flow
Authors: Graves, Tabitha Graves, Northern Arizona University; Paul Beier, Northern Arizona University; Jeffrey Royle, USGS Patuxent Wildlife Research Center; Katherine Kendall, USGS Northern Rocky Mountain Science Center
Poster #41 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: We are developing a technique to estimate the effect of environmental characteristics on gene flow. To best maintain and restore connectivity within and among grizzly bear (Ursus arctos) populations, we want to understand how gene flow is affected by variables such as road density, number of buildings per square mile, highways, railroads, land cover type, and poor habitat. Current approaches for corridor planning usually rely on expert opinion. Current analytical techniques use coarse search techniques, but do not provide variance estimates. Our approach will provide estimates of the influence of each variable along with variance around our estimates. Here we report on a simulation study examining the ability of our method to detect true resistance to gene flow under different scenarios. We evaluate the influence of landscape characteristics (random, slightly patchy, very patchy), relationship form (e.g. linear, quadratic, logistic), and the underlying assumption of how animals see their landscape (randomly= resistances based on circuit theory and all-knowing= least cost paths). We examine bias and precision of our estimates under all scenarios and provide recommendations about when our approach will be most appropriate. Our next step will be to apply this technique to over 1500 genetic captures of 545 grizzly bears collected in 2004 across the ~ 8 million acre Northern Continental Divide Ecosystem. This technique will promote science-based corridor planning efforts for multiple species.
Keywords: Connectivity, Bear, Genetics, Corridors, Habitat

40. Model-predicting thick epiphyte layers and related parameters on Haida Gwaii (Queen Charlotte islands, Canada)
Authors: Huettmann, Moritz Schmid, Lincoln University, New Zealand and University of Goettingen, Germany; Falk Huettmann, -EWHALE lab-, University of Alaska Fairbanks
Poster #42 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Epiphytes (here: mosses, liverworts and lichens) have been extensively studied for over hundred years (Schimper 1888). Nowadays we know that especially mosses, which are the major part of the epiphyte layer of the Haida Gwaii landscape, are a major contributor to the nutrient cycle, the carbon storage, that they regulate aboveground productivity and determine soil hydrology on a landscape scale. What has virtually not been done yet is to model-predict epiphyte thickness and other related parameters of complete islands in order to link them to habitat suitability or to address climate change issues for instance. We show that our field data from Haida Gwaii in combination with a machine learning algorithm, makes for a new way to combine and data-mine knowledge about the occurrence of a tree nesting seabird, the Marbled Murrelet, with the predicted moss metrics, e.g. thickness and richness. Earlier studies, as well as our results, indicate that there is a predictable relation between the predicted moss parameters and the abundance of the Marbled Murrelet. These models will become more precise as we implement new environmental data, which are currently analyzed and forthcoming. It is beyond doubt that ongoing logging and introduced species such as deer have a major impact on epiphyte abundance and affect the ecosystem. We give an outlook how

future research could address (1) the impact of epiphyte loss on the carbon cycle and (2) epiphyte layers as an indicator of climate change when combined with future predictions of climate.
Keywords: Pacific rim, Model-prediction, Epiphyte, Marbled Murrelet, Climate change

41. Hot and cold spots of total nitrogen (TN), total phosphorous (TP), and TN:TP in the Upper Mississippi River, USA
Authors: De Jager, Nathan De Jager, USGS Upper Midwest Environmental Sciences Center; Jeffrey Houser, USGS Upper Midwest Environmental Sciences Center
Poster #43 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: We examined associations between hotspots (spatial clusters of observations with high values that are locally correlated) as well as cold spots (spatial clusters of observations with low values that are locally correlated) of total nitrogen (TN) and total phosphorous (TP) concentrations as well as TN:TP ratios and four aquatic habitat types: main and side channels, backwater lakes, and impounded zones, within five reaches of the Upper Mississippi River using a long-term data set consisting of 6000 observations gathered from 1994-2008. TN hotspots were positively associated with side channels in the spring and summer and negatively associated with backwaters during both seasons ($p<0.001$). On the other hand, cold spots of TN were negatively associated with side channels and positively associated with backwaters during both seasons ($p<0.001$). TP hotspots were positively associated with backwaters and negatively associated with impoundments during spring and summer ($p<0.05$). Cold spots of TP were almost nonexistent during summer ($n=21$), but during spring, coldspots of TP were negatively associated with main and side channels and positively associated with backwaters and impoundments ($p<0.01$). TN:TP hotspots were positively associated with the impoundments during spring and summer and TN:TP coldspots were positively associated with backwaters during spring and summer and negatively associated with all other strata during both seasons. These associations and maps of hot and cold spot distributions help to clarify the locations and dominant spatial and temporal scales across which N and P delivery, denitrification, and P release from sediments may be occurring in the Upper Mississippi River.
Keywords: Denitrification, Eutrophication, Patch, Cluster

42. How do longitudinal patterns of in-channel sediment transport relate to floodplain heterogeneity?
Authors: Van Appledorn, Molly Van Appledorn, UMBC; Matthew Baker, UMBC
Poster #44 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: River floodplains are often the most geomorphically complex features within a watershed because of their exposure to dynamic fluvial and ecological processes. Distinct longitudinal and lateral patterns of floodplain landforms and their associated ecosystem types are presumed to vary in conjunction with strong hydrologic and hydraulic gradients. However, our understanding of how floodplain landforms are related to in-channel sediment transport processes throughout entire river networks remains poorly understood. The purpose of this study is to understand how longitudinal patterns of in-channel sediment transport relate to within- and among-reach heterogeneity in floodplain morphology for a series of watersheds from Michigan's lower peninsula. We use a simple classification scheme based on first-order controls of sediment transport processes to identify four types of channel reaches: net erosional, net depositional, equilibrium, or transportive. Geomorphic features on floodplains are identified through cluster analysis of mapped-derived variables and terrain derivatives. Feature diversity, size, shape, and contagion are compared across the four channel types for all watersheds. We find that heterogeneity of floodplain landforms is lowest for channels classified as net erosional and net depositional. The greatest diversity of geomorphic features in floodplains is associated with equilibrium channel reaches. The discontinuous distribution of channel types throughout Michigan stream networks results in complex patterns of floodplain heterogeneity. The results from this study suggest that first-order processes governing sediment transport may be

useful for elucidating spatial patterns of sediment storage as an ecosystem function across entire watersheds.
Keywords: Floodplain, Sediment transport, Geomorphology, Ecosystem, Riparian

43. Building spatially-explicit model predictions for ecological condition of streams in the Pacific Northwest: an assessment of landscape variables, models, endpoints and prediction scale
Authors: Weber, Marc Weber, U.S. EPA; John VanSickle, U.S. EPA
Poster #45 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: While large-scale, randomized surveys estimate the percentage of a region's streams in poor ecological condition, identification of particular stream reaches or watersheds in poor condition is an equally important goal for monitoring and management. We use the enhanced National Hydrography Database (NHDPlus) as the spatial framework for building predictive models across the Pacific Northwest (Oregon, Washington and Idaho) of stream ecological condition (i.e. water quality, biological condition, and physical habitat). Using data from the US EPA EMAP-West survey, from the USGS NAWQA program, and from other regional monitoring efforts, we constructed a number of predictive models for several endpoints using 136 landscape metrics as predictor variables. We map model results to every NHDPlus stream reach in the PNW and aggregate the predictions across all reaches within each 12-digit USGS Hydrologic Unit (HUC) and map the HUC-averaged model scores. We discuss the substantial uncertainties of our predictions and suggest how they could be reduced, as well as address issues of result aggregation at coarser spatial scales (i.e. from individual stream reaches to watersheds or HUCs).
Keywords: Models, Prediction, Streams, Surveys, Scale

44. Effects of river valley segment sequencing on floodplain hydroperiods
Authors: Panunto, Matthew University of Maryland Baltimore County; Matthew Baker, University of Maryland Baltimore County
Poster #46 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: As ecotones between rivers and surrounding uplands, river valleys typically rank among the most biophysically complex and species rich ecosystems in any landscape. Although it is relatively well known that local channel, floodplain, and terrace morphology constrain the flow of water in river valleys, current understanding is based entirely on models that simulate water delivery from a contributing area and local hydraulics. The influence of upstream patterns of different valley segment morphologies in a river network has received almost no attention despite the fact that valley hydraulics are known to control rates of water export and thus can have a dramatic influence on floodplain hydroperiod and water delivery to downstream segments. We developed a novel approach for characterizing patterns of valley morphology using local distributions of relative elevation throughout the White River basin in southern Indiana. Morphologic valley types were distinguished and used to identify characteristic patterns of valley sequencing throughout the river network. Hydrologic and hydraulic simulations were then employed to parse the impact of valley sequences relative to watershed properties in determining floodplain hydroperiod. We found that the relative constraint of river valleys differs as streams traverse different physiographic regions, some of which are characterized by historical glaciations. The order in which rivers encounter regional valley constraints can act to influence water levels, leading to spatial variation in flood risk throughout the basin independent of upland landscapes. Our findings have particular relevance for conservation and restoration efforts focused on river valley biodiversity and ecosystem services.
Keywords:

45. Relative effects of wetland amount, configuration and matrix quality on wetland birds and turtles
Authors: Quesnelle, Pauline Quesnelle, Carleton University; Kathryn Lindsay, Environment Canada and Carleton University; Lenore Fahrig, Carleton University

Poster #48 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The relative effects of habitat amount, configuration and matrix (non-habitat) quality on population distributions are variable across studies, species and ecosystems. One of the primary sources of this variability is the fact that landscape-scale predictor variables tend to be highly correlated, which confounds inferential interpretation and statistical analysis. Our objective was to determine the relative effects of habitat amount, configuration and matrix quality on the distributions of turtles and birds of wetlands, an ecosystem relatively understudied in landscape ecology. We selected 70 wetlands using a protocol to minimize multicollinearity among the landscape variables surrounding the wetlands. We used principal components analysis to select an orthogonal and parsimonious set of landscape predictor variables that explained ~90% of landscape spatial structure within the study area. We then used a randomized stratified sampling design to select wetland sampling sites for which the correlations among landscape predictors were low, while at the same time representing the full range in variation in the predictor variables. For marsh-obligate birds, wetland amount had a greater effect on the occurrence of Least Bittern (Ixobrychus exilis; p=0.03) and Virginia Rails (Rallus limicola; p=0.02). Whereas higher matrix quality (ie: forested landscapes) had a greater effect on the occurrence of Blanding's turtles (Emydoidea blandingii; p=0.045). Our results reveal different wetland taxa respond to different landscape-scale factors which suggest wetland management practices must consider multiple landscape-scale factors to conserve multiple wetland species groups.
Keywords: Wetlands, Landscape ecology, Fragmentation, Marsh birds, Turtles

46. Go with the flow: Hydrological connectivity influences the dispersal of an invasive forest pathogen
Authors: Hohl, Ale, University of North Carolina at Charlotte; Tom V, University of North Carolina at Charlotte; David Rizzo, University of California at Davis; Ross Meentemeyer, University of North Carolina at Charlotte
Poster #49 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The Sudden Oak Death disease, caused by the rapidly spreading plant pathogen Phytophthora ramorum, has killed tens of thousands of trees in forest ecosystems of California. Understanding the effect of landscape connectivity on pathogen dispersal is crucial to identify infested locations and predict future disease spread. Previous studies assessed mechanisms of short distance dispersal but the possibility of inoculum transport in streams has not been adequately researched. We hypothesize that streams could account for long distance transport, and address this mechanism by evaluating the role of hydrological connectivity of host vegetation and environmental conditions in explaining the probability of disease infection. We established 145 stream baiting plots where pathogen presence or absence was assessed during the period of 2004-2009, and used logistic regression to model probability of infection based on nine environmental variables. We included (i) the â€œForce of Infectionâ€ component accounting for inoculum pressure and potential short distance dispersal, and (ii) the cost-distance analysis assessing the importance of hydrological connectivity for inoculum transport in watersheds. In order to determine the influence of environmental conditions in the immediate neighborhood of the stream baiting plot, we performed the analysis both at watershed and local scales. Our results show that hydrological connectivity facilitates infection risk at a watershed scale while being insignificant at a local scale, indicating a long range transport of inoculum through streams rather than infection from neighboring sources.
Keywords: Sudden oak death, Hydrological connectivity, Cost distance, Stream baiting

47. Assessing complexity and scarcity: Managing urban water supplies
Authors: Padowski, Julie Padowski, University of Florida; James Jawitz, University of Florida
Poster #50 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Urban growth places increasingly concentrated demand pressures on local and regional water supplies. As a result, water managers must carefully evaluate the limits of water supply

systems to ensure that all needs are met. The amount of water available to an urban area can be measured as the product of both the local environmental context and the overlying anthropogenic framework for water supply regulation and distribution. Policy and management issues arise when demands exceed the amount of water available, often requiring a change to the institutional framework of water management if conflicts are to be avoided. A novel approach was used to define the relationship between the institutional complexity and water availability for the 255 largest urban areas in the conterminous United States. Local water availability measurements were used to calculate the extent of each urban area's "water capture zone", or the spatial extent required by each urban area to meet current demands. For each capture zone, the institutional complexity was scaled according to current water management hierarchy. In cases where water capture zones are shared between two or more urban areas, institutional complexity is increased relative to urban areas which do not share water resources, suggesting that urban areas with low water availability must form more complex institutions to continue to meet demands. Estimates of population and water demand growth were used to extrapolate the extent to which water capture zones will grow and overlap in the future and where new management frameworks might reduce potential water conflict.
Keywords: Water availability, Institution, Water conflict

48. Dyna-Plan. Landscape-level ecosystem model. Integration and optimization of spatial and temporal scales in forest management planning
Authors: Gerzon, Michael Gerzon, University of British Columbia; Anne Mathey, Canadian Forest Service; Harry Nelson, University of British Columbia
Poster #67 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: DYNA-PLAN is a landscape-level model. It is capable of simulating forest ecosystem dynamics while also optimizing harvest schedules. GIS data provides input for the model. Landbase is separated to raster cells that represent forested stands. Stands can have multiple eligible treatment regimes that the model can select from. (These treatments and stand dynamics are provided by any separate stand-level model). Once a specific treatment regime is initiated by Dyna-Plan, it implements a set of management activities at predetermined times. The model selects harvest timing and treatment regimes for each stand over time that will optimize user defined objectives. Common objectives include maximization of income while maintaining specific levels of old-growth forest or wildlife habitat. DYNA-PLAN is unique in its ability to optimize management decisions using a decentralized approach (co-evolutionary cellular automata). Optimal solutions are first determined for each stand while considering the state of its neighbours. Where necessary to meet landscape-level objectives, local stand-level decisions are favored or penalized to satisfy global goals. Such process is similar to real world management where local decisions influence the whole landbase and where local management is regulated by global government policies. The way in which natural disturbances are implemented into the simulation is also similar to real world processes. As disturbances occur on the landbase, future management plans are constantly being changed to react to the changed state of the landscape. Connection of Dyna-Plan to stand-level models of stand-dynamics, hydrology, and soil properties can directly incorporate changes in climatic conditions along with the effect of management actions; and consequently can be used to test variety of forest management strategies.
Keywords: Forest management, Climate change, Landscape modeling, Ecosystem modeling, Ecosystem management

49. Relating ancient Maya land use legacies to tropical tree species composition of Caracol, Belize
Authors: Hightower, Jessica Hightower, UCF; John Weishampel, UCF; Arlen Chase, UCF; Diane Chase, UCF
Poster #52 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Human land use legacies have significant and long lasting impacts across landscapes. However, investigating the impacts of ancient land use legacies (>400 years) remains problematic

due to the difficulty in detecting ancient land uses, especially those beneath dense canopies. The city-state of Caracol, on of the most important Maya archaeological sites in Belize, was abandoned after the collapse of the Maya civilization (~900 A.D.), leaving behind numerous structures, causeways, and agricultural terraces that persist beneath the dense tropical forest of western Belize. Using LiDAR (Light Detection and Ranging) technology, we were able to detect below canopy Maya archaeological features spanning a 200km2 area, providing an ideal opportunity to study the effects of ancient land use legacies on contemporary tropical forest composition. We recorded tree species over four land use classes: 1) structures 2) causeways 3) terraced and 4) non-terraced areas. Using ordination analysis (NMS) and multiresponse permutation procedures (MRPP) to test for differences between the classes, we found significantly distinct tree communities associated with the presence of terraces and the underlying topography. Terraced slopes appear to function as micro-valleys on the side of a hill, creating an environmental bridge" between slope and valley tree communities. Tree species composition over causeways and structures was also found to be significantly different from terraced and non-terraced plots. These results lead us to conclude that human land uses abandoned >1000 years ago continue to impact the contemporary forest at Caracol
Keywords: Land-use legacies, Tropical forest ecology, LiDAR, Maya archaeology, Soil

50. Development of microsatellite markers and characterization of genetic diversity in natural populations of Qualea grandiflora Mart
Authors: Ritter, Lia Maris Orth Ritter, Universidade de S; Miklos Bajay, Universidade de S; Mariza Monteiro, Universidade de S; Maria Andr, Universidade de S; Paulo Yoshio Kageyama, Universidade de S
Poster #54 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Aiming for studies of genetic diversity in populations of Qualea grandiflora Mart, species typical of the Brazilian Savannah, we developed a genomic library enriched, according Billotte et al (1999), where SSR containing clones were selected. Based on the sequencing of positive clones containing DNA from two plates of Q. grandiflora, were designed 22 primer pairs with percentages of nitrogen bases guanine and cytosine over 40% of dinucleotide motifs and at least six replicates using the software Primer3. The primers were tested on polyacrylamide gels stained with silver nitrate, using DNA samples from 130 different individuals from four different populations of Cerrado. Only six primers showed no amplicons, we selected eight primers that showed better visualization (without the presence of duplicate bands or stutters) to characterize the genetic diversity of natural populations of four Q. grandiflora. The microsatellite markers developed in this study had elevated PIC (Polymorphic Information Content) and are very important tools for management and conservation of the species.
Keywords: Qualea grandiflora, SSR, Cerrado, Genetic diversity, Microsatelite markers

51. Implications of climate and land use change for forest ecosystem services
Authors: Tavernia, Brian Tavernia, University of Missouri; Mark Nelson, U.S. Forest Service
Poster #55 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Forests provide a vast array of ecosystem services that sustain and enhance the existence of human beings. As humans continue to alter landscapes, ensuring a sustained flow of forest ecosystem services will require knowledge about the effects of human activities on forest extent, structure, and functioning. Land use and climate change have the potential to enhance or limit the delivery of forest ecosystem services. When accounting for these change agents, forest managers and policy makers will need information about ecosystem service tradeoffs under various scenarios of land use and climate change. Recognizing this need, the U.S. Forest Service and several partners have initiated the Northern Forests Futures Project (NFFP). The NFFP is using Forest Inventory and Analysis information on the conditions and trends of existing forests to parameterize a transition model capable of projecting future forest conditions through the year 2060, under a range of land use

and climate change scenarios. Using these projections, we address hypotheses about how climate and land use change interact to influence the supply of ecosystem services across 172 million acres of forest land in the Northeast and Midwest regions of the U.S. Specifically, we compiled wildlife-habitat matrices and habitat suitability indices and linked these to forest projections to produce estimates of future wildlife habitat availability. In addition, we used a quantitative supply-demand model to project the future availability of high quality water. We portray examples of results and maps that can inform forest management and policy decisions.
Keywords:

52. Potential climate change and fire management effects on future landscape vegetation dynamics and fire risk in Olympic National Park, WA
Authors: Haunreiter, Rebecca Kennedy, US Forest Service, Pacific Northwest Research Station; Erik Haunreiter, Oregon State University; Robert Keane,
Poster #56 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The forested landscapes of the Olympic Peninsula provide important ecosystem services and critical habitat for threatened and endangered species. Future climate change scenarios predict that these landscapes will become warmer and drier with increased intra-annual variability in moisture regimes, potentially having a significant impact on the provision of services and habitat quality. The objective of this study was to model the effects of climate change and fire management on fire and vegetation dynamics in dry conifer forests of the Olympic Peninsula. We used FireBGCv2, a simulation modeling platform that includes a mechanistic, individual tree succession vegetation model containing stochastic properties implemented in a spatial domain, and a spatially explicit fire ignition and spread routine. Along with current and historical conditions, we simulated two potential future climate scenarios (hot/dry, warm/moist) under three levels of fire suppression (90, 50, 10% fires suppressed) over a 500-year simulation period. We found that fire increased across all scenarios, in part resulting from fuels buildup from prior fire suppression activities, but that fires increased more and had more direct effects on vegetation structure in moister forest types. Shifts in temperature and precipitation associated with the hotter, drier climate change scenario were associated with shifts in species composition toward drier forest types. Both climate change scenarios were associated with landscape-level shifts toward earlier successional stages, even with higher levels of fire suppression. Our results contribute to a regional assessment of how management decisions will affect tradeoffs in the provision of ecosystem services in landscapes of the Pacific Northwest.
Keywords: Climate change, Fire, Forest landscapes, Ecosystem services, Olympic National Park

53. Decoupling fragmentation from area loss: an analysis of spider biodiversity in a patchy agro-ecosystem
Authors: Ziv, Yaron Ziv, Ben Gurion University; Yoni Gavish, Ben Gurion University
Poster #57 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Fragmentation couples effects of area loss and changes of the former continuous area into several smaller and more isolated patches. Although the effect of area loss on species diversity is mostly negative, the effect of fragmentation per-se (i.e., after removing the area loss effect) is less clear. We explore four methods that decouple the effect of fragmentation from area loss, using spider species in two landscapes in Israel. The first method plots the cumulative number of species against the cumulative area. Two additional methods relay on species area relationship, either within the original area range and for small number of patches, or outside the original area range and for all patches. The last method calculates the Fisher's alpha index for different fragmentation levels (defined as the number of patches whose total area equals the area of a focal patch) and compares the values to the Fisher's alpha of the original focal patches. All methods reveal a positive effect of fragmentation per-se on spider diversity, i.e., an increase in species diversity in more fragmented settings. However, each method has its own advantages and disadvantages, hence providing

different insights on the results. We conclude that the number of currently occurring spider species is larger on several small patches than on a single large patch. We suggest that the turnover of species between patches overcompensate for the reduced number of species in each patch due to area loss. Decoupling area loss from fragmentation per-se has important implications for short or long term conservation practices.
Keywords: Fragmentation, SLOSS, Habitat loss, Species diversity, Conservation

54. Integrating species distribution modeling and phylogeography to assess the impact of climate change on an alpine-arctic plant
Authors: Forester, Brenna Forester, Western Washington University
Poster #58 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: I am investigating the impact of climate change on the past, present and future geographic distribution and genetic variability of an alpine-arctic plant, Rhodiola integrifolia. I am testing a suite of hypotheses about the importance of climate in determining the rate of gene flow between disparate populations from glacial refugia to modern distributions. I can then establish if projected future habitat will be viable given increasing isolation as the climate warms. Using an ensemble modeling approach, I am developing models that predict probability of species occurrence as a function of present, past and future climates. I am testing these models with genetic data using a coalescent framework, providing a robust understanding of modern patterns of genetic variability, while helping constrain possible scenarios of future population viability. These data also provide an independent assessment of the effectiveness of the model as a predictor of future distributions. I am conducting this analysis at two spatial scales: the North American Cordillera and the Sierra Nevada Mountains (California). I can then compare model performance and predicted distributions across spatial extents and resolutions. Anthropogenic climate change will have the most significant impact on the distribution of alpine species since the retreat of the North American ice sheets. There is a lack of understanding, however, about how species will shift their ranges in response to a warming climate. My research works across disciplines to provide a robust assessment of range shifts under future climate scenarios. These methods have broad conservation applications extending beyond the alpine ecosystem.
Keywords: Species distribution modeling, Phylogeography, Biogeography, Climate change, Conservation

55. Monitoring the effects of climate on Southern Appalachian forest phenology
Authors: Hepinstall-Cymerman, Thomas Prebyl, University of Georgia; Jeffrey Hepinstall-Cymerman, University of Georgia
Poster #59 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Recent research has led to increasing evidence that global warming is occurring as well as inducing changes to ecological systems. There is however, much uncertainty about how continued warming will further influence ecological systems. An improved understanding of climate influence on deciduous forest phenology is particularly needed as the timing and length of forest growth cycles directly affect ecological trophic dynamics and the global carbon cycle. For ecologically relevant phenological predictions to be made, the response of deciduous tree species to climatic drivers must be understood at both local and regional spatial scales. In this study we have begun to monitor the phenological response of a Southern Appalachian deciduous forest to recent climate variability at multiple spatial scales. We use MODIS and Landsat datasets to identify temporal shifts in the timing of spring green-up at broad spatial scales in response annual temperature variability. We supplement the satellite datasets with ground-based measurements of species specific budburst and leaf-out dates. By combining these multi-scale datasets we are able to determine the correlation between satellite and ground-based measurements and are able to quantify the level of phenological synchrony between Southern Appalachian forests and recent climate variability.

Keywords: Phenology, Remote sensing, Global warming

56. An assessment of the redistribution of flood protection benefits in Chicago due to wetland mitigation banking using InVEST
Authors: Sweeney, Eric Sweeney, University of Illinois at Chicago
Poster #60 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Recently, the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency published a final set of regulations to be used in authorizing compensatory mitigation of wetland impacts under Section 404 of the Clean Water Act. For the first time in the history of the Section 404 program, these regulations consider ecosystem services in mitigation decision-making. However, the research necessary to develop efficient and scientifically-credible tools and methods for assessing ecosystem services for use by regulators remains insufficient. In this study, I applied the spatially-explicit Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) hydrology model to quantify flood protection benefits lost due to wetland impacts (pre-impact" wetlands) and gained through the establishment of sold-out wetland mitigation banks ("post-mitigation" wetlands) in the Chicago area. This study represents the first application of the InVEST hydrology model at local
Keywords:

57. Multiscale analysis of disease-environment relationships in an emerging plant pathogen across a heterogeneous landscape
Authors: Dillon, Whalen Dillon, University of North Carolina at Charlotte; Amelia Johnson, University of North Carolina at Charlotte; Sarah Haas, University of North Carolina at Charlotte; Ross Meentemeyer, University of North Carolina at Charlotte
Poster #61 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Species-environment interactions are often studied at a single spatial scale even though ecological processes can change across spatial extents. Multiscale sampling strategies attempt to address this issue and may be especially useful for invasive species when little is known regarding their dispersal biology. We conducted a multiscale analysis on Phytophthora ramorum across a heterogeneous landscape in Sonoma County, California to assess if ecological inference changes when predictor variables are measured at increasing spatial scales. This multiscale approach is important because little is known regarding the dispersal dynamics (e.g., frequency of long-distance dispersal events) of this invading pathogen. Generalized linear models included biotic and abiotic predictor variables collected across four nested scales (a 0.0225-ha core plot and three surrounding areas of 0.36, 1.96, and 4.84-ha). The response variable was calculated two ways using core-plot data: prevalence of infected hosts and average number of infected leaves in a key infectious host. Model results indicated that influence of predictors varied across scales. Infected leaf count predicted average infected leaf count ($p = 0.050$) only at the 0.36-ha scale, but predicted prevalence across all scales ($p < 0.05$). Total host density predicted prevalence of infected hosts only at the 0.36-ha scale ($p < 0.001$). Temperature measured in the core plot was the only significant abiotic variable, predicting prevalence and average number of infected leaves ($p < 0.05$). Our results indicate that host density, surrounding infection levels, and forest microclimate conditions are important factors governing P. ramorum infection at local to landscape scales.
Keywords: Landscape epidemiology, Invasive species, Multiscale, Sudden oak death, Disease ecology

58. A stochastic simulation model to predict future air quality in protected areas
Authors: Stavros, Erica Stavros, Fire and Mountain Ecology Lab, University of Washington; Donald McKenzie, Pacific Wildland Fire Sciences Lab, US Forest Service; Larkin Narasimhan, Pacific Wildland Fire Sciences Lab, US Forest Service; Strand Tara, Pacific Wildland Fire Sciences Lab, US Forest Service; Brian Lamb, Laboratory of Atmospheric Research, Washington State University

Poster #62 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Expected changes in climate are predicted to increase the extent, and possibly the frequency and severity, of wildfire. Wildfire affects both local and regional air quality, and increased wildfire across the American West may degrade the visibility of mountain landscapes, particularly those classified as “pristine areas” and the focus of national air-quality standards. Future projections of air quality on mountain landscapes are challenging, not only for the need to integrate disciplines (climatology, fire ecology, air chemistry), but also to be robust across temporal (hourly to decadal) and spatial scales (local to global). In response to this challenge, we are integrating a stochastic model to simulate fire events, the Fire Scenario Builder (FSB), with the BlueSky Modeling Framework, which links wildfire emissions to smoke dispersion and air quality models. FSB integrates fuel information and meteorological data, from Meteorology-Chemistry Interface Processor (MCIP), to simulate daily fire starts and area burned, producing aggregate fire-season statistics such as total area burned, number of fire starts and their spatial distribution. The BlueSky Modeling Framework then simulates total fuel consumption and smoke emissions. Fire emissions are then fed into the Community Multiscale Air Quality (CMAQ) model. The goals of this research are: 1) to compare fire emissions and air quality across the West for current (1995-2004) vs. future (2045-2054) decades and 2) to assess model uncertainty, by comparing model output to observations, analyzing parameter sensitivity, and verifying the theoretical basis of FSB model structure and the robustness of the FSB - BlueSky integration.
Keywords: Climate change, Wildfire, Missions, Smoke, Air quality

59. Fire history reconstruction in the Sky Islands of Northern Sonora
Authors: Arizpe, Alexis Arizpe, University of Arizona; Donald Falk, University of Arizona
Poster #63 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Reconstruction of fire history is a common application of dendrochronology in the Southwestern United States, but this technique is less common in Mexico. Northern Mexico and the Southwestern United States share biophysical and cultural characteristics that can act as variables that influence fire regimes. Both regions experience a bimodal precipitation regime dependent on the North American Monsoon and share similar forest vegetation associations. While human land use patterns have impacted forests in Northern Mexico much as they have in the Southwestern United States, a lack of widespread organized fire suppression means that these forests in Sonora have maintained many of the characteristics of historical forest structure and fire regimes. The similarities in these adjacent montane forest systems make the forests of northern Sonora an ideal location to examine 20th century fire regimes. We look at the role of both climate and land use history in determining these fire regimes. Fire scarred tree-ring samples were collected from three sites in Northern Sonora: Sierra Pan Duro, Sierra Los Ajos and Sierra de Bacadehuachi. Chronologies were created for each site and fire scars were used to analyze mean fire interval, fire seasonality, and common fire years. Composite mean fire intervals were calculated for each site, and compared to neighboring Madrean ecosystems. Low severity fires have been recorded at these sites well into the 20th century.
Keywords: Dendrochronology, Fire, Mexico

60. Cumulative effects analyses: Concepts, methods, and needed improvements
Authors: Johnson, Chris Johnson, University of Northern British Columbia
Offered Presentations: Symposium 1: Expert Knowledge and Assessing Cumulative Effects in Forest Landscapes - Monday (2011-04-04): 09:20 - 09:40 - Galleria 1
Abstract: Cumulative effects are the synergistic, interactive, or unpredictable outcomes of multiple land-use practices or development that aggregate over time and space, and have significant impacts for particular components of the environment. Although a relatively intuitive concept, current analytical approaches for documenting cumulative effects and regulatory approaches for managing or

limiting effects have received much criticism. Currently, landscape ecologists and other natural resource professionals are struggling to define better methods and data for identifying impacts so that regulatory processes are better informed. In this portion of the workshop I speak to the complexity of understanding and managing cumulative effects. I will introduce the key concepts of effect, impact, target, and threshold relative to current strategies for identifying and managing cumulative effects. Using woodland and barren-ground caribou populations from Canada as a case study, I will discuss the challenges and perhaps folly of attempting to manage cumulative effects based purely on empirical data. I make the argument that experts have a distinct and important role in identifying and parameterising complex landscape-level socio-ecological relationships such as cumulative effects. Such recognition is the first step in developing more integrative and effective approaches for maintaining sensitive flora and fauna across industrial landscapes.
Keywords: Cumulative effects, Wildlife, Caribou

61. What is expert knowledge, how is it gathered, and how should it be used to address questions in landscape ecology?
Authors: McBride, Mark Burgman, University of Melbourne; Marissa McBride, University of Melbourne
Offered Presentations: Symposium 1: Expert Knowledge and Assessing Cumulative Effects in Forest Landscapes - Monday (2011-04-04): 10:00 - 10:20 - Galleria 1
Abstract: Experts are defined by their qualifications, experience and track record. They acquire special knowledge based on their experience and training, and are deferred to in its interpretation. They are routinely used as a source of information within landscape ecology applications when other data are unavailable and time and resources are limited. However, the link between traditional metrics of expertise such as training and experience and objective performance is often weak. We report on a series of studies involving groups of experts in the environmental sciences that reveal that the relationship between perceived expertise and objective performance in making quantitative judgments is poor. Furthermore, traditional metrics of expertise are closely aligned with self and peer expectations of performance. Â These results suggests that better use of expert judgment will be achieved with the use of multiple experts from diverse backgrounds rather than any single expert, and via controlled interactions within a formal structured elicitation protocol. We discuss these results in terms of existing practices within landscape ecology, and suggest areas for potential research.
Keywords: Expert knowledge, Expert elicitation, Four-step elicitation, Delphi, Performance

62. Finding out what landscape ecology experts really think: techniques, targets and the Elicitator tool
Authors: Drew, Samantha Low-Choy, Cooperative Research Centre for National Plant Biosecurity, Canberra, Australia; Allan James, High Performance Computing unit, Queensland University of Technology, Brisbane, Australia; Justine Murray, Sustainable Ecology, CSIRO, Australia; Kerrie Mengersen, Mathematical Sciences, Queensland University of Technology, Brisbane, Australia; Ashton Drew, US Geological Survey and North Carolina Cooperative Fish and Wildlife Research Unit, North Carolina State University
Offered Presentations: Symposium 1: Expert Knowledge and Assessing Cumulative Effects in Forest Landscapes - Monday (2011-04-04): 10:20 - 10:40 - Galleria 1
Abstract: Expert knowledge can provide important and timely information to investigations and decision-making, particularly in landscape ecology where it is difficult to obtain timely yet comprehensive data that is relevant. Here we focus on the common situation where experts are called upon to help inform assessment of a species' habitat requirements and map out their potential spatial distribution. We cite different examples where expert information has been elicited, both in the context of biodiversity conservation as well as ensuring protection from exotic plant pests and disease. This helps motivate our recent research on a new elicitation technique and accompanying prototype of a software tool Elicitator. This approach (1) targets an expert's field-based knowledge on the expected ecological response in particular scenarios (e.g. geographic sites), and then (2) infers

the expert's underlying conceptual model regarding the pattern of ecological response to several factors. Among other features, the prototype tool streamlines and facilitates elicitation by automating calculations and providing instantaneous feedback (e.g. using dynamic graphs) to experts at various stages of elicitation. We demonstrate its use for capturing field-based knowledge from ecologists on habitat requirements of the threatened brush-tailed rock-wallaby, Petrogale Penicillata.
Keywords: Expert knowledge, Software tool, Species distribution modeling, Dynamic graphs, Statistical encoding

63. Discussion (led by Lisa Buse)
Offered Presentations: Symposium 1: Expert Knowledge and Assessing Cumulative Effects in Forest Landscapes - Monday (2011-04-04): 10:40 - 12:00 - Galleria 1

67. Lessons from landscape genetics for understanding alterations to connectivity in riverine environments
Authors: Dyer, Rodney Dyer, Virginia Commonwealth University; Catherine Viverette, Virginia Commonwealth University
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 09:20 - 09:40 - Broadway 1
Abstract: The integration of landscape ecology and population genetics has given rise to several new approaches amenable to estimating population connectivity. These â€œLandscape Geneticâ€ tools are quite varied and to date have mostly been applied to terrestrial systems. Here we provide a brief overview of both spatial and genetic analysis approaches with particular emphasis on how they could be applied to riverine systems to assess genetic connectivity. Using simulation approaches, we then examine the sensitivity of methods based upon genetic structure (Fst, Î¦st), distance (Dc), and conditional covariance (cGD) to accurately describe genetic connectivity. In general, we find that methods based upon conditional covariance outperform all other methods in terms of accurately reconstructing dispersal processes in both linear and branching riverine systems. Using perturbation analysis we then show that conditional approaches also have greater relative efficiency in detecting both changes in connectivity within in stream habitat networks as well as complete fragmentation.
Keywords: Gene flow, Connectivity, Riverine

68. Reconstructing river network influences on the natural fluvial landscape in controlled river environments
Authors: Benda, Lee Benda, Earth Systems Institute, USA; Daniel Miller, Earth Systems Institute, USA; Jose Barquin Ortiz, Universidad de Cantabria, Spain
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 09:40 - 10:00 - Broadway 1
Abstract: Natural fluvial landscapes by definition typically have high physical and biological connectivity. In watersheds with a long history of river control, it's a challenge to locate areas of high fluvial connectivity. Intensive land use on desirable valley floors that include engineered structures to reduce flooding and to increase developable land (levees, dikes, flow weirs etc.) can predate the earliest remote sensing. Consequently, morphological patterns of channel-valley connectivity that could provide important clues for developing effective restoration strategies can remain hidden. To address this issue in the Pas River basin (650 km2) in northern Spain, we coupled general principles of hydro-geomorphic processes with computer tools to reconstruct the natural fluvial landscape. Using a 5-m digital elevation model, zones of higher potential for river-valley interactions are identified based on elevation differences between channels and adjacent valley floors. Areas of potential high connectivity, that are spatially patchy, vary according to network geometry via tributaries and their confluences, spatial patterns of valley morphology, fan and terrace landforms, and basin scale. The vast majority of the natural fluvial landscape in the Pas River basin is presently masked by human

infrastructure including urban centers and agricultural areas. Overlaying the presently regulated and confined Pas River on the reconstructed fluvial landscape provides evidence for the magnitude of diminution of the fluvial-riparian ecosystem. Considering locations of urban centers, highways, roads, and agricultural areas in the context of the natural fluvial landscape is used to evaluate connectivity disruptions and restoration projects that could reconnect channels with their valleys.
Keywords: Connectivity, Networks, Geomorphology, Restoration, Ecology

69. River networks and habitat connections: influence of tributary junctions
Authors: Kiffney, Peter Kiffney, Northwest Fisherie Science Center and Hedmark University College; Correigh Greene, Northwest Fisherie Science Center; Thomas Good, Northwest Fisherie Science Center
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 10:20 - 10:40 - Broadway 1
Abstract: A variety of aquatic species require access to multiple linked habitats to grow, survive and reproduce. In river systems, there is also the simple concept that processes occurring upstream can influence downstream habitat via the transport of water, sediment, organic matter, and nutrients. Thus, maintaining habitat linkages is essential for maintaining ecosystem structure and function through a variety of mechanisms. We examined the importance of physical linkages in three river systems over three years by conducting intensive surveys around 13 tributary junctions. We hypothesized that tributary streams would increase habitat heterogeneity and productivity in the main stem rivers they entered thereby affecting insect and fish populations. There was considerable among- and within basin variation in physical, chemical and biological characteristics. Some of the within basin variation was explained by tributary junctions: we observed distinct discontinuities in main stem water temperature and limiting nutrients (nitrogen and phosphorus) at tributary junctions. Furthermore, we found that in some cases river biota responded to these discontinuities. We also found that the effect of tributaries on main stem habitat was correlated to tributary size, with larger tributaries having a greater effect than smaller tributaries. This study showed the importance of maintaining the physical linkages in river ecosystems and points out that maintaining these linkages may have important restoration and conservation implications.
Keywords: River networks, Connectivity, Tributary confluences, Conservation

70. Warmer summer air temperature will isolate thermally suitable habitat patches for coldwater lotic fishes
Authors: Ruesch, Aaron Ruesch, University of Washington; Christian Torgersen, United States Geological Survey; Joshua Lawler, University of Washington; Julian Olden, University of Washington
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 10:40 - 11:00 - Broadway 1
Abstract: Global climate change will result in increasing air temperature in many locales. Although such increases will affect stream temperatures, air and stream temperature will not increase in parallel, which challenges our ability to forecast climate change effects to lotic ecosystems. In this study, we estimated the isolation of thermally suitable habitat due to climate change for three coldwater species that distribute deterministically with stream temperature juvenile Chinook salmon and steelhead trout (Oncorhynchus tshawytscha and O. mykiss) and all age classes of bull trout (Salvelinus confluentus) in a large (20,700 km2) western interior basin. To understand the relationship between air and stream temperature, we fit multivariate linear models of summer stream temperature for the years 1993-2009 using climate and landscape predictor variables. We greatly enhanced the predictive capacity of the linear models using a new statistical modeling approach designed for understanding spatial relationships in stream networks while accounting for flow-connectivity between observations (simple linear model R2=0.59, flow-connected linear model R2=0.76). We found that the spatial distribution of summer stream temperature is largely governed by

elevation and riparian cover while inter-annual variation is governed by temporally localized air temperature; a 1Â°C increase in summer air temperature results in a 0.6Â°C increase in stream temperature. With this relationship, we estimated 50Â±10%, 33Â±9%, and 66Â±11% declines in thermally suitable habitat for Chinook salmon, steelhead trout, and bull trout respectively by the period 2070-99. However, the coefficients of our model suggest that these effects could be mitigated in part through riparian restoration.
Keywords: Stream, Temperature, Salmon, Trout, Climate

71. Tradeoffs associated with spawning site selection by hatchery-origin salmon
Authors: Cram, Jeremy Cram, University of Washington; Christian Torgersen, US Geological Survey; Ryan Klett, University of Washington; George Pess, NOAA Fisheries; Andrew Dittman, NOAA Fisheries
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 11:00 - 11:20 - Broadway 1
Abstract: Spawning site selection by female salmon is based on complex tradeoffs between homing instinct and habitat conditions, but the relative importance of homing versus habitat characteristics as they affect straying behavior by female salmonids within natal streams is poorly understood. Previous studies have shown that hatchery-origin Chinook salmon released from hatchery acclimation sites return with varying degrees of fidelity to those areas. To address this phenomenon, we quantified physical habitat throughout 160 km in the upper Yakima River basin (Washington, USA) and utilized existing spatially explicit redd and carcass data from 2004 to 2008. Principal components analysis showed marked differences among acclimation areas driven by substrate, cover, stream width, and gradient. Canonical correspondence analysis revealed that a limited suite of habitat features (e.g. substrate, gradient, channel type) were associated with spatial patterns of spawning ($p < 0.01$). Female salmon may forgo spawning near their acclimation area if surrounding habitat is marginal.
Keywords: Salmon, Habitat, Homing, Hatchery, Spawning

72. Designing headwater linkage areas: landscape connectivity for salmon and amphibians
Authors: Burnett, Deanna Olson, USFS PNW Research Station; Daniel Miller, Earth Systems Institute
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 11:20 - 11:40 - Broadway 1
Abstract: Headwater channels in forested, mountainous landscapes provide habitat for numerous species and can influence conditions and processes downstream. Efforts to quantify differences among headwater streams as a potential framework for prioritizing freshwater conservation have generally targeted a single resource or species. Of increasing concern is that such approaches are economically inefficient and ecologically ineffective, particularly for organisms that rely on both water and land. In this study, we synthesize understanding about the characteristics of headwater channels that may control their relative value both as amphibian habitat and as a source of materials for salmon habitats downstream. Thus, we evaluated the potential effects of headwater linkage areas aimed at different proportions and spatial configurations of the headwater channel network. Headwater channels were first ranked across the 2.5 million ha Oregon Coastal Province based on estimated probabilities of being affected by debris flows that deliver to salmon-bearing channels downstream. The ranks were used to delineate alternative streamside management zones encompassing 25% or 75% of the debris-flow susceptible headwater channels. Potential connections between these headwater channels were identified based on landscape-, drainage basin-, and forest stand-scale considerations for designing linkage areas. These multi-scale considerations include addressing known locations of target species, landownership patterns, number of links established, connectivity among major river basins, and climate change. We explored likely implications of alternative linkage scenarios based on the area added to existing conservation networks. Although

the proposed linkage areas target headwater species by design, the resulting landscape connectivity can benefit numerous forest-dependent species.
Keywords: Connectivity, Rivers, Salmon, Debris flows, Amphibians

73. Interbasin water transfer projects: more water, bad for fish?
Authors: Grant, Evan Grant, USGS- Patuxent Wildlife Research Center; Heather Lynch, University of Maryland; Rachata Muneepeerakul, Arizona State University; Ignacio Rodriguez-Iturbe, Princeton University; William Fagan, University of Maryland
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 11:40 - 12:00 - Broadway 1
Abstract: Conflict between resource use and the conservation of ecosystems will only increase as a developing population puts increasing pressure on nature to supply basic rights, most importantly the predictable access to water. With the uncertainty in timing, amount, and distribution of precipitation under a changing climate, large-scale interbasin water transfer (IBWT) projects are an increasingly attractive solution to solving water distribution and supply issues. Balancing ecosystem requirements, societal demands, politics, and economics is a monumental task in assessing the feasibility of such large-scale projects, and ecological consequences are often given the least attention. Under an IBWT project, river connectivity is restructured via the addition of canals. Such projects are expected to drastically affect the stability and identity of communities living in the hierarchically-structured river networks. We apply a neutral metacommunity model to both simulated and empirical data to show how freshwater fish communities are likely to be impacted by this project. We find that, when using simulated datasets, the addition of the canals facilitates the spread of common species at the expense of rare species, allowing them to become even more widespread. In many scenarios, this lowers the total number of species in the system. We compare our simulation modeling results with empirical data representing 460 freshwater fish species in river basins across peninsular India.
Keywords: Interbasin water transfer, Freshwater fish, Dendritic ecological network, Biodiversity

74. Human influence on the spatial structure of threatened Pacific salmon metapopulations
Authors: Fullerton, Aimee Fullerton, NOAA Northwest Fisheries Science Center; Steve Lindley, NOAA Southwest Fisheries Science Center; George Pess, NOAA Northwest Fisheries Science Center; Ashley Steel, US Forest Service, Pacific Northwest Station; Paul McElhany, NOAA Northwest Fisheries Science Center
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 13:20 - 13:40 - Broadway 1
Abstract: To remain viable, at risk populations must be resilient to both natural and human caused disturbances. While intimately tied to genetic diversity, resiliency also depends on spatial connections among interacting populations. We evaluated anthropogenic effects on the spatial structure of evolutionarily significant units (ESUs) or metapopulations of threatened Chinook salmon (Oncorhynchus tshawytscha) and steelhead (O. mykiss) in the Lower Columbia and Willamette Rivers. We used graph theory to characterize spatial structure within ESUs and to quantify the impact of humans on historical spatial structure of metapopulations by plotting variance in population size among the contributing populations against inter-population connectivity. Two human activities destabilized inter-population connectivity, causing spatial structure of ESU metapopulations to trend toward non equilibrium: (1) truncation of habitat by hydropower dams, which extirpated several contributing populations, and (2) degradation of habitat in some areas, which reduced population size for associated populations. A third activity, operation of fish hatcheries, increased connectivity among populations, leading to patchy or panmictic spatial structures. These findings directly inform conservation planning in two ways: first, in identifying specific populations for each ESU that, if preserved (extant populations) or re established (extirpated populations), would best restore ESU

spatial structure to near historical conditions. Second, our sensitivity analysis identified two factors for which increased or continued empirical monitoring for improved in situ estimates is warranted: (1) dispersal rates of wild and hatchery fish and (2) spatiotemporal trends in the size of contributing populations.
Keywords: Connectivity, Anthropogenic, Viability, Network, Spatial analysis

75. Documenting an Allee Effect in juvenile coho salmon distribution: implications for conservation
Authors: Flitcroft, Rebecca Flitcroft, US Forest Service, PNW Research Station; Gordon Reeves, US Forest Service, PNW Research Station; Jeffrey Snyder, Western Oregon University, Department of Biology; Kelly Burnett, US Forest Service, PNW Research Station; Lisa Ganio, Oregon State University, Department of Forest Ecosystems and Society
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 13:40 - 14:00 - Broadway 1
Abstract: Pacific salmon evolved within the dynamic riverscape of Pacific Rim freshwater systems. Disturbance processes operating at the scale of decades or centuries ensured the delivery of sediments and wood that created complex stream habitats and river configurations. Over the past century, simplification of stream systems due to anthropogenic actions such as dredging, diking, wetland removal, timber harvest, hydroelectric and irrigation dams have reduced the availability and connectivity of stream habitats. We explored the distribution of juvenile coho salmon (Oncorhynchus kisutch) in 11 subbasins on the mid-coast of Oregon over a 5 year period. As the population of juvenile coho increased or decreased, so did their distribution within the stream network. In low population years, juvenile salmon were distributed lower in stream systems. In the past, this adaptive response to low population would have meant that juvenile coho salmon were generally occupying the best stream habitat for this life history stage. However, due to anthropogenic alterations, the best available stream habitat for juvenile coho salmon is now found higher in the stream network. A distribution pattern that was historically adaptive may no longer result in higher juvenile survivorship in years of low population. Rather, occupying poorer habitat lower in the stream network is now maladaptive and may be defined as an Allee effect. This work indicates that conservation of endangered salmon must also include the context of habitat embedded within a stream network, rather than focusing on individual stream reaches in a disconnected stream web.
Keywords: Salmon, Stream network, Distribution, Allee effect
76. Reconciling human and natural systems for the equitable provision of ecosystem services in the Triangle of North Carolina
Authors: Urban, Dean Urban, Duke University; Larry Band, University of North Carolina - Chapel Hill; Phil Berke, University of North Carolina - Chapel Hill; Emily Bernhardt, Duke University; Sarah Bruce, Triangle J Council of Governments; George Hess, North Carolina State University; Melissa McHale, North Carolina State University
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 13:00 - 13:20 - Broadway 2
Abstract: The Triangle region of the North Carolina Piedmont is representative of an increasingly common pattern in urbanizing landscapes, in that there is no single urban core but rather, a network of cores distributed across a sprawling metropolitan area. Our ULTRA project focuses on the provision of ecosystem services within this landscape. A key issue is the mismatch between the spatiotemporal scaling of natural systems as compared to human systems. For example, watershed boundaries do not coincide with municipal jurisdictions, creating institutional complications in managing landscapes for watershed protection. This mismatch between human and natural boundaries separates landscapes that produce ecosystem services from the people that consume them, and invites inequities in sharing the costs and benefits of these services. This decoupling thus broaches issues of social equity and environmental justice. We are addressing this complicated issue by working on three fronts: (1) convening a network of collaborators in academia, government,

and nongovernmental agencies; (2) assembling a central data infrastructure to support regional analysis and planning; and (3) initiating a case study on the provision of clean water, to demonstrate that our regional, collaborative approach can provide timely and useful information to participants. In the future, we will expand our efforts to consider additional ecosystem services, including open space, habitat and biodiversity support, and carbon sequestration. Our intent is to develop the Triangle ULTRA as the hub of a regional network engaging scientists, managers, and community stakeholders in applied research.
Keywords: Urban ecology, Ecosystem services, Coupled natural and human systems, Watershed protection

77. Double exposures: Socio-ecological vulnerabilities in the Miami-Dade urban region
Authors: Hollander, Gail Hollander, FIU; Laura Ogden, FIU; Michael Ross, FIU; James Heffernan, FIU; Evelyn Gaiser, FIU
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 13:20 - 13:40 - Broadway 2
Abstract: The Miami-Dade urban region is characterized by a unique and paradoxical set of conditions and forces: a global commerce center, where assets are vulnerable to catastrophic coastal disasters; an affluent city with among the highest rates of poverty in the nation; a de-vegetated city situated between and dependent upon unique and protected natural environments; a city that receives copious rainfall, but whose freshwater supply is critically vulnerable to climatic change. What unites these strengths and vulnerabilities is their shared dependence on the interaction between local and global drivers. Our ULTRA project conceptualizes urban Miami-Dade as uniquely vulnerable to the double exposure of economic globalization and climate change, while recognizing the linkages, feedbacks and synergies between these two transformative processes as they impact local communities and vice versa. We are developing working groups of collaborators from academia, government, nongovernmental organizations and community activists to address three themes, 1) Coastal Vulnerabilities, 2) Urban Land Stewardship, and 3) Freshwater Sustainability, each focused on the following questions, respectively: 1) How do coastal social and ecological heterogeneity interact to determine vulnerability to sea-level rise? 2) What is the explanation for uneven vegetation cover and how do globalization and climate change influence its heterogeneity and management? and 3) What is the vulnerability of freshwater resources and quality in the presence of sea-level rise and urban development? Our goal is for the Miami-Dade ULTRA to become a leader and facilitator of the regional imperative to integrate socio-ecological research and urban policy and planning.
Keywords: Urban landscapes, Sea level rise, Tree canopy, Freshwater sustainability, Coupled natural & human systems

78. The carbon metabolism of Boston
Authors: Hutyra, Lucy Hutyra, Boston University; Mark Friedl, Boston University; Sucharita Gopal, Boston University; Jared Newell, Boston University
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 13:40 - 14:00 - Broadway 2
Abstract: Models of carbon exchange in urban environments are currently under-developed. Two challenges in adapting ecosystem carbon exchange models to urban environments are: (1) urban canyon topography and solar geometry create highly variable (if predictable) time/space patterns of light available for vegetation photosynthesis; and (2) vegetation is fragmented in patches with characteristic length scales as small as meters and individual tree crowns. We are adapting a vegetation carbon exchange model for use in Boston. This model ingests satellite greenness and standard meteorological data to produce estimates of vegetation carbon exchange. We have developed an approach to high resolution, dynamic carbon exchange mapping, and illustrate this approach with an idealized test run. In this test case, we computed greenness at 2.4 m resolution

data, and merged this data with 1.0 m resolution topography to provide information on how urban topography dynamically intercepts solar radiation from urban vegetation. A diel solar radiation geometry model was used to simulate diel carbon exchange in a 0.5 km x 0.5 km neighborhood of Boston over an idealized early summer day. The model produced maximum instantaneous ground-based estimates of vegetation Net Ecosystem Exchange of carbon of 10-15 umol m-2 s-1, which is comparable to maximum NEE at Harvard Forest, located in a rural region 100 km inland from Boston. We conclude by discussing strategies for ground validation and linking this model with a measurements and models of carbon exchange from the built environment and mobile urban elements (e.g., people, cars).
Keywords: Carbon, Urban, Metabolism, ULTRA

79. Socio-ecological interactions in the Charlotte metropolitan region: Can urbanization, forest and working lands coexist?
Authors: Meentemeyer, Ross Meentemeyer, University of North Carolina - Charlotte; Jean-Claude Thill, University of North Carolina - Charlotte; Douglas Shoemaker, University of North Carolina - Charlotte; Chunhua Wang, University of North Carolina - Charlotte; Todd BenDor, University of North Carolina - Chapel Hill
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 14:00 - 14:20 - Broadway 2
Abstract: Unmanaged development of natural and agricultural lands threatens ecological sustainability in evolving urban ecosystems. The rapidly growing â€œCharlantaâ€□ megalopolis, the 3rd largest mega-region in the U.S., is an example where demand for development continues to compromise delivery of ecosystem services. Despite the anthropocentric doctrine of â€œhighest and best useâ€□ which suggests the impossibility of coexistence between disparate land uses, significant forests and farmlands persist behind the frontier of development in the Charlotte region. We test the hypothesis that forests in urbanizing regions can persist when the combination of human and ecological intrinsic values plus the extrinsic values of a landscape exceed development value. We approach this complex socio-ecological question through a novel multi-layered research design grounded in hierarchy theory (ecology) and structuration theory (social science). In the first phase we established a long-term, broad-based network of regional stakeholders from government, industry, and non-profits engaged in land management, preservation, and economic development. This network is instrumental to conducting a pilot survey that uniquely articulates revealed and stated preferences toward land conversion, field-based measurements of ecosystem services, and cutting-edge computer visualization of alternative futures. Using a policy-oriented analytical framework, a contextual model of land conversion decisions is estimated. Our results parameterize a spatially-explicit agent-based model designed to explore response feedbacks between changes in policy, cultural and ecological values, and economic drivers, at multiple scales. Our research will inform the debate on ecological resiliency in evolving urban ecosystems and guide policy, especially regarding the efficacy of market-driven strategies and grassroot urban sustainable practices.
Keywords: Sustainability, Ecosystem services, Forest, Human-environment interaction, Policy

80. A Tale of Two Cities: The role of governance, biophysical systems, and feedbacks in mediating urban ecosystem services
Authors: Shandas, Vivek Shandas, Portland State Univesity; Alan Yeakley, Portland State University; Connie Ozawa, Portland State University; Sally Duncan, Oregon State University; Steve Bollens, Washington State University
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 14:20 - 14:40 - Broadway 2
Abstract: Despite the fact that governance systems are increasingly recognized as a key feature in transforming our built and natural environments, we have, to date, few empirical assessments about

how the differences in governance can mediate ecosystem services within an urbanizing context. Our NSF Urban Long Term Research Areas - Exploratory (ULTRA-Ex) project examines a pair of cities, Portland, Oregon and Vancouver, Washington, two anchors in a single metropolitan area that have developed over the past 30 years under contrasting policy regimes at the state, regional, and local levels. By building on almost two decades of urban ecological research in the region, we ask three research questions: (1) How do differences in local and state levels of governance and policy affect the resilience of both social and ecological landscapes? (2) How do alternative land use planning strategies affect the provision of ecosystem services in response to different disturbance factors? And (3) How effectively do the processes and outcomes of monitoring ecosystem services provide a usable feedback loop in an urban socio-ecological system? We address these questions by assessing the multiple pathways through which human actions, governance systems, and the built and social infrastructure affect ecosystem services provided by regional water quality. The aim of this ULTRA-Ex project is to establish the Portland-Vancouver metropolitan area as a hub for engaging managers, scientists, other community stakeholders in understanding the feedbacks between governance and biophysical systems.
Keywords: Goverance, Urban ecosystem services, Water quality, Feedbacks

81. Chicago ULTRA-ex: Connecting the social and ecological sciences with planners, managers, and the public
Authors: Minor, Aaron Durnbaugh, Chicago Department of the Environment; Paul Gobster, U.S. Forest Service Northern Research Station; Susan Stewart, U.S. Forest Service Northern Research Station; Lynne Westphal, U.S. Forest Service Northern Research Station; Liam Heneghan, DePaul University; Jennifer Hirsch, The Field Museum; Eric Lonsdorf, Lincoln Park Zoo; Bryan Pijanowski, Purdue University; Nancy Tuchman, Loyola University; David Wise, University of Illinois at Chicago; Moira Zellner, University of Illinois at Chicago
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 14:40 - 15:00 - Broadway 2
Abstract: Chicago is the country's third largest city, with nearly 3 million people in the city itself and approximately 9.6 million in the metropolitan region. Chicago is unique for its location (linking east and west, land and water), its people and cultures (diverse), its habitats (some of which are both regionally and globally rare) and the Chicago Wilderness alliance, a conservation consortium of over 250 organizations. Our research focuses on the Green Infrastructure Vision (GIV) of Chicago Wilderness. The GIV identifies 1.5 million acres of recommended resource protection areas " lands that require careful planning and management to enhance and support the region's currently protected lands and waters. The GIV was designed to implement the Biodiversity Recovery Plan of Chicago Wilderness and is already influencing long-range land planning in the region. Our goal is to investigate the convergences and tradeoffs between biodiversity and the provisioning of ecosystem services in a human-dominated landscape. To accomplish this goal, we will critically examine the capacity of the GIV for both long-term conservation of biodiversity (for which it was designed) and the delivery of critical ecosystem services to human communities throughout the Chicago region. A second goal is to initiate a pilot version of a multi-faceted, interactive, web-based Chicago ULTRA-Hub. The proposed ULTRA-Hub will be an umbrella and focal point for urban ecosystem research and policy and will feature an interactive platform for managing data, communicating research findings to planners and the public, and facilitating collaboration and interaction among scientists, practitioners, and educators.
Keywords: Urban landscapes, Ecosystem services, Biodiversity, Coupled natural & human systems, Conservation

82. Reconsidering the new normal: the impact of trauma on urban ecological and social diversity

Authors: Blum, Michael Blum, Tulane University; Kevin Gotham, Tulane University; John McLachlan, Tulane University; Wayne Zipperer, US Forest Service
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 15:20 - 15:40 - Broadway 2
Abstract: Traumatic anthropogenic or natural disasters can redefine the ecological and social diversity of cities, with new normal" conditions often emerging in post-trauma urban landscapes. The objective of our ULTRA project is to examine how the pace and trajectory of recovery in post-Katrina New Orleans reflect ecological and social diversity. Specifically
Keywords: Disturbance, Urban forest, Coupled natural & human systems

83. Urban development, power relations, and water redistribution as drivers of wetland change in the Tampa Bay Region Socioecosystem
Authors: Lewis, David Lewis, University of South Florida; Rebecca Zarger, University of South Florida; Shawn Landry, University of South Florida; Fenda Akiwumi, University of South Florida; Mark Rains, University of South Florida; Thomas Crisman, University of South Florida; Susan Bell, University of South Florida; Carl Trettin, US Forest Service
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 15:40 - 16:00 - Broadway 2
Abstract: Urban ecosystems form the hub of massive transfers of energy and material. Our ULTRA site, the Tampa Bay Region Socioecosystem (TBRS), investigates how social organization and distribution of power drive resource transfer, and thus modify social and ecological structures and functions in the built city and its hinterlands. Water is our focal resource, and the TBRS encompasses a mosaic of primarily water-consuming and water-providing areas overlying urban, suburban, and rural land covers. We are interested in the social and political structure that results in particular water policies, the social and ecohydrological consequences of water transfer in both the receiving and supplying areas, and how these consequences feed back on new power structures and water policies. Three core questions are being investigated. (Q1) What variability exists throughout the region in perceptions and values of hydroecological change, and what demographic factors explain that variability? (Q2) How, according to key informants at various levels in the water management hierarchy, do social and political power result in particular outcomes of water redistribution? (Q3) Owing to the region's shallow groundwater and karst geology, do the numerous forested wetlands ecologically and hydrologically express changes in water policy, and do these changes inform future policies? Current TBRS goals are to begin answering these questions with empirical research; instill an interdisciplinary perspective in social and natural science graduate students; and provide information that can improve communication between agencies with different jurisdictions and mandates that may consequently be at odds about regional water management.
Keywords: Wetlands, Ecoydrology, Political ecology, Water policy, Coupled natural & human systems

84. Generating large-scale maps featuring the capacity of landscapes to deliver ecosystem goods and services
Authors: Kienast, Felix Kienast, Swiss Federal Research Institute WSL; Thomas Edwards, USGS Utah Cooperative Fish and Wildlife Research Unit, Department of Wildland Resources, Utah State University; Marion Potschin, Centre for Environmental Management, School of Geography, University of Nottingham; Roy Haines-Young, Centre for Environmental Management, School of Geography, University of Nottingham; K Jones, Science Advisor for Ecology, U.S. Geological Survey
Offered Presentations: Symposium 5: Modeling Landscape Functions under Scenarios of Global Change - Monday (2011-04-04): 15:20 - 15:40 - Broadway 4
Abstract: Currently very few regional to global scale models are available to assess the capacity of land to deliver ecosystem goods and services. To overcome these difficulties, we suggest the development of expert-- and literature-driven models. The task is a challenging one, and requires

careful checking or where and under what conditions complex interrelations must be considered to achieve the most plausible yet parsimonious outputs. This paper describes recent work that builds on an earlier study which sought to map ecosystem functions at European scales using an expert- and literature-driven binary links (Kienast et al., 2009). Binary links were used to express whether specific land-uses or other environmental properties have a supportive or neutral role in the generation of ecosystem services. The current work refines the approach and extends it to the continental US and Mexico. Input data include (a) land-use, (b) net primary production, and (c) bioclimatic and landscape properties (e.g. mountainous terrain, adjacency to landscape and nature protection zones). In addition to estimating the current potential of different areas to deliver services, a novel aspect of the work is the analysis of marginal changes in service output resulting from recent historical land use change (1990 - 2000), and whether expected land use change by 2030 might alter the capacity to deliver specific services.
Keywords: Ecosystem services, Mapping, Continental, Large scale

85. Breaking through the class ceiling: a slightly more complex approach towards dynamic land systems modelling
Authors: Rutledge, Daniel Rutledge, Manaaki Whenua Landcare Research NZ Ltd; Alexander Herzig, Manaaki Whenua Landcare Research NZ Ltd
Offered Presentations: Symposium 5: Modeling Landscape Functions under Scenarios of Global Change - Monday (2011-04-04): 15:40 - 16:00 - Broadway 4
Abstract: Achieving true sustainability in dynamic landscapes will require new approaches that can capture the richness and complexity of land systems and how they evolve under influences operating across multiple scales. In the project â€œSustaining Ecosystem Services for Multiple Outcomes,â€ we are developing a slightly-more-complex approach to dynamic landscape change modelling to help explore the consequences of different scenarios of land-use change for the maintenance and availability of ecosystem services in New Zealand. Our approach seeks to overcome some (but not all) of the limitations of more traditional land use/land cover change modelling to better characterise the current and possible future state of ecosystem services across natural, production, and urban landscapes. In our presentation we will outline the limitations of standard land use/land cover change modelling, present the development to date of our slightly-more-complex approach, and discuss its advantages and limitations.
Keywords: Land systems modelling, Systems dynamics, Land use/land cover, New Zealand, Ecosystem services

86. Maximizing land use and ecosystem services performance
Authors: Herzig, Alexander Herzig, Manaaki Whenua Landcare Research NZ Ltd; Daniel Rutledge, Manaaki Whenua Landcare Research NZ Ltd; John Dymond, Manaaki Whenua Landcare Research NZ Ltd; Anne-Gaelle Ausseil, Manaaki Whenua Landcare Research NZ Ltd
Offered Presentations: Symposium 5: Modeling Landscape Functions under Scenarios of Global Change - Monday (2011-04-04): 16:00 - 16:20 - Broadway 4
Abstract: Land use and land-use change have a major impact on ecosystem services. This means, in turn, land use and its associated management practices are one of the most important instruments for managing ecosystem services and sustainability. The performance of land uses, i.e. the expected revenue or qualitative benefit in terms of recreation and cultural use, depends on the spatial location, i.e. soils, climatic condition, traffic networks, etc. The performance of ecosystem services also depends on the spatial location, though in a different way than land use. Given this complex network of dependencies, maximising monetary and qualitative benefits from land use and maximising the performance of ecosystem services at the same time becomes an ill-structured problem. The presentation demonstrates the use of spatial multi-objective optimisation to address this issue and

discusses the advantages and difficulties (e.g. neighbourhood relationships) of this approach. We also present the results of a New Zealand-based case study.
Keywords: Ecosystem services, Land use, Spatial multi-objective optimisation, New Zealand

87. Predicting recent outbreaks of insect and disease attacks on native tree species in response to climate
Authors: Waring, Richard Waring, Oregon State University; Nicholas Coops, University of British Columbia
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 14:40 - 15:00 - Broadway 3/4
Abstract: The climate between 1950 and 1975 was exceptionally cool and wet compared with more recent conditions in the Pacific Northwest. We reasoned that these changes in climate could result in expanded outbreaks of insects, diseases, and fire. To test this premise, we first modeled seasonal variation in photosynthesis and growth for the 1950-1975 period for Douglas-fir, the most widely distributed species in the region. To validate predictions, we converted growth potential into maximum leaf area index (LAImax), which ranged from 1 to 9. The patterns in LAImax closely matched those acquired from satellites. We used seasonal physiological constraints on Douglas-fir photosynthesis, averaged for the 1950-1975 period, to build decision tree models for 15 species and successfully predicted their presence or absence on > 22,000 field plots with an accuracy of 82 %Â± 12% . Areas no longer deemed favorable for a given species during the period 1976-2006 were identified. For any given ecoregion (n=34), the number of species predicted to be stressed correlated with satellite-derived measurement of recent disturbance (r2=0.7).
Keywords: Climate change, Species distribution, Model, Disturbance, Remote sensing

88. Assessing the effectiveness of agro-environmental conservation programs in maintaining high alp meadow biodiversity
Authors: Edwards, Felix Kienast, Swiss Federal Research Lab WSL; Janine Bolliger, Swiss Federal Research Lab WSL
Offered Presentations: Symposium 5: Modeling Landscape Functions under Scenarios of Global Change - Monday (2011-04-04): 16:40 - 17:00 - Broadway 4
Abstract: We evaluated the effectiveness of conservation programs in halting or otherwise ameliorating reforestation transition likelihoods on dry grassland meadows of conservation importance in the high Alps of Western Europe. These meadows contain up to 65% of the IUCN-listed rare and endangered flora and fauna. We first constructed reforestation likelihoods (successional models) for 1,472 meadows using a logistic GLM. Model accuracies both 10-fold cross-validation and an additional 149 independent meadows, respectively, were good (PCC: 79%-89%; Sensitivity: 75%-70%; AUC: 0.74-0.75), indicating our successional model accurately predicted reforestation likelihoods for the meadows. Using an independent data set of an additional 3,609 meadows, we next used logit models to evaluate the effectiveness of 3 different agro-environmental programs (here, labeled H, S, E) designed to halt or reduce reforestation likelihoods. With the successional models defined as the baseline, the three agro-environmental programs were 2 (Program H) to 6 (Programs HSE, combined) times more effective at reducing reforestation likelihoods (Ï‡2=468.1, df=8, p<0.001), indicating their application to Swiss meadows was effective in reducing or halting reforestation. Last, we used these program results to re-condition the successional models, thereby providing a means of determining where application of specific programs would be most effective. Overall, application of the 3 programs would reforestation in approximately 45 %-60% of the meadows. Higher elevation meadows were more likely to respond favorably to application of the conservation programs than lowland meadows.
Keywords: Biodiversity, Alps, IUCN, Agro-environmental

89. Landscape and disturbance legacies of railroad logging: 50 to 130 years of post disturbance recovery
Authors: Piikkila, Erik Piikkila, Railroad Logging Legacies Project
Offered Presentations: Symposium 6: Landscape and Disturbance Legacies of Railroad Logging: 50 to 130 Years of Post Disturbance Recovery - Tuesday (2011-04-05): 09:20 - 09:40 - Broadway 1
Abstract: Railroad logging dominated the landscapes of the Pacific Northwest for almost 70 years from the 1890's to 1957, impacting 7 million acres of westside forests by 1940. Spatial and temporal attributes of railroad logging are long forgotten and have not been considered for over 50 years, or within the fields of landscape and disturbance ecology. Second growth forests are now the matrix on these landscapes some 50 to 130 years later. These forests were created by complex interactions of an anthropogenic disturbance (railroad logging) followed by one or more natural (wildfire) and/or anthropogenic (slash and/or escape fires) disturbances. Patch sizes of railroad logging harvest units were typically 40 and 150+ (range: 40 - 740) acres and occasionally reached 1,050 acres. Patch sizes for post railroad logging fires averaged 419 (range: 114 - 955) acres which was 60.5% of all fires. These fires occurred in cutover (67.6%) and old burn (23.5%) areas. The annual reburn rate was 3.9% (not including slash fires). Railroad logging's peak in the 1920's and 1930's coincided with the 2nd and 3rd warmest decades of the 20th Century and mountains of logging waste that averaged 21,000 (range: 16,000 to 28,000) bft/acre and total woody debris (coarse and fine) that averaged 95,232 and 98,304 respectively (range: 26,112 - 210,432) bft/acre. Often harvested areas and wildfires became conflagrations such as the Yacolt Burns, the Tillamook Burns and the 1938 Fire on Vancouver Island. Complex interactions between railroad logging and successive, multiple natural/anthropogenic fires created landscapes with mixed severity disturbance regimes that may enhance biodiversity.
Keywords: Disturbance, Anthropogenic, Natural, Harvesting, Post-disturbance recovery

90. A glimpse into historical railroad logging methods in Oregon's North Coast and the influence of legacy structures on riparian systems
Authors: Rogers, Ann Rogers, NRCS; Debora Johnson, Applegate Forestry
Offered Presentations: Symposium 6: Landscape and Disturbance Legacies of Railroad Logging: 50 to 130 Years of Post Disturbance Recovery - Tuesday (2011-04-05): 09:40 - 10:00 - Broadway 1
Abstract: This paper is a case study of the Blodgett Forest, located in Columbia County, Oregon. Initially railroad logged prior to 1927 with the removal of an estimated 15 mmbf. The area was subsequently impacted by the Tillamook burn complex of forest fires. Today the area has regenerated with Douglas fir, western hemlock, and western red cedar timber. The riparian areas are characterized by alder and big leaf maple and often associated with important anadromous fish habitat. The remnants of the historic railroads have affected and been utilized by forest management primarily for access. While recognized for their historic qualities, however, the impacts of these structures as they age and fail transform the landscape catastrophically. These failed structures bring large volumes of sediment unlike what would have happened naturally and adversely impact salmon habitat.
Keywords: Historic railroads, Forestry, Riparian, Oregon

91. Log transport approaches and legacies to anadromous fish habitat in the Willamette Valley, Oregon
Authors: Danehy, Robert Danehy, Weyerhaeuser Company; Peter James, Weyerhaeuser Company; Rebecca Miller, Oregon State University; Kelly Burnett, US Forest Service PNW Research Station
Offered Presentations: Symposium 6: Landscape and Disturbance Legacies of Railroad Logging: 50 to 130 Years of Post Disturbance Recovery - Tuesday (2011-04-05): 10:00 - 10:20 - Broadway 1
Abstract: Industrious and creative early loggers addressed challenges in log transport by a variety of means, including: floating logs down the rivers, setting up mills close to forests, and using rail where

feasible. The earliest logging was of riparian areas where logs could be transported via the river. In many cases, transportation was assisted with the use of splash damming. Railroading for transportation was widespread, yet limited by topography as steep, highly dissected terrains were it was difficult to build railroads. We compare the history logging in two adjacent watersheds in the Willamette Valley with major topographical differences, In the Mohawk watershed there was extensive use of railroads that included a network of spurs into landings. Whereas in the Calapooia watershed, a rail head was established only as far as the Dollar logging camp mid-way up the watershed. We evaluate the impact of these differences in logging history with a disturbance index. The index, focusing on anadromous salmon habitat, is calculated from the impact of three types of disturbance: fire, floods and associated landslides, and logging practices. Logging practices include both log transport and riparian forest removal. The index shows the disturbance peaks and durations of highly disturbed conditions. Each disturbance was scaled by spatial extent and intensity and the index calculated annually. While current disturbance index values continue to decline, the overall legacy of logging practices on anadromous habitat will endure for many decades without substantial restoration.
Keywords: Logging, Railroads, Splash dams, Disturbance index, Salmon

92. Modelling the recovery of old-growth attributes in coastal forest following variable retention and natural disturbances
Authors: Gerzon, Michael Gerzon, University of British Columbia
Offered Presentations: Symposium 6: Landscape and Disturbance Legacies of Railroad Logging: 50 to 130 Years of Post Disturbance Recovery - Tuesday (2011-04-05): 10:20 - 10:40 - Broadway 1
Abstract: Logging in coastal British Columbia has reduced the extent of old-growth forest area from its historical distribution of 90% toward 55% of the landbase. Presently, the province employs an age threshold to identify old-growth forest. While this approach allows for a rapid inventory assessment on a landscape level, there are several factors that limit its efficacy: the age-based method does not capture the gradual development of old-growth features and it does not work well in multi-aged stands created through variable retention (VR) harvesting or natural disturbance. The objectives of the presented research were to: develop a set of structural attributes for assessing the old-growth condition based on a chronosequence analysis, evaluate capability of the FORECAST model to project the temporal trends in old-growth structural development, and employ FORECAST to assess the implications of VR scenarios on the recovery of old-growth attributes. A chronosequence study was established including 33 sites along the west side of Vancouver Island. Data collection included disturbance history, stand structural attributes, and soil properties. A set of attributes representing stand structure was developed that showed trends in the recovery of old-growth characteristics. The ecosystem management model, FORECAST, was evaluated against the chronosequence for its ability to project patterns of old-growth development. The model evaluation showed that FORECAST could be employed to project the impact of silviculture systems on the development of old-growth conditions. The modelling analysis of logging scenarios showed that VR can help to mitigate the effects of harvesting on the maintenance of old-growth structural attributes.
Keywords: Ecosystem modelling, Variable retention, Old-growth, Ecosystem recovery

93. Stand development following railroad logging: Stand reconstruction methods to assess disturbance effects of historical railroad logging
Authors: Deal, Robert Deal, PNW Research Station
Offered Presentations: Symposium 6: Landscape and Disturbance Legacies of Railroad Logging: 50 to 130 Years of Post Disturbance Recovery - Tuesday (2011-04-05): 11:00 - 11:20 - Broadway 1
Abstract: Stand reconstruction methodology is a highly useful tool to determine date and intensity of disturbances and their effect on regeneration and mortality, tree species composition and stand growth. Stand reconstruction methods could be applied to assess the effects of historical railroad

logging and determine whether railroad logging leads to major changes in stand development and species composition or reduced stand growth. As an example of this technique, the effects of historical partial cutting on stand structure, growth, mortality and species composition were evaluated on 73 plots in eighteen stands that were harvested 12-96 years ago in southeast Alaska. Stands were reconstructed using past records, cut stumps and tree increment cores from 986 western hemlock, Sitka spruce, western redcedar and yellow-cedar trees. Site-specific regression equations were developed to predict diameter at breast height (DBH) at time of cutting for all trees, relating former DBH with current DBH, basal area, species, and plot cutting intensity. These equations explained 77-99% of the variation in tree DBH at time of cutting. Stand mortality was estimated using snag class and snag age. Results were used to test assumptions that partial cutting of older forests results in reduced stand growth and vigor, increased wounding and mortality and changes in tree species composition. The current stand basal area, tree species composition, and stand growth for all cutting intensities was strongly related to trees left after harvest. Concerns about greatly reduced stand growth, lack of spruce regeneration, and increased stand mortality after partial cutting were largely unsubstantiated.
Keywords: Partial cutting, Stand reconstruction, Sitka spruce, Western hemlock, Stand structure

94. Discussion (led by Erik Piikkila)
Authors: Piikkila, Erik,
Offered Presentations: Symposium 6: Landscape and Disturbance Legacies of Railroad Logging: 50 to 130 Years of Post Disturbance Recovery - Tuesday (2011-04-05): 11:20 - 11:40 - Broadway 1

95. Discussion (led by Erik Piikkila)
Authors: Piikkila, Erik,
Offered Presentations: Symposium 6: Landscape and Disturbance Legacies of Railroad Logging: 50 to 130 Years of Post Disturbance Recovery - Tuesday (2011-04-05): 11:40 - 12:00 - Broadway 1

96. Social values for ecosystem services (SolVES): quantifying and mapping stakeholder values for ecosystem assessments
Authors: Sherrouse, Ben Sherrouse, U.S. Geological Survey
Offered Presentations: Symposium 7: Methods for Sustaining Ecosystem Services: Combining Landscape Ecology and Spatial Economics to Prioritize Actions - Tuesday (2011-04-05): 09:20 - 09:40 - Broadway 2
Abstract: Natural ecosystems are under increasing pressures as human demand for their goods and services continues to grow. Tools and methods for effectively incorporating quantified and spatially explicit metrics of stakeholder values into ecosystem assessments, including tradeoff analysis among various ecosystem services, are an important area of research. The U.S. Geological Survey (USGS), in collaboration with Colorado State University, is contributing to this research with the development of a public domain tool, Social Values for Ecosystem Services (SolVES), available at http://solves.cr.usgs.gov. SolVES is a GIS application capable of mapping stakeholder values across the landscape. Using public attitude and preference survey responses, SolVES derives a 10-point Value Index representing the relative perceived social values of ecosystem services such as aesthetics and recreation for various groups of ecosystem stakeholders. These groups are distinguished according to their attitudes and preferences regarding ecosystem uses such as motorized recreation and logging. Correlation and regression analyses of SolVES output can identify and model relationships between stakeholder values quantified by the Value Index and metrics calculated from data layers representing physical characteristics of the underlying landscape such as elevation and distance to roads. These relationships can then be applied in a form of value-transfer methodology to generate predicted Value Index maps for areas lacking primary survey data. USGS will continue to develop more robust versions of SolVES by working with land and resource managers

as well as other researchers to apply it to specific ecosystem management problems in a variety of physical and social contexts.
Keywords: Ecosystem services, Social-ecological systems, Ecosystem assessment, Ecosystem management, Geographic information system

97. The National Atlas of Sustainable Ecosystem Services
Authors: Neale, Anne Neale, US Environmental Protection Agency
Offered Presentations: Symposium 7: Methods for Sustaining Ecosystem Services: Combining Landscape Ecology and Spatial Economics to Prioritize Actions - Tuesday (2011-04-05): 09:40 - 10:00 - Broadway 2
Abstract: The US Environmental Protection Agency along with its partner organizations is developing a National Atlas of Sustainable Ecosystem Services to promote human well-being. The Atlas is a web-based application that will allow users to map and analyze indicators of ecosystem services for the contiguous United States. The Atlas provides users the ability to assess the impacts of decisions on multiple ecosystem services in a spatially explicit context. Ecosystem service categories in the Atlas include clean water for drinking; clean water for recreation and support of aquatic habitat; food, fuel, and fiber; recreation, cultural, and aesthetic value; climate regulation; clean air; protection from floods; and habitat for maintenance of biodiversity. The Atlas, which is still in its early stages of development, currently includes 25 simple indicators of ecosystem services as well as other biophysical data layers relevant to decision-making. Indicators, derived from a variety of data sources including land cover, crop type, elevation, climate, population, hydrography, and soil attributes, are generally summarized by 12- digit hydrologic unit codes. A decision maker will frequently need to have information about supply, demand, and drivers of ecosystem services in order to make a wise decision; the Atlas includes all three of these aspects. We will briefly describe the Atlas and illustrate how it could be used in a decision-making context.
Keywords: Ecosystem services, Indicators, Atlas, Sustainability, Decision-making

98. Characterizing the spatial and temporal pattern of ecological values in dynamic landscapes
Authors: Spies, Thomas Spies, US Forest Service, PNW Research Station
Offered Presentations: Symposium 7: Methods for Sustaining Ecosystem Services: Combining Landscape Ecology and Spatial Economics to Prioritize Actions - Tuesday (2011-04-05): 10:00 - 10:20 - Broadway 2
Abstract: Conserving biodiversity and associated ecosystem values (e.g. carbon, recreation) in forest landscapes must be grounded in a solid understanding of ecological dynamics. While reserves and protection from human and natural disturbances are critical to conservation, these approaches are not sufficient to sustain ecosystems especially where landscapes have been altered by past human actions and where natural disturbances such as fire maintain ecosystem functions and ecological diversity. I present two cases that illustrate the importance of dynamics in sustaining ecosystem services in forest environments: 1) coastal Oregon where past logging has significantly reduced old forest habitats, and 2) the eastern Cascades of Oregon, where past logging has degraded old forests and ecological values are dependent on relatively frequent fire. In coastal Oregon, where conservation and future forest conditions vary across ownership, recovery of old forest conditions will require long periods of time and active management to increase ecological diversity of plantations. Other ecologically valuable forest types such as early successional forests and hardwoods will decline unless active management or natural disturbances create them. In the eastern Cascades, ecological values of forests are quite sensitive to frequency of fire. For example, northern spotted owls need dense coniferous forests that have developed without fire but old-growth mixed conifer and pine forest structure is dependent on frequent fire. Managers must use a landscape approach to prioritizing actions that restore resiliency of forests to wildfire while maintaining spotted owl habitat.
Keywords: Disturbance, Succession, Fire, Old growth

99. Assessing and mapping the capacity, flow, and demand on ecosystem services
Authors: Villamagna, Amy Villamagna, University of Maryland; Paul Angermeier, Virginia Tech; Elena Bennett, McGill University
Offered Presentations: Symposium 7: Methods for Sustaining Ecosystem Services: Combining Landscape Ecology and Spatial Economics to Prioritize Actions - Tuesday (2011-04-05): 10:40 - 11:00 - Broadway 2
Abstract: Ecosystem services (ES) are at the forefront of the conservation science frontier and provide a crucial management nexus among ecological function, economic value, and biological conservation of ecosystems. However, despite the recognized importance of protecting and enhancing the ecological processes that provide such services, ES have yet to be completely incorporated into private and public sector decisions. To date, assessments have focused on the flow of benefits to humans with little attention paid to the biophysical capacity of the ecosystem to provide the services. Our understanding and ability to quantify, map, and conserve ES can be enhanced by distinguishing among the biophysical capacity of an ecosystem to provide services, the flow of benefits to humans, and the ecological and social demand on ES. We present a new framework which evaluates each aspect of the ES and enables us assess ES condition independent of monetary value. The new framework identifies differences among provisioning, regulating, and cultural services and incorporates ecological and social demand on ES to provide a clearer picture of landscape-level sustainability. Using the framework and a watershed approach, we demonstrate a novel method for estimating flow of regulating services which, up until now, has largely relied on ambient quality measures that do not reflect the relationship between ecological stressors and capacity. We map the capacity and flow of freshwater-related ES (e.g. surface water supply and nitrogen and sediment regulation) using publicly available geospatial data to assess current ES condition across the Albemarle-Pamlico basin (North Carolina and Virginia).
Keywords: Ecosystem services, Capacity, Flow, Ecological demand, Freshwater

100. Describing landscape benefits to support land management decisions and policy analysis
Authors: Kline, Jeffrey Kline, US Forest Service, Pacific Northwest Research Station
Offered Presentations: Symposium 7: Methods for Sustaining Ecosystem Services: Combining Landscape Ecology and Spatial Economics to Prioritize Actions - Tuesday (2011-04-05): 10:20 - 10:40 - Broadway 2
Abstract: Since its emergence into the common lexicon of natural resource and environmental policymaking and management, scientists from a variety of disciplines have earnestly worked to apply the concept of ecosystem services to real-world decision-making. For the USDA Forest Service, applications have tended to focus on how the ecosystem services concept can aid in both evaluating the effects of management actions under consideration and fostering local or regional support (including even financial support) for specific actions that benefit people in specific localities or regions. From an economic perspective, these goals fit neatly with the objectives of landscape analysis as it has been conducted by Forest Service scientists in the Pacific Northwestâ€"specifically, describing the long term consequences of various policy and management paths. However, although the ecosystem services concept does help to frame landscape analysis in terms of human benefits, it may not necessarily address the lasting obstacles that appear to hinder public lands management on the ground. For example, anecdotal evidence from various national forests in Oregon suggests that those obstacles have less to do with the availability of information for describing expected management outcomes, and more to do with public and stakeholder trust in the Forest Service. This suggests that simply figuring out how to apply the ecosystem services concept in characterizing landscape-level benefits of management will not necessarily garner public and stakeholder support for actions under consideration. Rather, the ecosystem services concept must be fitted into a broader decision process that invites public and stakeholder input and participation.

Keywords: Ecosystem services, Benefits, Landscape analysis, Economics

101. Evaluating spatial concordance of ecosystem services and biodiversity in an urbanizing environment

Authors: Harris, Nyeema Harris, NCSU; Kevin Bigsby, NCSU; Melissa Mchale, NCSU; George Hess, NCSU

Offered Presentations: Symposium 7: Methods for Sustaining Ecosystem Services: Combining Landscape Ecology and Spatial Economics to Prioritize Actions - Tuesday (2011-04-05): 11:00 - 11:20 - Broadway 2

Abstract: The benefits and goods provided by nature for the well-being of people (ecosystem services) are determined in part by features of the landscape. As populations grow and urban areas expand, ecosystem services may be degraded and conservation efforts become progressively more difficult. One strategy to conserve natural areas for multiple human and wildlife purposes is to identify locations high in both ecosystem services and biodiversity. However, this strategy may be less successful in highly developed, urbanized ecosystems than it is in rural areas. We evaluated the concordance between ecosystem services and biodiversity in the Upper Neuse Watershed (1,961 km2) of North Carolina's Triangle region, a state with the fifth-largest population growth rate nationally. We used the program InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) to quantify pollination, carbon storage, and nutrient retention; and evaluated whether the land providing the highest quartile of these stacked ecosystem services included species and ecological communities of conservation concern. Our interpretation of spatial concordance varied with the metric of biodiversity used. The land providing the highest quartile of ecosystem services protected only 22% of significant natural heritage areas, yet included 71% of known species and ecological communities of conservation concern, and held 98% of the total vertebrate species expected in the region. Ultimately, identifying lands that provide high levels of both ecosystem services and biodiversity protection may be possible in urbanized area. The heterogeneity and high land costs of such landscapes, however, will make doing so challenging and potentially inefficient.

Keywords: Urban, Biodiversity, Conservation, Stacked services, Concordance

102. Using risk of reinvasion to prioritize invasive plant species management

Authors: Lookingbill, Todd Lookingbill, University of Richmond; Emily Minor, University of Illinois - Chicago; Joseph Ferrari, University of Maryland Center for Environmental Science; Lisa Wainger, University of Maryland Center for Environmental Science

Offered Presentations: Symposium 7: Methods for Sustaining Ecosystem Services: Combining Landscape Ecology and Spatial Economics to Prioritize Actions - Tuesday (2011-04-05): 11:20 - 11:40 - Broadway 2

Abstract: Understanding the relationship between landscape pattern and the distribution and spread of exotic species is a necessary first step in determining where and whether management actions are best applied. We have developed an interdisciplinary approach for prioritizing treatment of harmful non-native invasive plants in mixed-use National Parks within the Washington, D.C. region. We describe in this presentation the approach used in the spatial decision support tool to calculate the risk of reinvasion following invasive species treatment. We present the details of restorability modeling for Ailanthus altissima (tree of heaven) in Antietam National Battlefield, and then demonstrate how the tool is applied to general classes of invasive species for parks in the region. The model combines information on (I) habitat suitability, (II) global seed rain, and (III) local propagule pressure to quantify reinvasion risk. The habitat suitability model uses a Mahalanobis distance approach, parameterized from plant inventory plot data and GIS-based data on plot wetness, land cover, slope, radiation, and soil characteristics. Global seed rain estimates are derived empirically from park inventory data. Local propagule pressure is modeled using species life history characteristics including dispersal attributes, connectivity to nearby plant populations, and increased

propagule pressure through disturbance. We validate the model using treatment effectiveness data from the parks' Exotic Plant Management Teams. The results of the modeling highlight parks and regions of the parks where eradication would be most prudent and feasible based on current infestation patterns and landscape attributes. Placed within the context of the entire decision support tool, the assessment ranks spatially explicit treatment options based on their ability to enhance ecosystems services per dollar spent.
Keywords: Invasive species, Habitat models, Ecosystem management, National Parks, Washington, D.C.

103. Applying spatial benefit transfer to measure the economic returns from restoration
Authors: Wainger, Lisa Wainger, University of Maryland Ctr Environ Science; Alynne Bayard, University of Maryland Ctr Environ Science
Offered Presentations: Symposium 7: Methods for Sustaining Ecosystem Services: Combining Landscape Ecology and Spatial Economics to Prioritize Actions - Tuesday (2011-04-05): 11:40 - 12:00 - Broadway 2
Abstract: Ecosystem service values are location-specific and multiple efforts have sought to map these values in order to represent the spatial heterogeneity of benefits or cost-effectiveness attributable to environmental policy choices, such as which locations to protect or restore. Most of these mapping systems use some type of benefits transfer because it allows economic studies from one location to be transferred to unstudied locations, thereby saving substantial effort when multiple sites must be compared. The majority of such systems use simple transfer techniques in which ecological condition or land cover type is associated with an average value per acre, an approach that typically fails to characterize two important aspects of social value, namely, the demand for services or their scarcity in a given location. The robustness of benefit transfer can be enhanced by applying a transfer function that inflates or deflates values according to location-specific characteristics that are known to influence social benefits of the service being provided. By applying economic theory and empirical evidence, we have created indicators and applied multivariate techniques to build a transfer function to represent the relative social benefits of restoration decisions by location for use and non-use services. The indicators quantify: the quality of relevant ecological conditions and processes, presence of complementary inputs that define service capacity and popularity, and scarcity as represented by rarity and substitutability. We will demonstrate our system for spatial benefit transfer using a case study that evaluates the economic benefits of invasive species management in two National Parks.
Keywords: Ecosystem services, Economics, Invasive species, Restoration

104. Dueling myths: The pristine vs. the garden
Authors: Mladenoff, David Mladenoff, University of Wisconsin - Madison
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 09:20 - 09:40 - Broadway 1
Abstract: The extent of Native American Indian effects on ecosystems has produced mixed understanding. There is a dichotomy I will address framed in the context of our symposium of historical ecology in developed landscapes. These dueling myths are about the foundational mythology of human use and effects on ecosystems. I characterize these as two caricatures: one often described as â€œthe pristine mythâ€□â€"that before Euro-American settlement and industrialization period, North American ecosystems were in there virginal, pristine state, with negligible human impacts. The second I characterize as the â€œgardenâ€□ myth, that in this pre-European period, Indian impacts on ecosystems were widespread and dominant, and that rather than a pristine environment, it was a human-dominated landscapeâ€"in effect, a cultivated garden. I also recognize ambiguity the â€œgardenâ€□ term, which is intentional, and can refer to a naÃ¯ve garden

in the biblical sense, both virginal but harmonious with humans. To an extent, both of these viewpoints have been defended and debased by opposing intellectual camps, with ideological and philosophical roots both shared and divergent. Sorting out this conundrum remains important to many aspects of historical ecology, including human effects and legacies on ecosystems, the long-term range of variation of ecosystems, and understanding the future trajectories of change. I will address this by drawing on recent literature within historical ecology, broadly defined, to suggest that both of these â€œmythsâ€ are inaccurate and unhelpful to understanding past effects of humans and their long-term legacies on ecosystems.
Keywords: Historical ecology, Native American Indian effects, Pristine myth, Garden myth, Human use legacy effects

105. Linking historical geomorphology and historical ecology to guide river restoration in the Puget Sound region
Authors: Collins, Brian Collins, University of Washington; David Montgomery, University of Washington
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 09:40 - 10:00 - Broadway 1
Abstract: River ecosystems are tightly linked to the physical template. This makes it necessary, in highly modified landscapes, to understand historical physical processes and landforms as well as historical ecology. We reconstructed the linked historical ecology and geomorphology of the Puget Sound region's primarily agricultural and urban rivers and estuaries using a combination of cross-referencing approaches including field studies in relatively unmodified areas and a regional map reconstruction of pre-settlement habitats and landforms. Anthropogenic change generally simplifies and homogenizes river landscape; â€œpeeling awayâ€ that change in the Puget Sound region reveals considerable landscape complexity and spatial variation that historical change has obscured or eliminated. For example, ongoing, contrasting fluvial responses to the legacy of Pleistocene glaciation create different sets of physical processes and landforms. These geomorphic templates comprise different river patterns, river dynamics, floodplain landforms, and river-floodplain connectivity that in turn generate different forest compositions, wetlands, and aquatic habitats. Failing to understand the geomorphic templates, their role in organizing ecosystems, and the scale and pattern of their spatial variation, could limit effectiveness of restoration efforts which might otherwise rely on inappropriate landscape models. In addition to providing conceptual models for restoration in the Puget Sound region, the historical reconstruction provides quantitative measures of historical processes and habitats; these models and measures are being applied to estimating changes to historical salmonid productivity, creating targets for salmonid recovery, land use planning, and restoration design at the site, basin, and region scales.
Keywords: Historical ecology, Fluvial geomorphology, River restoration, Riverine ecology

106. Beaver in tidal wetlands: the impact of lost habitats on forgotten ecological relationships
Authors: Hood, Gregory Hood, Skagit River System Cooperative
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 10:00 - 10:20 - Broadway 1
Abstract: Wholesale anthropogenic transformations of ecological communities that characterized historical landscapes has led to loss or alteration of ecosystem functions, many of which were never documented prior to their loss. The resulting ecological amnesia can impair management of threatened or endangered speciesâ€"including habitat restoration for species recovery. For example, tidal shrub habitat is rare in Pacific Northwest estuaries due to historical conversion to agriculture. A survey of remnant tidal shrub habitat revealed that beaver occupy this estuarine vegetation zone, but

not the tidal emergent vegetation zone. Beaver dams and lodges were found exclusively in shrub zone tidal channels at densities equal or greater than those in riverine or lacustrine systems. Beaver dams were overtopped by high tides, but they formed extensive pools at low tideâ€"quadrupling the amount of low tide pool habitat compared to channels without dams. Seven fish species were caught in low tide pools, including threatened juvenile Chinook salmon. Chinook densities (by volume) were 3.2 times higher in low tide pools than shallows. Accounting for the total contribution of pools and shallows to juvenile Chinook abundance at low tide, beaver pools nearly triple total channel carrying capacity for juvenile Chinook salmon at low tide relative to systems without low-tide beaver pools. Current Chinook recovery efforts focus on restoring tidal marsh habitat for rearing juveniles, but this focus overlooks a suite of currently rare and poorly understood habitat types that existed on the historical landscape and likely interacted synergistically to support Chinook salmon and other fish and wildlife.
Keywords: Beaver, Salmon, Estuary, Ecological amnesia

107. The Welikia Project: Reconstructing the ecological landscape of New York City at the time of European contact
Authors: Sanderson, Eric Sanderson, Wildlife Conservation Society; KIM Fisher, Wildlife Conservation Society
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 10:40 - 11:00 - Broadway 1
Abstract: Cities are highly modified ecosystems, created by and dedicated to human settlement, work and recreation. Because they are highly modified by infrastructure and high population densities, it can be difficult for urban planners to understand them as ecosystems, let alone as ecological landscapes, characterized by ecosystem patterns and processes, even at the same time urban planners seek more ecologically-minded, sustainable patterns of development. One way to help build the understanding of landscape is to use landscape ecology to reconstruct historical patterns and processes at times when the human footprint fell less heavily across the landscape. In New York City, this search has meant looking back to the moment of European discovery, 400 years ago, when Manhattan was known as Mannahatta. In this talk I will present evidence for the historical ecology of Mannahatta, including the 55 different ecological communities once found on the island, providing habitat and conveyors for water, carbon and other ecosystem components. I will connect these historical ecology studies to modern conversations about and benchmarks for sustainability in New York, and describe the process of expanding our work to the other five boroughs of New York City (the Bronx, Queens, Brooklyn, Staten Island and the New York Seascape,) to discover â€œWelikia,â€□ which in the Lenape Native American language of the Contact period meant â€œmy good home.â€□

108. Cultural landscape change in northern Wisconsin (1860-1987): Insights from an integration of history and ecology
Authors: Steen-Adams, Michelle Steen-Adams, University of New England; David Mladenoff, University of Wisconsin-Madison; Nancy Langston, University of Wisconsin-Madison; Jun Zhu, University of Wisconsin-Madison; Feng Liu, University of Wisconsin-Madison
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 11:00 - 11:20 - Broadway 1
Abstract: In recent years landscape ecologists have tapped into historical ecology to inform landscape change analysis and restoration targets. A less-explored perspective is that a related field, environmental history. In this presentation, we examine the development of a cultural landscape in northern Wisconsin, U.S.A. on the Lake Superior Clay Plain, a landscape that has been highly

modified by more than a century of intensive forest harvest, agriculture, and settlement (ca. 1860-1987), and prior to these actions, centuries of alteration by the Great Lakes Ojibwe and other tribes. Multinomial regression landscape model analysis shows that a cultural variable (on-Indian reservation versus off-reservation), soil content (percent clay and sand) and land elevation interacted to influence land cover pattern and transition. We find that within this single land type association (LTA), two geographically distinct zones of landscape composition developed by 1930 and persisted into the late 20th century. Environmental history analysis provides insight to these results: the spatially distinct histories of the Bad River Indian reservation, subject to the dominant influence of the Bureau of Indian Affairs, in contrast with that of a neighboring off-reservation (primarily private ownership) region, led to the development of two distinct zones in the landscape. For applied landscape ecologists, an integration of environmental history arguments, archival datasets, and methods with those of landscape ecology can reveal a more complete, complex story of how current landscapes developed and illuminate the cultural context to which restoration initiatives must respond.
Keywords: Environmental history, Landscape change, Cultural landscape, Indian reservation, US Public Land Survey

109. Intensive native Sami land-use in the Swedish mountains AD 800-1200 leads to deforestation and ecosystem transformation
Authors: Ostlund, Lars Ostlund, SLU
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 11:20 - 11:40 - Broadway 1
Abstract: Historical deforestation in Europe has primarily taken place in densely populated temperate regions and in connection with the expansion of agriculture. In the northern boreal parts of Europe, deforestation has been spatially rather limited and often only temporary. In this talk I will present results from a multidisciplinary study of the deforestation of a subalpine valley in the Fennoscandian mountain range by native Sami people in the period 800-1200 AD. The studied area encompasses approximately 10 km2 and lies at 67Â° N and at an altitude between 600 and 700 m a s l near the Sulitelma glacier. We combined detailed archaeological surveys (including advanced 14C-dating of hearths) with retrospective ecological methods, historical demography, experimental approaches and ecosystem modeling to analyze the deforestation process and to interpret how and why this past land-use caused a permanent large dent in the present birch (Betula pubescens ssp. tortuosa) tree-line in this region. Sami settlers built StallÃ³-huts of birch stems and birch bark, and they used raw mountain birch for fuel while living in the harsh subalpine environment during winter. This land-use triggered deforestation and vegetation changes which in turn had long-term negative effects on the natural regeneration of trees. We conclude that the present tree-line can be affected by past anthropogenic factors even in areas with very low human population historically, that under certain conditions deforestation can have very long lasting effects in low-productive ecosystems, and that a multi-disciplinary approach with intense collaboration is necessary in order to decipher historical land-use legacies.
Keywords: Forest history, Sami, Sweden, Deforestation, Land use

110. Poverty and land-use history shape landscape dynamics and ecosystem function in a swidden-fallow system in the Peruvian Amazon
Authors: Rhemtulla, Oliver Coomes, McGill University; Sylvia Wood, McGill University
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 11:40 - 12:00 - Broadway 1
Abstract: Swidden-fallow cultivation is one of the most important drivers of tropical deforestation. While deforestation has many detrimental ecological consequences, secondary forest regrowth

during the fallow period has the potential to restore important ecosystem functions such as biodiversity, carbon storage, and soil fertility. In a subsistence peasant community in the Peruvian Amazon, we are investigating how poverty (defined in terms of total household land holdings) affects land-use practices (frequency and length of swidden cycles), and therefore forest dynamics at the landscape scale. Moreover, we are testing whether differences in land-use history (resulting from differential land-use practices) create persistent legacies in plant composition and soil nutrient cycling, thereby influencing future land-use options and the sustainability of the swidden-fallow system. To answer these questions, we conducted detailed household surveys (n=50), and visited, mapped, and reconstructed yearly land-use/cover history for each field and forest fallow (nâ‰ˆ350) from the mid 1960s to 2007 in a small community (886ha) near Iquitos, Peru. Changes in land cover mapped through field histories were compared to independent land-cover maps derived from historical airphotos and satellite imagery from 1965, 1972, 1978, 1991, and 2007. Results show that poorer farmers have shorter average cultivation cycles, younger forest fallows, fewer fields with tree crops, and a higher average number of previous cultivation cycles per field. Preliminary analysis suggests that the more intensive land-use history of poorer farmers affects current biodiversity and soil characteristics, thereby potentially creating a positive feedback leading to lower crop productivity and pressure to increase cultivation intensity further.
Keywords: Historical ecology, Land-use history, Agroforestry, Landscape pattern, Land cover change

111. Wildlands and Woodlands: Using history, science and a vision to advance a conservation future for New England
Authors: Foster, David Foster, Harvard Forest Harvard University
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 13:00 - 13:20 - Broadway 1
Abstract: The New England landscape is at another turning point. Following rampant deforestation and intensive harvesting, the region began reforesting in the 19th C when agriculture and forest production shifted to other regions of the country. Today, after a 150-year resurgence, forest cover has begun to decline in every state. History has provided the region, and much of the eastern U.S., with a second chance to determine the fate of its forests: what will we do with this opportunity and challenge? Forged by twenty academics, the Wildlands and Woodlands vision calls for a 50-year conservation effort to retain at least 70 percent of New England in forestland, permanently free from development: 90% of these forests would be â€œWoodlands,â€ conserved by willing landowners and sustainably managed for multiple uses and10% would be â€œWildlandâ€ reserves, identified by local communities and shaped only by the natural environment. This vision cannot be accomplished by sweeping public acquisition or regulatory fiat. It will require working with thousands of willing private landowners who are interested in securing the future of their land through conservation easements and other approaches. This effort raises fundamental questions that will be addressed in this presentation regarding the value of once heavily degraded lands, the appropriate role for academics in shaping and advancing major policy initiatives, and the utility of historical research and ecological science in directing conservation goals and management and assisting in forecasting future changes in our lands.
Keywords: Conservation, Land use, Land protection, Forest ecology

112. New strategies from old maps: using historical ecology to design diverse, resilient landscapes
Authors: Grossinger, Robin Grossinger, San Francisco Estuary Institute; Letitia Grenier, San Francisco Estuary Institute; Erin Beller, San Francisco Estuary Institute
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 13:20 - 13:40 - Broadway 1

Abstract: Historical landscape studies conducted over the past decade in highly modified watersheds of coastal California have created a dataset of intensively studied areas with comparable mapping of historical ecological and hydrogeomorphic patterns. Taken together, these data provide an uncommonly detailed perspective on the relationships between ecological functions and physical gradients before intensive Euro-American modification. Comparison between watersheds reveals certain themes consistent across broad climatic, topographic, and geologic/edaphic gradients, allowing us to begin developing â€œreference landscapesâ€□: new conceptual models describing the distribution of ecological functions in relation to physical processes. For example, habitat types such as valley oak savanna and freshwater wetland are observed consistently and in similar proportions across a broad precipitation gradient; in contrast, riparian forest types exhibit strong differences between wetter and drier climates. We also find that local variations in topography and groundwater consistently exhibited strong controls on lowland habitat distribution across coastal California. Many of these gradients are still intact today, even in urbanized areas. As a result, this emerging understanding of former dynamics in California is an essential foundation for establishing management strategies for future landscapes. Directing conservation efforts toward the areas with amenable topography for perennial wetlands/river reaches and maintaining groundwater levels for target communities can maximize the resilience of California coastal landscapes to climate change and other stressors. Since highly modified systems are often intensively managed, these regions represent a significant opportunity to actively design projects that re-establish natural processes along these gradients.
Keywords: Historical ecology, Landscape history, Urban ecology, Groundwater, Climate change

113. Discussion (led by David Mladenoff)
Offered Presentations: Forest Ecology - Wednesday (2011-04-06): 13:40 - 14:00 - Broadway 1

114. Mapping potential vegetation communities: A comparison of methods
Authors: Christopher, Theresa Burcsu, Institute for Natural Resources, Portland, Oregon State University; Emilie Henderson, Institute for Natural Resources, Portland, Oregon State University
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 09:20 - 09:40 - Broadway 2
Abstract: Maps of potential vegetation are valuable for natural resource management and planning. Despite their importance, such maps are subject to a great deal of misclassification and disagreement for several reasons: field-based misclassification of potential vegetation subtypes (i.e., plant associations); differences in the way subtypes are grouped before and after modeling; differences in modeling methods; and differences in the environmental inputs used to model these groups. In our work, we use potential vegetation maps to define ecological boundaries spatially and to parameterize state and transition models of vegetation dynamics used for management applications. In this study we compared maps developed using random forest classification with imputation and maps developed using non-linear regression methods. Our goals were to assess map uncertainties and potential drawbacks of rapid map production using random forest with imputation. We analyzed map differences using two fuzzy kappa techniques (a statistical measure of agreement): fuzzy categories, based on a similarity matrix of potential vegetation classes; and fuzzy location, using search neighborhoods to account for small location differences. We also independently assessed map accuracy with traditional, classification error matrices based on validation plot data. Our study areas were the Winema-Fremont and the Mt. Baker-Snoqualmie National Forests of Oregon and Washington, respectively. Additional research on improving the accuracy of these maps included: the effect of the model region size, the effect of lumping categories (i.e., coarsening), and increasing the number of environmental inputs.
Keywords: Potential vegetation, Predictive vegetation mapping, Random forest classification, Kappa statistic, Map accuracy

115. Predicting cheatgrass and juniper invasion in eastern Oregon shrub steppe using state-and-transition models
Authors: Creutzburg, Megan Creutzburg, Institute for Natural Resources
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 09:40 - 10:00 - Broadway 2
Abstract: Many threats are jeopardizing the shrub steppe of the Columbia Basin, including the spread of invasive species such as cheatgrass (Bromus tectorum) and expansion of Western juniper (Juniperus occidentalis) into shrub steppe beyond its historical range. Native shrub steppe provides important habitat for many wildlife species and is valued for its biodiversity, and land managers are in need of tools to aid in assessing risk of shrub steppe conversion and management options to maintain native shrub steppe. For the Integrated Landscape Assessment Project, we use a state-and-transition modeling approach to project changes in shrub steppe vegetation over time. We construct models using both empirical data, including empirically-derived fire probabilities, and expert opinion for transitions that are still poorly understood, such as livestock grazing effects. Without aggressive management, cheatgrass is expected to increase in many warm, dry Wyoming big sagebrush communities, and juniper invasion is likely to expand throughout much of the cool, moist mountain big sagebrush habitat where seed sources are readily available. In transitional communities between Wyoming and mountain big sagebrush zones, we expect that most of the landscape will convert to either cheatgrass or juniper woodland. We discuss the treatment rates for cheatgrass and juniper control that are likely to maintain native shrub steppe vegetation at its current level. We conclude that predictive state-and-transition models provide a useful framework for conceptualizing vegetation dynamics of shrub steppe systems, making projections of future vegetation conditions, and evaluating the likely effects of management treatments.
Keywords: Shrub steppe, Cheatgrass, Juniper, Invasive species, Rangeland

116. Forecasting future landscape conditions of forested lands in Oregon coast range using Vegetation Dynamics and Development Tool
Authors: Bisrat, Simon Bisrat, OSU; Emilile Henderson, OSU; Josh Halofsky, WA-DNR; Miles Hemstrom, USFS; Rich Gwozdz, OSU
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 10:00 - 10:20 - Broadway 2
Abstract: As part of the Integrated Landscape Assessment Project (ILAP) that is underway in Oregon, Washington, Arizona, and New Mexico, we forecasted the future landscape conditions of forested lands in Oregon coast range (OCR) using Vegetation Dynamics and Development Tool (VDDT) which is a state and transition modeling environment. The models consist of various states (a combination of cover type and structure) where structure is defined by tree diameters, density, and canopy layers. The transitions include both deterministic transitions (i.e. aging in the absence of any disturbances) and probabilistic transitions (i.e. disturbances such as fire and insects). The OCR is known to have a complex vegetation type and structure that provides various ecosystem services such as timber production, recreation, and wildlife habitat. A sound forest land management necessitates an approach that integrates all different ownerships across a landscape. But forests in OCR like in any other region are managed by different state and federal agencies. This modeling approach gave us the opportunity to predict future landscape conditions across the different ownership boundaries. We used a total of 18 models that represent the major potential vegetation types (PVTs) of OCR with each model containing its own set of natural and management transitions and the probability each transition occur. We used PVT, current vegetation, watershed (HUC5), and ownership and management GIS layers to more realistically define our initial conditions. We present model outputs that were run for 300 years at 30 Monte Carlo simulations for “no management with fire suppression” scenario.

Keywords: VDDT, Landscapes, Disturbances, Forests, Oregon coast range

117. Simulating fire hazard across landscapes through time: Integrating VDDT and the Fuel Characteristic Classification System (FCCS)
Authors: Hart, Stephanie Hart, 1University of Washington and US Forest Service, PNW Research Station, Pacific Wildland Fire Sciences Laboratory; Jessica Halofsky, 1University of Washington and US Forest Service, PNW Research Station, Pacific Wildland Fire Sciences Laboratory; Morris Johnson, US Forest Service, PNW Research Station, Pacific Wildland Fire Sciences Laboratory; Miles Hemstrom, US Forest Service, PNW Research Station, Portland Forestry Sciences Lab; Roger Ottmar, US Forest Service, PNW Research Station, Pacific Wildland Fire Sciences Laboratory
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 10:20 - 10:40 - Broadway 2
Abstract: The Vegetation Disturbance Dynamics Tool (VDDT) and the Fuel Characteristic Classification System (FCCS) are two valuable products used by many land managers throughout the United States. VDDT is a state and transition model that simulates changes in vegetative composition and structure across a landscape under different disturbance regimes and management scenarios. The FCCS is a software application that allows users to record fuel characteristics as fuelbeds and analyze fire potential of wildland and managed fuels. Although the utilities of VDDT are many, VDDT does not directly assess fire hazard for different vegetation states. We are integrating VDDT and FCCS to enhance the utility of VDDT and enable simulation of vegetation composition, structure, and related fire potential across a landscape over time. Multiple FCCS fuelbeds will be created, based on plot data, for every VDDT state class (vegetation structure and cover combination) in mid-scale (5th field watershed) models covering the states of Oregon, Washington, Arizona and New Mexico. Fire potential, including fire behavior potential, crown fire potential, and available fuel potential, will be calculated for each fuelbed in FCCS, and mean fire potential will be calculated for each VDDT state class. The resulting link between VDDT state classes and fuelbed fire potential will allow users to assess the effects of disturbance regimes and management activities, such as fuel treatments, on vegetation communities and related fire hazard across a landscape over time.
Keywords: Model, Fuel, Fire, VDDT, FCCS

118. Balancing feasibility and precision of wildlife habitat analysis in planning for natural resources
Authors: Morzillo, Anita Morzillo, Oregon State University
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 10:40 - 11:00 - Broadway 2
Abstract: Wildlife conservation often is a central focus in planning for natural resource management. For planning efforts at regional or national levels, evaluation of wildlife habitat involves balancing the desire for information about fine-scale habitat characteristics and the feasibility of completing analysis across large areas. My objective is to use experiences from an ongoing study to describe approaches for managing assessment of wildlife habitat within a multiple-objective modeling framework. The Integrated Landscape Assessment Project is a broad-scale effort to evaluate impacts of land management strategies on fuels condition, timber production, wildlife habitat, and community economics across Oregon, Washington, Arizona, and New Mexico. During the first year of this project, the wildlife team has worked through several obstacles in habitat assessment. For example, although the Vegetation Dynamics Development Tool (VDDT) was chosen as the central model within the multi-objective framework, the quantitative forest characteristic output of that model often does not match well with descriptions of habitat features important to focal wildlife species. Researcher interpretation of existing habitat information is subjective, which can lead to inconsistency in habitat definition. Attempts are being made to validate habitat identification with group discussion and consultation with field biologists. Further analysis will focus on important fine-scale and species-specific information (e.g., connectivity, water sources) that cannot be accounted for in current model

output. When preparing knowledge for application to natural resource planning, there is a need to focus on consistent and defensible information and emphasize the limitations of knowledge derived from data analysis.
Keywords: Fuels management, Habitat, Land use planning, Systems model, Wildlife management

119. Variation and uncertainty in future amounts of dry, older forest in the Eastern Cascades, Washington
Authors: Hemstrom, Miles Hemstrom, US Forest Service; Joshua Halofsky, Washington Dept. of Natural Resources; Jessica Halofsky, University of Washington
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 11:00 - 11:20 - Broadway 2
Abstract: Older forest structural conditions are important sources of wildlife habitat and other resource values in dry environments of the Eastern Cascades in Washington. A combination of natural disturbances (especially wildfire and insect outbreaks), forest management activities, and vegetation development rates may interact in variable ways to produce future amounts of old forests. We use a state and transition modeling approach to integrate these factors to estimate potential future old forest conditions. Our process includes variation in natural disturbances over time, based on a 25-year empirical record of wildfire size and severity in the Washington East Cascades ecological region. Our results show that future old forest conditions are likely to vary substantially depending on temporal patterns of disturbances and feedback loops between disturbances, management, and vegetation development. Individual Monte Carlo runs look very different from the average of many runs. Overall, we suggest that old forests are likely to be less abundant in the future than at present and that future trends likely include strong boom-and-bust periods depending on rare but important wildfire events.
Keywords: Dry forests, Pacific Northwest, Simulation modeling, Management, Disturbances

120. Translating landscape management intent across ownership boundaries: applications for modeling and conservation planning
Authors: Whitman, Melissa Whitman, Oregon State University; Jimmy Kagan, Oregon Biodiversity Information Center; Miles Hemstrom, US Forest Service PNW Research Station
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 11:20 - 11:40 - Broadway 2
Abstract: Landscape assessments involving large areas (â‰¥ 500,000 ha) and many ownerships should be based on a comprehensive understanding of how individual land owners manage their lands. Events like fire, animal migration, and vegetation development are independent of ownership boundaries, but are influenced by anthropogenic actions. To date, conservation status has been largely restricted to whether or not a parcel is protected (commonly based on ownership), but explicit details of management intent are rarely mapped. However, a unified map of management decisions is essential for collaboration among landscape stakeholders for â€œall landsâ€□ assessments, ecological forecasting, and conservation planning. The Integrated Landscape Assessment Project (ILAP) is evaluating a set of scenarios based on both past performances and current direction, as established by various plans including the Northwest Forest Plan, Land and Resource Management Plans (LRMP), and Visual Resource Management Plans. We describe the process used to integrate land management information for all of Oregon and Washington using geospatial data from multiple agencies (e.g. Forest Service, Bureau of Land Management). Our goal is to standardize management allocation language and to evaluate large-scale implications of various designations. We also discuss the barriers and significant challenges associated with this project, such as the differences in terminology within and between agencies, even for areas managed with similar intent (e.g. wildlife conservation, recreation, scenic buffers, logging revenue). Details, such as database design and

methods for integrating data into national datasets, are also discussed. Lastly, applications for future landscape level projects, reserve design, or conservation efforts are presented.
Keywords: Landscape management, GIS, Conservation, Washington, Oregon

121. Decision support for integrated resource assessment
Authors: Gordon, Sean Gordon, Oregon State University
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 11:40 - 12:00 - Broadway 2
Abstract: Integrated resource assessments face the challenge of how to summarize and present large, diverse data sets. One approach being used by the Integrated Landscape Assessment Project is the Ecosystem Management Decision Support system (EMDS). EMDS brings fuzzy logic and multicriteria decision analysis tools into the GIS environment for assessing and combining diverse indicators and presenting results at multiple levels of aggregation. Results will be presented for a prototype assessment for a 2.3 mixed ownership area in central Washington. Major challenges and decision points to be discussed include choosing indicators relevant to management concerns; assessing indicators to a common scale for aggregation; choosing levels for conceptual, temporal and spatial aggregation; and handling uncertainty in the modeling framework.
Keywords: Decision support, Integrated assessment, Multicriteria decision analysis, Fuzzy logic, Modeling

122. Producing relevant simulation results for land managers
Authors: Bachelet, Dominique Bachelet, Conservation Biology Institute
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 13:00 - 13:20 - Broadway 2
Abstract: Climate change scientists have been providing climate model ensembles for global assessments with some attempts at quantifying uncertainty. They have compared the various climate model approaches and provided some guidance to prioritize them as a function of their relevance to regional issues and to the scale of the study. Meanwhile, ecologists have rarely provided ensembles of impacts models and results from the literature often appear contradictory and thus confusing to land managers and decision makers. Moreover, hydrologists have provided projections of the impacts of climate change on regional hydrological cycles with minimal consideration of potential vegetation shifts and changes in water demand as climate changes. The lack of close collaboration between vegetation and hydrological scientists has caused discrepancy in recommendations for strategic preparation for change. Model ensembles bring together different approaches and conflicting results often simply highlight gaps in knowledge. Ensembles of impacts models could help define needs for measuring and monitoring ecosystems with the ultimate goal of calibrating and testing forecast models. New sets of data are useful to revise previous assumptions based on historical understanding of ecosystem response to change. Web-based GIS tools such as databasin.org provide a useful platform to make available various model results to the various research teams and managers alike. They help to compare and discuss strengths and weaknesses of various modeling approaches, allowing easy comparison with observations and the calculation of spatial and temporal uncertainty indices, translating model output into relevant economic currency such as ecosystem services values, while encouraging creative hypotheses testing.
Keywords: Modeling, Climate change, Management, Web tools

123. Climatizing state and transition models using a dynamic global vegetation model: tales from the trenches
Authors: Kerns, Becky Kerns, USDA FS; Dominique Bachelet, CBI; David Conklin, CBI; Michelle Buonopane, USDA FS; Miles Hemstrom, USDA FS

Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 13:20 - 13:40 - Broadway 2
Abstract: Evaluating how climate change may potentially impact ecosystems sustainability and ecosystem services is a key challenge for land managers. State and transition models such as the Vegetation Dynamics Development Tool (VDDT), can be used to design landscape management strategies that anticipate potential changes, but they do not explicitly incorporate climate. Our objectives are to link output from the Dynamic Global Vegetation Model MC1 to a suite of VDDT models using two example landscapes: (1) eastern Oregon Cascades; and (2) Arizona's Mogollon Rim. First we calibrated 30-arcsec MC1 output using historical climate and existing vegetation maps and information. We then developed a crosswalk between the broad MC1 vegetation types (VTs) and VDDT potential vegetation types (PVTs). We are creating new MC1 rules and VTs that allow for finer biological resolution with our test landscapes and that have broad-scale application. This calibration will be used to run MC1 using future climate data from two General Circulation Models run for the A2 emission scenario. We will aggregate the current and future major VDDT PVTs into a single model for each landscape. Transition probabilities and multipliers can then be developed to allow PVT shifts through time and to reflect changes in fire probabilities through time. Our new climatized VDDT models will only reflect two potential scenarios. We are well aware of the considerable uncertainty associated with these choices. Nonetheless, these models will allow managers to understand some potential interactions of proposed management strategies with projected changes in climate and derive practical answers to future challenges.
Keywords: Climate change, MC1, VDDT, Landscape modeling, Forest planning

124. Incorporating rural community characteristics into fuel-reduction treatment decisions
Authors: Crandall, Mindy Crandall, College of Forestry, Oregon State University; Ellen Donoghue, PNW Research Station, US Forest Service; Jane Harrison, College of Forestry, Oregon State University; Claire Montgomery, College of Forestry, Oregon State University
Offered Presentations: Symposium 9: Modeling and Managing Dynamic Landscapes: Getting the Most Bang for your Buck - Wednesday (2011-04-06): 13:40 - 14:00 - Broadway 2
Abstract: For this contribution to the US Forest Service's Integrated Landscape Assessment Project, we have created a layer to be included in a decision support system that allows managers who are considering fire-hazard reducing thinnings to include potential community benefits in their considerations. To do this, we create a Watershed Impact Score" that scores each watershed (potential source of wood material) with respect to the communities that are likely to benefit from increased wood supply. The communities we consider are census county subdivisions that correspond to all rural places in Oregon and Washington. Incorporated into the Watershed Impact Score are tabulations of community characteristics (indicators of low socio-economic well being such as poverty rate)
Keywords: Fuel treatments, Rural communities, Community characteristics, Landscape analysis

125. Spatio-temporal controls on fire severity patch sizes in eastern Cascade Mountain ecoregions
Authors: Hessburg, Paul Hessburg, US Forest Service, Pacific Northwest Research Station; Nicholas Povak, US Forest Service, Pacific Northwest Research Station
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 09:20 - 09:40 - Broadway 4
Abstract: Mountain landscapes develop predictable and resilient patterns of vegetation structure and composition presumably derived from interactions among the regional climate, patterns of vegetation and environments, and other ecological processes. They are also sensitive to changes in climatic forcing, which can have substantive effects on biotic assemblages and processes that support them. Here we provide evidence for the origin and spatial controls on native landscape resilience to wildfire, a keystone disturbance process, in four mountain ecoregions in eastern Washington, USA. We apply

physical theories appropriate to self-organized systems and associated statistical models, to help explain the ongoing derivation of wildfire severity patch size distributions, and we evaluate evidence for external and internal forcings on the distributions. Based on our findings, we hypothesize that severity patch sizes in eastern Washington are externally controlled by the biogeoclimatic or physiographic setting, and internally by underlying templates of topography, environments, and multi-scale vegetation patchiness present at the time of the events. Vegetation patchiness at scales reflecting the physiognomic, land cover, and structural conditions reflect ongoing restructuring by prior fire severity and subsequent vegetation recovery, yielding mosaics of lagged landscape memories. We suggest that these mosaics provide a multi-level resistance surface that structures future mosaics, thereby creating highly heterogeneous, non-stationary, yet self-similar distributions of disturbed and recovering patches. We suggest that knowledge of these mechanisms is crucial to understanding how current landscapes may respond to future climate forcing.
Keywords: Resilience, Self organization, Climate change, Spatial controls

126. Mixed-severity fire regimes of the Klamath Mountains, northern California and southwestern Oregon
Authors: Skinner, Carl Skinner, US Forest Service, Pacific Southwest Research Station; Alan Taylor, Dept. of Geography, The Pennsylvania State University, University Park, PA; Becky Estes, USFS, Pacific Southwest Research Station, Redding, CA; Eric Knapp, USFS, Pacific Southwest Research Station, Redding, CA
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 10:00 - 10:20 - Broadway 4
Abstract: The forests of the Klamath Mountains, both pre-historically and currently, are generally characterized by a mixed-severity fire regime. With the pronounced dry summers of the region, nearly anywhere that fuel accumulates can burn on a regular basis. Thus, before the 20th Century, fires were generally frequent regardless of forest type. The sizes of fires, in all but the driest years, appear to have been controlled mostly by topographic (ridge tops, permanent watercourses, aspect changes) and edaphic features. Fire severity patterns are associated primarily with slope position and aspect. Higher severity patterns are more generally found in upper slope position and south and west-facing aspects. These landscape positions are more likely to display a pattern of scattered, remnant, older trees and patches, within a coarser-grained pattern largely of younger stands, shrubs, or more open herbaceous areas. Conversely, due to more low-severity fire, lower thirds of slopes and north and east aspects are more likely to promote and sustain long-term, structurally diverse, late-successional conditions. Further, multi-aged stands of diverse structure are associated with locations that frequently burned with low intensity. Managers using topography and other physical features to contain prescribed fires, managed wildfires, or wildfires using modified suppression responses will more likely create burn patterns consistent with historical fire patterns. Managers desiring to reduce the likelihood of large, unusually severe fires and provide for the long-term, resilient, late-successional conditions, may find it advantageous to pattern the severity and extent of management activities after the historical patterns of fire severity.
Keywords: Fire severity, Topographic effects, Siskiyous, Mixed conifer, Mixed evergreen

127. Wildlife faunal patterns and management in interior conifer forests with mixed-severity fire regimes
Authors: Lehmkuhl, John Lehmkuhl, US Forest Service, Pacific Northwest Research Station
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 10:40 - 11:00 - Broadway 4
Abstract: Landscape-scale habitat patterns under a mixed-severity fire regime are a mosaic of compositional and structural stages created by a patchy distribution of fire severities. I predicted that patchiness of forest types in mixed-severity vegetation types would support a wildlife community that

was a mix of species typical of low- and high-severity fire regime vegetation types. I also tested whether unique patterns of standing and down dead wood created by mixed severity fires might influence faunal patterns. Analysis showed that fauna in the mixed-severity Eastside Mixed Conifer Forest of eastern Washington and Oregon was a mix of faunal elements from low-severity Ponderosa Pine and high-severity Montane Mixed Conifer Forest, with only about 4% of species unique to the mixed-severity vegetation type. Species were mostly seral/structural stage generalists (44%) and closed-canopy generalists (41%), with 12% of species associated with the stand-initiation stage and 3% with late-seral old and mature forest. No strong species associations with snag or down dead wood conditions were found; but, snags and down wood were important for many species. Coarse-filter management of vegetation pattern seems appropriate for conservation of most species. Two families" of species of conservation concern need additional fine-filter management consideration: low-elevation old forest associates and broad-elevation old forest associates. The latter is a quintessential mixed-severity group of species. The northern flying squirrel is given as an example of a mixed-severity wildlife species."
Keywords: Wildlife, Mixed-severity fire, Mixed-conifer forest, Washington, Oregon

128. Assessing wildfire and management risk in dry, fire-prone forests
Authors: Spies, Thomas Spies, US Forest Service, PNW Research Station; Alan Ager, US Forest Service, PNW Research Station; Miles Hemstrom, US Forest Service, PNW Research Station
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 11:20 - 11:40 - Broadway 4
Abstract: Risk management in fire-prone landscapes requires risk assessment to determine probabilities of gains or losses to values associated with wildfire and management actions (e.g. thinning prescribed burning). Wildfires and pre and post-fire management actions can have positive, negative or neutral effects depending on severity (or intensity), frequency, size, location, and ecological resilience. Probability estimation is challenging, especially in mixed-severity regimes where fire occurrence and fire behavior is highly variable across multiple spatial and temporal scales. The assessment is also challenging because the process of estimating fire and management event effects on ecological and social values is plagued by conflicting outcomes (e.g. both positive and negative effects) and poorly known and defined ecosystems. Probablistic estimates of loss or gain can be made based on historical fire data, but these data are typically temporally and spatially limited and may not reflect trends under future climates. Simulation models based on current stand and landscape conditions can overcome many of these limitations but their accuracy is typically not known. Hybrid approaches are needed to support risk management across large heterogeneous landscapes. However, the many limitations of risk assessment suggest that active adaptive management may be the best way to reduce uncertainties and promote a better understanding of potential wildfire effects on social and ecological values.
Keywords: Disturbance, Landscape, Conservation, Uncertainty

129. Management strategies for mixed severity forested landscapes
Authors: Perry, David Perry, Oregon State University; Jerry Franklin, U. Washington; Scott Stephens, U. California, Berekley
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 11:40 - 12:00 - Broadway 4
Abstract: Increasingly common objectives for public forests historically characterized by mixed severity fire regimes are to create landscapes: (a) resistant to fire, drought and insects, and (b) containing the heterogeneity of habitats originally characteristic of mixed-severity fire regimes, including both late- and early successional patches in the appropriate size and mix. Achieving these goals will require focusing on heterogeneity at scales ranging from 10s of m to several kilometers rather than simply stands. Since large, early seral tree species are usually relatively resistant to fire,

two primary objectives are to protect these where they exist and to nurture new ones where they don't. Burn patterns are strongly influenced by topography, providing a template for creating heterogeneous structure across landscapes. Strategically placed landscape area treatments (SPLATS) show promise for lowering fire severity on large landscapes and increasing the heterogeneity of fire severity patches. Although these do not protect against drought and insects outside of treated areas, their use as a first step buys time for more extensive evaluations and treatments. Some components of early successional habitat will be provided by SPLATS and variable density thinning outside SPLATS, however the full suite of early successional attributes are best captured by allowing natural recovery processes after wildfire. Increased use of managed wildfire in remote areas will increase the robustness of mixed severity forests.
Keywords: Fire, Management, Heterogeneity, Habitat, Robustness

130. Climate and fire in western US ecosystems and implications for mixed severity fire regimes
Authors: Littell, Jeremy Littell, University of Washington; David Peterson, United States Forest Service; Donald McKenzie, United States Forest Service
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 13:00 - 13:20 - Broadway 4
Abstract: Climate affects fire regimes directly through the availability of fuels to fire and indirectly through the arrangement of fuel patches on landscapes. We present empirical west-wide fire climate relationships and put them in a landscape mixed-severity context. Both modern fire and tree-ring based records suggest two primary climatic mechanisms are associated with fire occurrence. First, large fires in forested landscapes are associated with drought. In the paleo record, frequently recorded fires occur in warm dry years, and in the modern record increased area burned is associated with increased water deficit (increasing temperature / potential evapotranspiration, decreasing precipitation / actual evapotranspiration). Second, large fires in non-forested ecosystems are associated with antecedent moisture in the years prior to fire, and sometimes subsequently by abnormally dry years in the year of fire. In the southwestern dry forest paleo record, the most frequently recorded fires occur in dry years, but often have strong prior influences of antecedent moisture. In the modern record, this pattern is even clearer, and increased area burned is associated with increased winter precipitation in the years prior to fire and secondarily by drought in the year of fire. These patterns suggest a consistent climate-fuels-fire relationship across coarse vegetation classifications, and point to an important control on landscape level transience in mixed severity fire regimes. Specifically, climate can mediate the degree to which a fire regime resembles the low" or "high" severity ends of the "mixed" severity spectrum via its control on vegetation production
Keywords: Climate, Fire, Landscape, Vegetation

131. Discussion (led by Thomas Spies)
Authors: Spies, Thomas,
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 13:20 - 13:40 - Broadway 4

132. Living on the edge: bat activity at a forest-agriculture interface
Authors: Jantzen, Meredith Jantzen, University of Western Ontario
Offered Presentations: Wildlife Ecology 1 - Monday (2011-04-04): 09:20 - 09:40 - Parlor BC
Abstract: The effects of landscape edges on animal activity may extend up to 120m into surrounding habitat. Based on different echolocation call structures, different bat species are expected to exhibit different depths of edge influence (DEI) at forest edges. I used five ultrasonic microphones arranged in an 80m transect line to monitor the activity of Ontarian bat species, with respect to distance from a forest edge. Calls were analyzed using an automated call viewing software, callviewer 18. I found that overall bat activity decreased significantly as distance away from the forest edge increased, and

bats with low frequency, long duration calls had significantly higher numbers in the field, compared to bat species with higher frequency, shorter duration calls. This research may help to inform future habitat surveys using ultrasonic detectors, as well as planning for wind turbine placement.
Keywords: Edge effects, Bats

133. Distribution of red tree vole habitat across national forest of the Pacific Northwest
Authors: Calkins, Michael Calkins, Oregon State University; Eric Forsman, Pacific Northwest Research Station; Anita Morzillo, Oregon State University
Offered Presentations: Wildlife Ecology 1 - Monday (2011-04-04): 09:40 - 10:00 - Parlor BC
Abstract: The red tree vole (Arborimus longicaudus) is a highly specialized microtine endemic to western Oregon and northwestern California. Habitat loss and fragmentation of mature Douglas-fir forests as a result of extensive logging has resulted in concerns over the persistence of red tree voles because of their poor dispersal abilities, small litter sizes, slow growth rate, and extended parental care. The objective of our study was to evaluate the distribution of red tree vole habitat across eight National Forests within their geographic range. We developed habitat models using Maxent software in conjunction with LANDFIRE datasets and species occurrence records. We reclassified the model based on a minimum required patch size of 29.55 ha and used Patch Analyst to calculate the mean patch size, number of patches, and mean distance to nearest neighbor for all suitable patches in each National Forest. Results suggest that the Siuslaw and Umpqua National Forests contain the least fragmented habitat with mean nearest neighbor distances and mean patch sizes, respectively, of 300 m and 547 ha for the Siuslaw, and 251 m and 2,330 ha for the Umpqua. These metrics are within the maximum observed dispersal distance of 340 m indicating potential connectivity among patches. Mean distance to nearest neighbor for the remaining six National Forests ranged between 372 m to 1,108 m, signifying low potential for connectivity. Data from our models can be used to better inform management plans for the red tree vole across National Forests within its geographic range.
Keywords: Red Tree Vole, Arborimus longicaudus, Patch analyst, Fragmentation, Maxent

134. Brown-headed Cowbird presence in relation to avian predator abundance, brood host abundance, and landscape legacy conditions.
Authors: Pinney, Tracy Pinney, Baylor University; Walker Melanie, Baylor University; Amy Liu, Baylor University; Kevin Gutzwiller, Baylor University
Offered Presentations: Wildlife Ecology 1 - Monday (2011-04-04): 10:00 - 10:20 - Parlor BC
Abstract: The Brown-headed Cowbird (Molothrus ater) is an obligate brood parasite that is often associated with woodland edges, agricultural land, and developed areas. Conservationists have concerns about Brown-headed Cowbirds because of their potential influence on the reproductive success of their avian hosts. We hypothesized that the presence of cowbirds was associated with diurnal avian predator abundance and host abundance, but that it was most related to landscape conditions because of basic food and cover requirements. We studied birds at 282 study sites in the Oaks and Prairies region of Texas during the middle of the 2008 cowbird breeding season. We used logistic regression to relate cowbird presence to avian predator abundance, host abundance, and metrics of percent landcover, edge density, mean patch area, and fractal dimension for six cover types (woodland, grassland, agriculture, developed area, shrub, and wetland). We computed landscape metrics from the 2001 National Land Cover Data. Contrary to our hypothesis, cowbird presence was most associated with the abundance of diurnal avian predators. Cowbird presence also was positively associated with some landscape legacy conditions (agricultural land cover, edge, and mean patch area). The importance of the association between cowbird presence and avian predator abundance was four times that of the association between cowbird presence and landscape influences. Cowbird presence was not related to host abundance. Our results suggest that landscape conditions can have lag effects on cowbird presence over several years, but that

conservationists cannot assume that landscape conditions will necessarily be the dominant influence on cowbird presence.
Keywords: Population ecology, Brown-headed Cowbird, Landscape legacy effects

135. Cumulative effects of cowbird management, military training, and climate-driven changes in fire on the Black-capped Vireo
Authors: Wilsey, Chad Wilsey, University of Washington; Josh Lawler, University of Washington; Nathan Schumaker, Environmental Protection Agency; Betsy Bancroft, Southern Utah University; David Cimprich, Fort Hood Military Reservation, U.S. Army
Offered Presentations: Wildlife Ecology 1 - Monday (2011-04-04): 10:20 - 10:40 - Parlor BC
Abstract: The endangered Black-capped Vireo (Vireo atricapilla) is a neotropical migrant bird that breeds in early seral shrubland habitats historically maintained by fire. We developed a system of linked landscape models to assess the cumulative effects of multiple threats to the future viability of the vireo population at Fort Hood, Texas. All models were parameterized with data collected at Fort Hood. We used a vegetation growth and disturbance model initialized with current vegetation data to simulate future vegetation composition and structure under multiple scenarios for climate-induced changes in fire regimes and disturbance from military training. Projected landscapes were used as inputs to an empirical vireo habitat suitability model. We then used HexSim, an individual-based spatially explicit population model, to project the effects of training and fire regimes on vireo populations inhabiting these future landscapes. Finally, we modeled the impacts of decreased cowbird trapping on vireo populations by creating a two-species population model (vireos and cowbirds), also in HexSim. We combined multiple scenarios representing each of the three types of threats to characterize their potential cumulative impacts on the vireo population over the next 50 years. We conclude that cowbird control will likely continue to be an important management action into the future despite potential increases in habitat availability resulting from climate-driven increases in fire activity and the maintenance of low quality habitats due to increased military training activities.
Keywords: Endangered species, Population model, Landscape disturbance model

136. Landscape models of water resource availability for and habitat use by desert bighorn sheep (Ovis canadensis mexicana)
Authors: Hoglander, Cerissa Hoglander, Northern Arizona University; Brett Dickson, Northern Arizona University; Steven Rosenstock, Arizona Game and Fish Department
Offered Presentations: Wildlife Ecology 1 - Monday (2011-04-04): 10:40 - 11:00 - Parlor BC
Abstract: The desert bighorn sheep (Ovis canadensis mexicana) is one of the few ungulate species native to North America that is capable of surviving in harsh desert mountain environments. However, the increased drought cycles and warmer temperatures anticipated with ongoing climate change could adversely affect the species' use of and range of suitable habitat and, consequently, its survival. In this context, an improved understanding of existing habitat and resource needs of desert bighorn sheep subpopulations could help to guide future conservation and management of the species. The desert bighorn sheep herds on the Kofa National Wildlife Refuge (KNWR) and the U.S. Army Yuma Proving Ground (YPG) are subpopulations actively managed by state and federal agencies who work to conserve the subpopulations and re-establish herds across the Southwest. We used location data for individual sheep outfitted with global positioning system collars during 2007-2010 to derive spatially explicit statistical models of space and resource use on the KNWR and YPG. Specifically, we used model selection and an information-theoretic approach to model the intensity of space and resource use as a function of topography, development, artificial water resources, and the presence of green vegetation estimated through the use of satellite imagery and vegetation indices. We focused our analyses and inference on two key seasons in the region: peak lambing and drought. Our results can inform future desert bighorn sheep management and conservation in the Southwest,

particularly with respect to maintaining artificial waters as resource supplements during intense drought seasons.
Keywords: Desert bighorn sheep, Artificial water resources, Habitat use, Landscape models

137. Using an individual based spatially explicit simulation to inform the recreational planning of Fort Harrison State Park
Authors: Zollner, Zollner Patrick, Department of Forestry and Natural Resources, Purdue University; I Rodr, Department of Forestry and Natural Resources, Purdue University; Victoria Bennett, Department of Forest Ecosystems & Society, Oregon State University; Esteban Fern, Department of Biological Sciences, Purdue University; Mike Mycroft, Division of State Parks and Reservoirs (Indiana Department of Natural Resources)
Offered Presentations: Wildlife Ecology 2 - Wednesday (2011-04-06): 16:40 - 17:00 - Broadway 4
Abstract: As the popularity of outdoor recreation rises, understanding the spatially explicit impacts of anthropogenic disturbance on wildlife species of management concern increases. In this study we used a flexible, spatially explicit and individual-based model (Simulation of Disturbance Activities or SODA) to evaluate the relative quantity of disturbance that each of the three alternative trail designs will have on the nesting birds within the Lawrence Creeks Unit of Fort Harrison State Park in Indiana. We also simulated the interactions of these alternative trail scenarios with alterations to nesting bird habitat associated with the removal of invasive Amur honeysuckle from the park. This use of an individual-based simulation model to investigate impacts of human disturbance upon wildlife is unique because it simultaneously considers the response of nine different bird species to the range of potential management scenarios. Not surprisingly all scenarios that increase the trail footprint within the park resulted in higher levels of disturbance of birds. However, for the species of greatest conservation concern (ovenbird, hooded warbler, brown creeper, wood thrush, and Kentucky warbler) the differences between the current trail system and an alternative that greatly increased trail area around the periphery of the park were non-significant or of low magnitude. The removal of honeysuckle slightly increased the disturbance experienced by breeding birds primarily because of the loss of the protective cover that dense honeysuckle provides. However, this slight increment in disturbance is of low importance compared with the long-term pervasive effects that this invasive bush can have on native ecosystems.
Keywords: Disturbance, Individual based model, Simulation, Songbirds, Recreation

138. Testing predictions about top-down vs. bottom-up habitat selection by birds in barrier-based landscapes
Authors: Tavernia, Brian Tavernia, University of Missouri; J. Michael Reed, Tufts University
Offered Presentations: Wildlife Ecology 1 - Monday (2011-04-04): 11:20 - 11:40 - Parlor BC
Abstract: Species distributions within and across landscapes depend on habitat evaluation strategies. It has been hypothesized migratory birds may evaluate habitat features in a top-down, hierarchical manner, with decisions cascading down from entire landscapes to more local scales (e.g., nest site). In contrast, year-round resident birds may select breeding habitat using a bottom-up strategy in which individuals make a series of local-scale movements and incrementally increase their knowledge of surrounding landscapes. These movements may be inhibited by behavioral barriers (e.g., habitat gaps), thus limiting the ability of residents to evaluate landscapes. Based on these alternative scenarios for breeding site selection, we predicted that behavioral barriers to movement would affect the distribution of year-round resident species but not of migrants. We evaluated these predictions by relating the distributions of migratory and resident forest birds to landscape features in extents that were either complete buffers or that were buffers truncated at local barriers to movement. Barriers were defined using either rivers or highways. We found that some forest bird distributions were better explained by landscape features quantified in extents truncated at movement barriers, suggesting barrier-based limits to distributions. Responses to barriers were species-specific; some species

responded only to rivers as barriers, others only to highways, and some to both rivers and highways as barriers. Contrary to our predictions, however, residents were no more likely to respond to landscape features in truncated extents than were migrants. Our results suggest that migratory status cannot be used as a proxy for habitat evaluation strategy in birds.
Keywords: Connectivity, Dispersal, Exurban, Habitat fragmentation, Permeability

139. A landscape model simulating ficus trees and their obligate wasp pollinator
Authors: Palace, Michael Palace, Complex System Rearch Center - UNH
Offered Presentations: Wildlife Ecology 1 - Monday (2011-04-04): 11:40 - 12:00 - Parlor BC
Abstract: The study of Figs (Ficus spp. Moraceae) has received considerable attention in the scientific literature. This interest in Ficus is due to the genus' large number of species (700), pollination mutualism with Aganoid wasps, and its role as a keystone food resource in tropical ecosystems. Temporal sexual separation in hermaphroditic Ficus and asynchronous flowering among individuals within populations creates problems in supporting a viable population of dependent pollinator wasp species. To maintain the short-lived wasp populations, Ficus populations must provide a continuous temporal sequence of flowering trees, which are havens for the pollinating wasps. The minimum number of trees to support a population of wasps is termed the Critical Population Size (CPS). Continued deforestation and fragmentation of the continuous forest in the tropics may lead to local wasp extinctions and loss of a viable population of Ficus. Utilizing concepts from Bronstein et al. (1990), I have developed a temporal and spatial model that examines CPS. Parameterization of this model is from current literature and applicable to many species of Ficus. Parameterization of flowering temporal length, flight distance, and floristic temporal variability are explored. Distance of wasp flight is essential in designing sustainable populations of Ficus. Smaller variability in temporal floristics allows for a smaller population of trees to support a viable wasp population, but greater variability allows for a more stable population by allowing for recovery from when asyncrhronouscity is not synchronized between female and male phased trees. A few trees tend to link to each other more frequently, indicating that these trees are important hubs or nodes in maintaining the wasp population.
Keywords: Ficus, Wasp, Pollination, Tropical, Stochastic

140. Identification of representative landscapes: What are the typical land cover patterns in Quebec?
Authors: Partington, Kevin Partington, University of Montreal; Jeffrey Cardille, University of Montreal
Offered Presentations: Landscape Assessment - Monday (2011-04-04): 09:20 - 09:40 - Broadway 2
Abstract: Whether it is natural or not, changes induced to landscapes may have reached spatial and temporal scales like never before. In this context, can a small set of landscapes represent the land cover composition and spatial configuration for wide regions such as the Province of Quebec? Could this set of representative landscape reveal interesting patterns or land cover, perhaps suggesting locations worth further study? The main goal of this research is to determine landscapes that best summarize land cover patterns of each bioclimatic domain in Quebec. Beginning with the Earth Observation for Sustainable Development of forest (EOSD) dataset, a Canadian national land-cover classification of Landsat satellite images, we partitioned the Province with more than 1500 individual landscapes along the National Topographic System 1:50000 map sheet borders. For each of them, we calculated over 2000 landscape metrics. These metric values were used to quantitatively compare patterns to calculate a measure of similarity between all pairs of landscapes. Using similarity values as inputs, we adapted a recent computer science pattern recognition algorithm that simultaneously groups similar objects and objectively identifies the ones that best represent each group. Expected outputs, small sets of landscapes along with their five most similar relatives, demonstrate representative land-cover patterns of each bioclimatic domain of Quebec. This set of objectively determined representative landscapes can be useful for ecologists through identifying representative sampling landscapes for long-term, broad-scale studies. Such representative landscapes could help

scientists determine whether, for example, land cover patterns remain consistent with expectations based on climate.
Keywords: Quebec, Representative, Patterns, Metrics, Land cover

141. Applying the landscape development intensity index to the National Land-use Dataset to assess the condition of ecosystems
Authors: Morefield, Phil Morefield, U.S. EPA National Center for Environmental Assessment; Britta Bierwagen, U.S. EPA National Center for Environmental Assessment; Dave Theobald, Colorado State University
Offered Presentations: Landscape Assessment - Monday (2011-04-04): 09:40 - 10:00 - Broadway 2
Abstract: Sustainable management of ecosystems and the services they provide depends on a thorough understanding and assessment of ecosystem impairment. The first step in that assessment process is the development of a nationally consistent metric or set of metrics that reliably estimate(s) ecosystem impairment at a meaningful spatial resolution. When coupled with projections of future environmental change, such a metric allows for the prioritization of resources to restore currently impaired ecosystems, as well as an assessment of future impairment and the emergence of strategies for sustainable designs of the built environment. Here we use the Landscape Development Intensity Index (LDI; Brown and Vivas, 2005) as one such metric and apply it to the National Land-Use Database (NLUD) to assess the condition of aquatic and wetland ecosystems throughout the coterminous United States. The LDI consists of coefficients for 27 land-use types based on expected levels of human disturbance. The NLUD is a new composite database generated by compiling spatially explicit, national-level datasets ranging from housing density and airports to landmarks and military bases. The result is a ~1 hectare resolution dataset of land use types that differentiates the simple land cover type of â€œurbanâ€ into residential, industrial, commercial, shopping, and recreational land uses. Using metrics of aquatic condition from the EPA Wadeable Streams Assessment (WSA), we evaluate the skill of LDI + NLUD to predict disturbance of aquatic systems. We also apply the LDI + NLUD framework to wetlands and explore the potential for this type of analysis to inform the forthcoming EPA National Wetlands Condition Assessment.
Keywords: Land use, Assessment, Wetlands, Streams, GIS

142. Navigating the methodological landscape: a roadmap for landscape ecologists
Authors: Wilson, Tammy Wilson, University of Wisconsin; Thomas Edwards Jr., US Geological Survey Coop
Offered Presentations: Landscape Assessment - Monday (2011-04-04): 10:00 - 10:20 - Broadway 2
Abstract: Landscape ecologists typically ask questions addressing complex systems at spatial and temporal scales that make data analysis using traditional statistical methods inappropriate. In recent years there has been a rapid increase in statistical methods used by landscape ecologists for analyzing spatial ecological data. Development of these different approaches has gone on in relative isolation, leading to the creation of cottage industries surrounding methods. This trend has the potential to lead to a narrowing of focus among researchers working on both the development and application of a specific technique. We review the use of several statistical modeling approaches used by landscape ecologists to determine trends about the types of questions, scale domains, and quality of spatial information characteristic of each. In doing this, we identify similarities of seemingly disparate lines of research, and illustrate opportunities for advancing the field of landscape ecology by combining efforts of different methodological camps.
Keywords: Generalized linear model (GLM), Niche model, Occupancy model, Resource selection functions, Species distribution model

143. Soundscape conservation
Authors: Pijanowski, Sarah Dumyahn, Purdue University; Bryan Pijanowski, Purdue University

Offered Presentations: Landscape Assessment - Monday (2011-04-04): 10:20 - 10:40 - Broadway 2
Abstract: We argue that soundscapes possess both ecological and social value and that they should be considered natural resources worthy of preservation. Given that soundscape conservation is new, we present a summary of conservation principles that need to be considered in soundscape conservation planning. These include the need to set goals, identify targets, assess condition, identify and manage threats, and conduct monitoring of the soundscape. We also argue that soundscape conservation needs to consider the soundscape within the larger mosaic of the landscape that is occupied by humans - a perspective provided by landscape ecology. We describe several different kinds of soundscapes that need to be conserved, such as quiet, sensitive, threatened, and unique soundscapes, and the ways that conservation planning needs to protect these for the future.
Keywords: Soundscapes, Conservation, Values, Noise, Landscapes

144. Exploring the use of participatory information to monitor, map, and assess aquatic ecosystem services at landscape scales
Authors: Hychka, Kristen Hychka, USEPA Atlantic Ecology Division; Jeffrey Hollister, USEPA Atlantic Ecology Division; W. Bryan Milstead, USEPA Atlantic Ecology Division; Henry Walker, USEPA Atlantic Ecology Division
Offered Presentations: Landscape Assessment - Monday (2011-04-04): 10:40 - 11:00 - Broadway 2
Abstract: Traditionally, the EPA has monitored aquatic ecosystems using statistically rigorous sample designs and intensive field efforts which provide high quality datasets. But by their nature they leave many aquatic systems unsampled, follow a top down approach, have a long lag between data collection and dissemination, and miss important ephemeral events. To overcome some of these short falls, we have augmented these robust datasets with landscape assessment techniques and models. Another source of complimentary data is participatory information obtained using Web 2.0 technologies, mobile-phone applications, crowd-sourced data, and citizen-science monitoring. We report on initial efforts to tap into the potential of participatory information in the understanding, monitoring, assessment, and mapping of aquatic ecosystem services at a landscape scale. In this talk, we: 1) review existing applications and technologies that can benefit monitoring of aquatic ecosystem services, with an emphasis on wetlands and lakes; 2) highlight untapped sources of information; 3) evaluate how existing EPA datasets and monitoring efforts can compliment and be complimented by the use of participatory information; 4) assess how this type of information can inform our understanding of citizens' interaction with and valuation of aquatic ecosystems; and 5) identify institutional barriers and opportunities to this type of paradigm shift in data collection.
Keywords: Participatory, Monitoring, Aqatic ecosystems, Ecosystem services

145. Assessing quality in forest landscapes west of Mexico City: A methodological approach
Authors: Avila-Akerberg, Victor Avila-Akerberg, UNAM; Jorge Meave del Castillo, UNAM; Lucia Almeida-Le, UNAM
Offered Presentations: Landscape Assessment - Monday (2011-04-04): 11:00 - 11:20 - Broadway 2
Abstract: Mexico hosts a great cultural and biological diversity, with an estimated 22,800 vascular plant species, of which 52% are considered endemic. In spite of their importance in terms of biodiversity, Mexican forests have an average annual cover loss of 350,000 ha. Attempts have been made to define criteria and indicators (C&I) for the assessment of sustainable forest management (SFM). The WWF and the IUCN developed the forest quality C&I initiative to assess SFM at the landscape level, relying on criteria from three categories: (1) forest authenticity, (2) environmental benefits and (3) other social and economic benefits. The aim of this study was the assessment of high elevation temperate forests west of Mexico City, which provide goods and services to ca. 22 million people, adhering to the concept of forest quality, in order to generate and integrate the needed information towards SFM. We integrated field and laboratory verifiers of forest composition, pattern,

function, process, tree health, area and fragmentation, and management, as well as ecosystem services indicators. C&I, together with their verifiers, were weighted by a group of experts through a pairwise multicriteria analysis. A forest quality map was produced by means of spatial interpolation by integrating information for all indicators combined with an object based land cover classification; this tool is expected to provide a solid yet flexible framework for decision making and monitoring of the SFM in the area and other places around the world.
Keywords: Forest quality, Ecosystem services, Temperate forests, Multicriteria analysis, Object-oriented classification

146. Identifying representative landscape metrics in large LU/LC datasets: a possible strategy using affinity propagation
Authors: Cardille, Jeffrey Cardille, U de Montreal; Kevin Partington, U de Montreal
Offered Presentations: Landscape Assessment - Monday (2011-04-04): 11:20 - 11:40 - Broadway 2
Abstract: If we were stuck on a desert island and could take only a few landscape metrics with us, which ones would they be? For many wary landscape ecologists, the answer might be â€œNone at all, thanksâ€□ but metrics remain an important and often-used tool for understanding pattern variation. Yet as any student in a landscape ecology course knows, there are a lot of metrics, many of which are somewhat or highly correlated with others. Answers to a basic question-- which aspects of pattern are measured by which metrics-- remain largely elusive. A recently developed computer algorithm delivers substantial advantages over many other clustering techniques such as the well-known k-means classifier. In particular, the algorithm promotes an â€œexemplarâ€□, or representative member, of each cluster that best typifies the characteristics of its group. In recent work, we used this strategy to compress the information content from a large set of landscapes and their metrics, identifying representative landscapes for the continental United States. In this presentation, we transpose the data in a search for representative landscape metrics. Using several large land-use data sets, we identify the landscape-level or class-level metrics that were most frequently identified as representing the variation contained in a large 1000-metric set. This set can perhaps be considered a small set of â€œdesert islandâ€□ metrics for these data setsâ€"that is, a collection of specific metrics that best represent the measurable aspects of landscape pattern. This approach can be easily generalized for others to use in relevant data sets.
Keywords: Landscape metrics, Land use, Land cover, Information, Compression

147. An effective assessment protocol for continuous geospatial datasets of forest characteristics using USFS FIA data
Authors: Riemann, Rachel Riemann, US Forest Service, Northern Research Station; Barry Wilson, US Forest Service, Northern Research Station; Andy Lister, US Forest Service, Northern Research Station
Offered Presentations: Landscape Assessment - Monday (2011-04-04): 11:40 - 12:00 - Broadway 2
Abstract: Geospatial datasets of forest characteristics are modeled representations of real populations on the ground. These datasets provide an incredible source of information at the landscape level for ecosystem research, policy analysis, and planning applications, all of which are critical for addressing current challenges related to climate change or urbanization pressures. However, the effectiveness of these applications is dependent upon the accuracy of the geospatial input datasets. A comprehensive set of robust measures is necessary to provide sufficient information to effectively assess the accuracy of these modeled geospatial datasets being produced. Yet challenges in the availability of reference data, in the appropriateness of assessment methods to dataset use, and in the completeness of methods available have continued to hamper the timely and consistent application of map assessments. In this study we present a suite of assessments that can be used to characterize the accuracy of geospatial datasets of modeled continuous variables. It is a comparative accuracy assessment, recognizing both the potential for error in reference data, and

probable differences in spatial support between the datasets. When used together, this proposed suite of assessments provides essential information on the type, magnitude, frequency and location of errors in each dataset, substantially improving a user's ability to apply modeled geospatial datasets effectively and to assess the relative strengths and weaknesses of multiple datasets depicting the same forest characteristic. We illustrate the application of this suite of assessments to the modeled biomass and species distribution datasets recently completed for the coterminous United States.
Keywords: Accuracy, Geospatial datasets, Comparative assessment, Uncertainty, FIA

148. Landscape Builder: software for the creation of initial landscapes for LANDIS from FIA data
Authors: Dijak, William Dijak, US Forest Service
Offered Presentations: Forest Landscape Modeling - Monday (2011-04-04): 13:00 - 13:20 - Council Suite
Abstract: Development of spatially explicit landscapes representing tree species composition and tree age that are realistically complex and spatially representative of forest lands is difficult. I developed software, Landscape Builder, which uses Forest Inventory and Analysis (FIA) data collected over multiple years to create spatially explicit landscapes as starting conditions for Landis Pro 7.0 and Landis II. Landis Pro and Landis II are landscape forest simulation models that project future landscapes resulting from growth, forest and fire disturbance and management. The software uses inventory year, FIA unit code, county code, plot number, subplot number, tree status code, tree species code, tree species group code, tree diameter, stand age and tree expansion factor from the FIA database and FIA unit map, National Forest type map, National Forest size class map, land cover map and landform map to assign FIA plots to raster pixels representing the landscape. In addition to the initial starting condition map, the software produces the species map attribute file in Landis Pro or Landis II format. Resulting landscapes are spatially representative but not spatially exact. For US National Forest lands which have forest type stand maps and size class maps, FIA plots matching forest type and size class are assigned. Currently, the software supports national forests lands found in the eastern half of the United States (US National Forest regions 8 & 9). Forest maps produced from Landscape Builder can also be used in the wildlife habitat suitability modeling software Landscape HSImodels. The software is Windows based and has been tested on Windows XP and Windows 7, producing landscapes that have 7500 rows and 6500 columns.
Keywords: Landscape builder, Forest Inventory and Analysis, Landis Pro, LANDIS-II

149. Effectiveness of forest management strategies to mitigate effects of global change in Siberia
Authors: Sturtevant, Eric Gustafson, Institute for Applied Ecosystem Studies; Anatoly Shvidenko, International Institute for Applied Systems Analysis; Robert Scheller, Portland State University; Brian Sturtevant, Institute for Applied Ecosystem Studies
Offered Presentations: Forest Landscape Modeling - Monday (2011-04-04): 13:20 - 13:40 - Council Suite
Abstract: Siberian forest ecosystems are experiencing multiple global changes. Climate change produces direct (temperature and precipitation) and indirect (altered fire regimes and increase in cold-limited insect outbreaks) effects. Although much of Siberia has not yet been subject to timber harvest, the frontier of timber cutting is advancing steadily across the region. We investigated questions about the ability of broad silvicultural strategies to reduce losses to disturbance, maintain the abundance of preferred species, mitigate fragmentation and loss of age class diversity, and sequester above-ground carbon under future climate conditions in Siberia. We conducted a 2x2x2 factorial experiment using the LANDIS-II landscape disturbance and succession model. Treatments were cutblock size, cutting rate and cutting method. Simultaneously, the model simulated natural disturbances (fire, wind, insect outbreaks) and forest succession under projected future climate conditions as predicted by an ensemble of global circulation models. The cutting method and cutting rate treatments generally had a large effect on species and age class composition, residual living

biomass and susceptibility to disturbance, while cutblock size had no effect. Cutblock size affected only measures of fragmentation, but cutting method and cutting rate often had an even greater effect. Based on the results, we simulated a â€œrecommendedâ€ strategy and compared it to the current forest management practice (â€œbusiness as usualâ€). The recommended strategy resulted in higher forest productivity, increased abundance of favored species and reduced fragmentation, but it did not significantly reduce losses to disturbance. No single strategy appears able to achieve all possible forest management objectives.
Keywords: Climate change, Timber harvest, Forest management, Sustainability, Silviculture

150. Modeling above and below ground forest carbon in response to future climate projections and wildfire activity in the Lake Tahoe
Authors: Loudermilk, Louise Loudermilk, Portland State Univ.; Robert Scheller, Portland State Univ.; Peter Weisberg, Univ. Reno-Nevada; Jian Yang, Univ. Revo-Nevada; Alison Stanton, .; Tom Dilts, University of Nevada-Reno; Carl Skinner, US Forest Service
Offered Presentations: Forest Landscape Modeling - Monday (2011-04-04): 13:40 - 14:00 - Council Suite
Abstract: Forests in the U.S. are an important carbon sink that currently offsets ~20% of the nation's fossil fuel emissions. However, the strength of this carbon offset is unknown at the regional scale and will most likely weaken as forests age, climate warms, and natural disturbances increase due to climate change. Wildfire regimes in the western U.S. are expected to worsen with projected decreases in snowfall, longer growing seasons, and increases in fuel loads. For this study, we modeled the compounding effects of climate change and wildfire activity on above and below ground forest carbon dynamics across the Lake Tahoe Basin (LTB, located in CA and NV). The entire forested area of the LTB was modeled using a spatially explicit landscape simulation model, LANDIS-II, which includes the direct and indirect effects of climate on succession and disturbance. Two climate scenarios (high and low greenhouse gas emissions) were used as model inputs, influencing vegetative growth, wildfire activity, and soil decomposition. We addressed the immediate impacts of fire on forest carbon loss as well as forest resiliency, forest recovery, and changes in species composition over multiple decades. Our preliminary results indicate that, although growth rates will increase, climate change will result in a net reduction of forest carbon in the LTB. We also discuss the next steps in our project, including the implementation of fuel treatment scenarios for mitigating wildfires and sequestering carbon. This work will provide managers of the LTB with quantifiable carbon estimates as well as carbon fluxes across the landscape.
Keywords: Carbon, Climate change, Forest succession, LANDIS-II, Lake Tahoe

151. Modeling the impacts of communication among nonindustrial private forest owners on forested landscapes
Authors: Mayer, Audrey Mayer, Michigan Technological University; Mark Rouleau, Michigan Technological University; Mackenzie Roeser, Michigan Technological University; Jillian Schubert, Michigan Technological University
Offered Presentations: Forest Landscape Modeling - Monday (2011-04-04): 14:00 - 14:20 - Council Suite
Abstract: Forest management policies governing timber harvesting that target nonindustrial private forest (NIPF) owners can have a considerable impact on landscapes dominated by these owners. This impact is rarely understood or measured when communication about the policies among NIPF owners is a factor. We developed a cellular automata model for Houghton and Keweenaw Counties in the Upper Peninsula of Michigan. These counties are 80% forested and thousands of small NIPF owners control the harvesting decisions of about 30% of the area. Using a GIS base layer of parcel boundaries, we assigned each NIPF parcel a probability of owner characteristics (e.g., age, education, absenteeism) based on US Census data. These characterisics have been shown in the

literature and the Naitonal Woodland Owner Survey to influence the likelihood of harvest. We also incorporated data from interviews with NIPF owners about the degree to which they make harvesting decisions based on information from neighboring NIPFs. Forests were eligible for harvest in any timestep after reaching a stand age of 40 years. Reforestation rate of parcels was influenced by the previous harvest (clearcut or selective) and age of the forest in surrounding parcels. A small increase in communication among owners dramatically decreases the landscape's average forest age and increases patch size of young forests, even with a considerable portion of absentee owners (who do not communicate with neighbors). Clustering patterns of harvests due to communication among NIPF owners may help state forest agencies implement forest management policies more efficiently and create more sustainable forest landscapes.
Keywords: Private forests, Policy, Communication, Harvest, Sustainability

152. Validating the ecological realism of a heterogeneous forest landscape simulation using FIA inventory data
Authors: Fraser, Jacob Fraser, Department of Forestry, University of Missouri-Columbia; Hong He, School of Natural Resources, University of Missouri-Columbia; William Dijak, Northern Research Station, U.S. Forest Service; Stephen Shifley, Northern Research Station, U.S. Forest Service
Offered Presentations: Forest Landscape Modeling - Monday (2011-04-04): 14:20 - 14:40 - Council Suite
Abstract: Forest landscape models are tools that can represent a user defined landscape and simulate the succession and disturbance events that occur over a temporal and spatial extent. Normally model validation is especially difficult for forest landscape models due to the lack of spatiotemporal data to compare against. In its newest version, LANDIS PRO 7.0 can output a number of quantitative stand attributes, such as number of trees, basal area and tree age for each cell. Using these new quantitative attributes we were able to make a direct comparison of the model simulation results to inventory data for our study area in the Missouri Ozarks. The model was initialized and calibrated using Forest Inventory and Analysis (FIA) data from cycle four in 1989. Simulations are run for 20 years at five year time steps and then compared to the most recent FIA cycle six data for validation. Examining the initial landscape shows that the number of trees simulated by LANDIS were within 15% of the FIA results for shortleaf pine (Pinus echinata) and the white oak group (Quercus spp.), while other species were within 20%. The total basal area results from LANDIS PRO 7.0 for the entire landscape were within 5% of the FIA results for the white oak group while the red oak group (Quercus spp.) were within 20%. Comparing simulated results with FIA data for each land type reveals varied but acceptable discrepancies. FIA data will be used to further calibrate the model before running multiple iterations.
Keywords: Forest landscape model, Calibration, Validation, LANDIS Pro 7.0, FIA

153. Incorporating fire probability into plant species distribution models for California and Oregon ?
Authors: Waller, Eric Waller, University of California, Berkeley
Offered Presentations: Biogeography - Monday (2011-04-04): 13:00 - 13:20 - Forum Suite
Abstract: Fire is often invoked as a control on vegetation and plant species distribution patterns that are difficult to explain based on other factors, such as climate, soils, hydrology, competition and disease. Disentangling the role fire may play independently of these other factors is difficult due to the covariance of fire with many of these same factors. Nevertheless, the frequency or probability of fire at a given location should have reasonable explanatory power in species distribution models if, in fact, fire is a dominant control. This work investigates whether the incorporation of a modeled fire probability variable, based on historic fire records for California and Oregon together with climate data, improves plant species distribution models over those based on climate data alone. A range of plant species were grouped according to their presumed response to fire, from fire dependent to fire tolerant, to fire sensitive. It was hypothesized that i) fire dependent and fire sensitive species show

greater model improvement with the incorporation of the fire probability metric, and ii) the fire metric contributes to more parsimonious models of species distribution than climate data alone. Given the uncertainty associated with fire probability, the sensitivity of results to its variation was also explored. Results may have implications for determining the relative contributions of fire and climate in regulating future plant distributions in the western United States.
Keywords: Species distribution modeling, Fire probability, Climate

154. Forest Dynamics of abandoned meander wetlands in the Southeastern Atlantic Coastal Plain
Authors: Meitzen, Kimberly Meitzen, Geography Department, University of South Carolina
Offered Presentations: Biogeography - Monday (2011-04-04): 13:20 - 13:40 - Forum Suite
Abstract: This study examines the spatial variability of vegetation dynamics in abandoned meander wetlands in an old-growth bottomland floodplain forest at Congaree National Park in South Carolina. It provides two theoretical contributions by validating traditional bottomland forest successional models but also elucidating multiple state and transition pathways of change relative to natural and human-induced controls. I combined field-based surveys of vegetation structure and composition on 60 0.1256 ha plots, high-resolution LiDAR derived digital terrain models, 1D/2D hydrodynamic modeling, and maps of logging history to examine spatial variability in forest patterns. Data were analyzed using self organizing map-based clustering and non-metric multidimensional ordinations. Gamma diversity across the abandoned meanders included 34 species; average plot diversity included nine species, and beta diversity measured 2.7, indicting moderate landscape-level diversity. Forest structure and composition varied spatially across the floodplain as a function of hydrogeomorphology, topographic complexity, and logging history. Forests with prolonged hydrologic connectivity and minimal topographic complexity supported communities with low diversity, low relative abundance, and high relative dominance. Forests characterized by low hydrologic connectivity and high topographic complexity supported the greatest diversity, high relative abundance, and high relative dominance. Post-logging forest regeneration patterns produced diverse compositional patterns. Historic logging practices had the greatest impact on old-growth bald cypress (Taxodium distichum) forests, which were mostly replaced with forests dominated by swamp tupelo (Nyssa aquatic) and water elm (Planera aquatic). Floodplain forests dynamics of Eastern Coastal Plain river systems are ideal indicator sites for monitoring and studying ecosystem responses to natural and human-induced changes.
Keywords: Floodplains, Succession, Hydrologic and hydrualic modeling, LiDAR, GIS

155. Spatial narratives in practice for landscape conservation and spatial literacy
Authors: Silbernagel, Janet Silbernagel, University of Wisconsin-Madison
Offered Presentations: Biogeography - Monday (2011-04-04): 13:40 - 14:00 - Forum Suite
Abstract: Spatial narratives were framed in 2005 as a conceptual tool to bring the qualitative experience of place together with the analytical geo-science of space. Since then, the spatial narrative concept has come to life through several projects. We applied spatial narrative thinking first to a study of wild rice landscapes in the northern Great Lakes region. In this case they facilitated the delivery of research findings while developing a shared sense of stewardship among harvesters and managers across wild rice landscapes - something previously lacking and upon which a community-based conservation program emerged. Similarly our second application, an assessment of community food production in the Madison, WI area, uses a spatial narrative framework to distill the social and spatial complexity of food production landscapes. Next, in our research to evaluate effectiveness of forest conservation strategies, we integrate spatially explicit landscape modeling with scenario building informed by expert knowledge. Teams of local and regional experts frame spatial narratives around scenario model output. Our most recent application, Spatial Narratives of the St. Louis River Estuary, connects aquatic science research on human-based stressor gradients in the watershed with spatially explicit vignettes of local resource issues and place-based geo-quests to

enhance spatial awareness and stewardship of the estuary. In this talk, I will begin by explaining the concept of spatial narratives, then elaborate on these applications as examples of spatial narratives in practice, while grounding the tool within a larger body of related work and thinking that includes bio-regionalism and landscape futures.
Keywords: Scenario building, Landscape futures, Stewardship, Bioregion, Spatial literacy

156. Influence of avian species ecology and sample unit size on interpretation of occupancy estimates from point count data
Authors: Roberts, L. Jay Roberts, PRBO Conservation Science
Offered Presentations: Biogeography - Monday (2011-04-04): 14:00 - 14:20 - Forum Suite
Abstract: Occupancy estimates that adjust species occurrence data to account for imperfect detection have led to improved reliability of state variables for a wide variety of monitoring projects. The occupancy parameter can be interpreted biologically as a variety of quantities depending on the relationship between the size of the sample unit and the pattern of distribution of the species of interest. As in other ecological modeling exercises (e.g. habitat models) the interpretation of model outputs is tied to particular ecological characteristics (territory size, prevalence, etc.) of individual species. I show how parameters of occupancy models correlate with species ecological characteristics by modeling occupancy for 20 species that vary in body size, detectability, territory size, prevalence, and specificity of habitat associations. Using data over two years from a large set of point count locations spread throughout National Forest lands in the Sierra Nevada mountains of California, I modeled occupancy for sample units of 1, 5, or 10 point count locations to show how parameters vary at these spatial scales and in relation to species characteristics. In general, the results show that occupancy increases with larger sample units since more area is sampled, but the effect is diminished for very prevalent and highly detectable species. Detectability shows a similar pattern but the increase with larger sample unit size diminishes for species that are less prevalent and habitat specialists. These and other results are intended to help guide the design of monitoring projects that intend to track occupancy as a state variable.
Keywords: Occupancy, Avian monitoring, Sierra Nevada, Sample unit scale, Point count

157. Accounting for multi-scale spatial autocorrelation improves performance of invasive species distribution modeling (iSDM)
Authors: Vaclavik, Tomas Vaclavik, University of North Carolina-Charlotte; John Kupfer, University of South Carolina-Columbia; Ross Meentemeyer, University of North Carolina-Charlotte
Offered Presentations: Biogeography - Monday (2011-04-04): 14:20 - 14:40 - Forum Suite
Abstract: The origins of spatial autocorrelation (SAC) in biogeographical data can be manifold, including population dynamics, autocorrelation in environmental conditions, or missing explanatory variable. However, SAC may be especially important for invasive species distribution models because invaders are influenced by dispersal and colonization processes that result in spatially structured geographical patterns. Here, we examine the efficacy of using a multi-scale framework to account for different origins of SAC and compare non-spatial models with models that account for SAC at multiple levels. We apply one conventional statistical method (GLM) and one non-parametric technique (MAXENT) to data on the invasive forest pathogen Phytophthora ramorum (n=3787) to develop four types of models that either ignore spatial context, or incorporate it at (i) a broad scale using trend surface analysis, (ii) a local scale using autocovariates, or (iii) multiple scales using spatial eigenvector mapping. Results show that non-spatial models exhibit lower predictive power than models that incorporate SAC. Dramatic improvements were observed when fine-scale SAC was included, suggesting that local range-confining processes are driving P. ramorum invasion. The relative importance of environmental variables was consistent across all models but the explanatory power decreased in spatial models for factors with strong spatial structure. While accounting for SAC reduced the amount of residual autocorrelation for GLM but not for MAXENT, it still improved

performance of both methods. This confirms our hypothesis that SAC may be a crucial surrogate for dispersal and colonization processes that determine the spatial distribution of biological invasions.
Keywords: Spatial autocorrelation, Species distribution model, Invasive species, Scale, Model performance

158. Spatial transferability of rare plant species distribution models within the Nez Perce National Forest
Authors: Walter, Christopher Walter, The University of Montana; Anna Klene, The University of Montana; Zachary Holden, United States Forest Service; Solomon Dobrowski, The University of Montana; John Young, United States Geological Survey
Offered Presentations: Biogeography - Monday (2011-04-04): 14:40 - 15:00 - Forum Suite
Abstract: Species distribution modeling is rapidly becoming a standard method for discovering new species occurrences and we need to improve our understanding of projecting models into unsampled space. In this study, occurrence data for nine rare plant species within the Nez Perce National Forest in north central Idaho were used as species presence data to build a habitat suitability estimate using Maximum Entropy (Maxent) software. Once the estimate was built in an area with high numbers of occurrences, the algorithm was made to predict in unsampled areas. The ability of an algorithm to do this is known as spatial transferability, and it can be assessed in areas where occurrences are known but not provided to the model. These tests are often performed across broad areas and using environmental data with a large spatial resolution (e.g. 1x1 km). This research was done using short-length watersheds as study units and 30x30 m resolution environmental data. Maxent's transferability success was assessed using the area under the receiver operating characteristic curve (AUC). Results from this study reveal that quantifying the relative distribution of environmental variables between sampled and unsampled areas can improve rare plant habitat predictions.
Keywords: Rocky mountains, Plants, Species distribution modeling, Habitat

159. Plant spatial patterns influence ecological processes in experimental semiarid grassland communities
Authors: Rayburn, Andrew Rayburn, Utah State University; Eugene Schupp, Utah State University
Offered Presentations: Arid Landscapes - Monday (2011-04-04): 13:00 - 13:20 - Studio Suite
Abstract: A central goal of ecology is to elucidate the processes that structure plant communities in space and time. Plant spatial patterns and the distribution of species are known to influence community-structuring processes, yet few empirical studies have directly addressed the effects of both factors on community dynamics. In this study, our objective was to test the effects of these factors on both biotic and abiotic components of experimental grassland communities. We conducted a well-replicated field study that manipulated both plant patterns and species distribution of two co-occurring semiarid perennial grasses: the strongly competitive Crested wheatgrass (Agropyron cristatum) and Snake River wheatgrass (Elymus wawawaiensis), a relatively weaker competitor. Treatments consisted of 12 combinations of plant patterns (regular, random, and two types of aggregation) and species distribution patterns (random, small aggregations, and large aggregations). Patterns were generated using spatial simulation software, and precisely replicated in the field to produce realistic experimental communities. Two years of data were collected on above-ground production, relative growth rates, and mortality of approximately 2000 grasses. Variability in soil and light resources were also quantified. Preliminary analysis strongly suggests that treatments influenced production and growth rates of both species, but that the effects were much larger for the weaker competitor in aggregated patterns and species mixtures. Variability in both light and soil moisture were also significantly affected by aggregated treatments, suggesting that plant patterns influence the heterogeneity of key plant resources. Our study provides new evidence of the role of plant spatial patterns in structuring semiarid grassland communities.

Keywords: Pattern-process, Plant spatial patterns, Agropyron cristatum, Elymus wawawaiensis, Heterogeneity

160. Patchiness in wind erosion-deposition patterns in response to a recent state change reversal in the Chihuahuan Desert

Authors: Pillsbury, Finn Pillsbury, USDA-ARS; Debra Peters, USDA-ARS; Jin Yao, USDA-ARS; Gregory Okin, University of California, Los Angeles

Offered Presentations: Arid Landscapes - Monday (2011-04-04): 13:20 - 13:40 - Studio Suite

Abstract: Shifts from shrub-dominated states to grasslands are believed to be irreversible as a result of positive feedbacks between woody plants and soil properties. In the Chihuahuan Desert, mesquite (Prosopis glandulosa) expansion into black grama (Bouteloua eriopoda) grasslands is maintained by wind redistribution of material from bare soil gaps to canopies beneath woody plants. However, a series of wet years starting in 2006 resulted in increased grass production, biomass, and lateral cover. We hypothesized that this increase in grasses modified the spatial distribution of gaps and therefore the patchiness of wind erosion-deposition dynamics. Further, we expected that positive feedbacks promoting grass recovery would act to interrupt long-term patterns of mesquite expansion. We tested this hypothesis by examining patterns of sand flux and changes in the spatial distribution of gaps through time in grasslands and shrublands at the Jornada Basin LTER from 1998 - 2010. Wind-driven sediment deposition decreased markedly at mesquite-dominated sites beginning in 2007. The spatial variability of sediment deposition also decreased, indicating that an increase in the amount and homogeneity in herbaceous vegetation in previously unvegetated gaps reduced saltation by sand particles and stabilized the soil surface. These results indicate that a reduction in the spatial variability of bare gaps and changes in the structure of vegetated patches reduce the patchiness of wind erosion and deposition. Successful remediation of arid grasslands depends on our ability to exploit the altered spatial dynamics that have accompanied recent state change reversals.

Keywords: Desertification, State change, Wind erosion, Grassland, Shrubland

161. Multi-scale analysis of the influence of soil depth on patch dynamics associated with shrub proliferation

Authors: Browning, Dawn Browning, USDA-ARS, Jornada Experimental Range; Michael Duniway, USDA-ARS Jornada Experimental Range; Andrea Laliberte, New Mexico State University, Jornada Experimental Range; Albert Rango, USDA-ARS, Jornada Experimental Range

Offered Presentations: Arid Landscapes - Monday (2011-04-04): 13:40 - 14:00 - Studio Suite

Abstract: Proliferation of woody plants in grasslands and savannas (hereafter, â€œrangelandsâ€□) is a persistent problem globally.Â This widely-observed shift from grass- to shrub-dominance in rangelands worldwide has been heterogeneous in space and time largely due to interactions between soils, climate, and land use history. Our objective was to evaluate the relationship between spatial patterns in soil properties and long-term shrub dynamics in the northern Chihuahuan Desert of southern New Mexico, USA. To meet this objective, shrub patch dynamics from 1937 to 2008 were characterized at patch- and landscape-scales using historical imagery and a recent digital soils map. Effects of annual precipitation on patch dynamics on two soils revealed strong correlations between shrub growth on deep sandy soils and above-average rainfall years. Patch-level analysis of demographic patterns revealed significant differences between patches on deep and shallow sandy soils. Shallow and deep sandy soils both exhibited low shrub cover in 1937 and were characterized by colonization or appearance of new patches until 1960. However, differing demographic responses to the cessation of severe drought on the two soils and increased frequency of wet years after 1960 have resulted in very different endpoints. Present-day shrub vegetation constitutes a shifting mosaic marked by the coexistence of patches at different stages of development. Management implications of this long-term multi-scale assessment of vegetation dynamics support the notion that efforts to

remediate grasslands should be focused on sites characterized by shallow sandy soils as those characterized by deep sandy soils pose challenges to grass recovery and survival.
Keywords: Cross-scale linkages, Honey mesquite, Shrub encroachment, Shrub patch dynamics, Soils

162. Spatial heterogeneity in aboveground net primary production and species richness at multiple scales in the Chihuahuan Desert
Authors: Yao, Jin Yao, USDA-ARS Jornada Experimental Range; Debra Peters, USDA-ARS Jornada Experimental Range
Offered Presentations: Arid Landscapes - Monday (2011-04-04): 14:00 - 14:20 - Studio Suite
Abstract: We analyzed patterns in spatial heterogeneity and the processes driving these patterns in two ecosystem properties, aboveground net primary production (ANPP) and species richness, at multiple scales in the Chihuahuan Desert. We used long-term data (1990-2009) to examine the importance of a suite of drivers and ecosystem properties to patterns in ANPP and species richness at two spatial scales: patch and landscape unit. Three patches were sampled annually within each of five landscape units: upland and playa grasslands, and mesquite, creosotebush, and tarbush shrublands. Spatial heterogeneity at the patch scale was measured as the coefficient of variation across quadrats (n = 48 or 49). Spatial heterogeneity at the landscape unit scale was measured as the coefficient of variation across patches. At the patch scale, heterogeneity was affected by growth form of the dominant plant species and by precipitation. Grasslands were more homogeneous than shrublands under drought conditions, but shrublands were more homogeneous in wet years. At the landscape unit scale, heterogeneity was mainly affected by variation in distance between patches and variation in precipitation. Because of high spatial heterogeneity across these diverse landscapes, we concluded that estimates of ANPP and species richness from fine scales can not be directly extrapolated to broader scales in the Chihuahuan Desert without accounting for both local and spatial drivers of processes.
Keywords: Spatial heterogeneity, Aboveground net primary production, Species richness, Multiple scales, Long-term data

163. Influence of land-use and conservation programs on playas across the short-grass prairie ecotone of the U.S. High Plains
Authors: O'Connell, Jessica O'Connell, Oklahoma State University; Loren Smith, Oklahoma State University; Scott McMurry, Oklahoma State University; Lacrecia Johnson, Texas Tech University; Dave Haukos, Texas Tech University
Offered Presentations: Arid Landscapes - Monday (2011-04-04): 14:20 - 14:40 - Studio Suite
Abstract: Playa wetlands are common in the 30 million ha High Plains and function as keystone ecosystems in a semi-arid landscape. The High Plains largely have been converted from grassland to cropland and the United States Department of Agriculture Conservation Reserve Program (CRP) has allowed planting of introduced tall-grasses on former cropland. To assess land-use and conservation program influences on playa ecosystems, we examined wetland area, inundation frequency, aboveground biomass, and plant composition in 261 playas (87 each in native grassland, CRP, and cropland catchments) of 6 states within 3 High Plain's sub-regions: southern, central and northern. Vegetation composition was surveyed twice/growing season and aboveground biomass was estimated in July from clip-plots (N = 30 playas/land-use). Playas were 52% smaller in cropland (8 ha) than native grasslands (17 ha). Grassland playas were dominated by native perennials. Cropland playas had fewer species/ha, generally had greater cover of annuals, and had 80% greater exposed ground than other catchments. CRP playas were dominated by perennials, wet 48% less often, and had the greatest cover of introduced and upland species with double aboveground biomass than other catchments. High-biomass perennial grasses may inhibit runoff, causing CRP playas to pond less water. Conservation programs contain provisions to protect playas, though rarely applied in the High Plains. Conservation programs should be applied in playas as they are in other systems. Tall

grasses, whether native or introduced, should not be planted near playas, as they alter inundation frequency and the natural short-grass vegetation.
Keywords: Conservation Reserve Program (CRP), Hydrology, Plant composition, Playa wetland, Agriculture

164. Quantifying spatio-temporal patterns of woodland recovery process using Landsat TM imagery and spectral mixture analysis
Authors: Yang, Jian Yang, University of Nevada, Reno; Peter Weisberg, University of Nevada, Reno; Nathan Bristow, University of Nevada, Reno
Offered Presentations: Arid Landscapes - Monday (2011-04-04): 14:40 - 15:00 - Studio Suite
Abstract: The vegetation in arid and semi-arid ecosystems is of great importance in supporting the majority of the world's livestock, global biodiversity, and carbon sequestration. As drylands are increasingly affected by the rapid climatic and land-use change, there is a great need to understand the rate and patterns of the spread and contraction of woody vegetation in arid and semi-arid landscapes. We studied woodland recovery process in three historical chaining (a tree-removal approach) sites across a Pinyon-Juniper (P-J) woodland landscape in the eastern Nevada, USA. We acquired 24 Landsat TM images of the dry season from year 1985 to 2008 and developed an improved spectral mixture analysis (SMA) model to quantify spatial and temporal patterns of P-J woodland recovery process. In particular, we examined the spatio-temporal trend of tree cover in response to the gradient from the edge into the interior of disturbed patches. Our research found that (1) the improved SMA approach, which incorporated both a photosynthetic component and a non-photosynthetic component, was better than the vegetation index (e.g., NDVI) and conventional SMA approach in estimating woodland tree cover and its rate of change; (2) tree cover exhibited strong edge effects in recently disturbed P-J woodland patches, while no edge effect was detected in the adjacent undisturbed patches; and (3) Edge effects generally remained unchanged during the years we examined but certain sites showed stronger effects in the early post-disturbance years.
Keywords: Pinyon-juniper woodland, Edge effects, Disturbance, Remote sensing, Landscape patterns

165. Habitat modeling for spring peeper: multi criteria evaluation verses ecological niche factor analysis
Authors: Shrestha, Namrata Shrestha, Toronto and Region Conservation Authority
Offered Presentations: Conservation Biology 1 - Monday (2011-04-04): 15:20 - 15:40 - Broadway 1
Abstract: The Toronto and Region Conservation Authority's (TRCA) vision is for a sustainable Living CityÂ® founded on regional biodiversity. Protecting and enhancing biodiversity in the most densely populated area of southern Ontario requires an inovative approach. For this, a Terrestrial Natural Heritage System Strategy (TNHSS) has been developed. As more land becomes available for protection and restoration, it becomes increasingly important to have a strategic direction that effectively prioritizes conservation activities. A multi scale Recovery Planning Program (RPP) was designed to facilitate this process by developing a series of tools based on sound ecological principles. In this paper we present part of the RPP where we identified high suitability areas (both existing and potential) for habitat restoration for one of the focal species, spring peeper, within TNHS using two conceptually different habitat modeling methods; Multi Criteria Evaluation (MCE) and Ecological Niche Factor Analysis (ENFA). Multiple scenarios of MCE and ENFA using different sets of environmental variables were examined and the best models were compared. The results present the spatial distribution of the high suitability areas for spring peeper within TRCA's jurisdiction. In general the results of both methods were comparable; however there were a few differences attributing mainly to the scale of analysis and the underlying techniques used in each method. Regardless, both methods were found to be equally useful depending on the nature of the questions asked. Moreover, the ENFA was found to be easily repeatable when multiple species were involved.

Keywords: ENFA, MCE, Habitat modeling, Spring peeper, Toronto

166. Loss of diversity in arthropod and fungal communities due to stress causes a shift in phylogenetic patterns

Authors: Jarvis, Karl Jarvis, Northern Arizona University; Rebecca Beresic-Perrins, Department of Biological Sciences, Northern Arizona University; Anjel Craig, Department of Biological Sciences, Northern Arizona University; Catherine Gehring, Department of Biological Sciences, Northern Arizona University; Gerard Allan, Department of Biological Sciences, Northern Arizona University; Thomas Whitham, Department of Biological Sciences, Northern Arizona University

Offered Presentations: Conservation Biology 1 - Monday (2011-04-04): 15:40 - 16:00 - Broadway 1

Abstract: We tested the hypothesis that drought and the presence of an insect parasite on host trees will cause phylogenetic clustering in associated communities. It has been shown that drought and parasitism can reduce species diversity of communities, but the budding field of community phylogenetics has yet to shed much insight on the long-term evolutionary effects of harsh conditions on communities. We focused our study on arthropod and fungal communities associated with pinyon pine and cottonwood. We infer phylogenetic effects of drought and presence of parasites by analyzing a dataset of arthropod and mycorrhizal communities associated with pinyon pines and cottonwoods. We found two principal patterns, all of which supported our hypothesis: 1) Susceptibility of host trees to insect parasites is associated with increased phylogenetic clustering in both arthropod communities and fungal communities, indicating that arthropod communities remaining on affected trees tend to be closely related; and 2) Drought leads to increased phylogenetic clustering in mycorrhizal communities. These results suggest that the loss of species diversity associated with stress from drought and parasitism leads to a greater than expected loss of ecological and evolutionary diversity.

Keywords: Climate, Community, Phylogenetics, Diversity

167. Patterns of protection and threats along productivity gradients in Canada

Authors: Andrew, Margaret Andrew, Canadian Forest Service; Michael Wulder, Canadian Forest Service; Nicholas Coops, University of British Columbia

Offered Presentations: Conservation Biology 1 - Monday (2011-04-04): 16:00 - 16:20 - Broadway 1

Abstract: Productivity is an important driver of broad-scale diversity gradients and community composition. Surprisingly, it is rarely used as a biodiversity proxy in protected area (PA) network assessments and planning. We evaluated the bias and representativeness of Canada's PAs and assessed the distribution of anthropogenic threats to protection along productivity and topographic axes. Productivity was expressed as the annual integrated fraction of absorbed photosynthetically active radiation (fPAR) and its seasonality. Overall, PAs are biased to lower productivities (higher seasonalities), but are relatively unbiased along elevation. The highest elevations and seasonalities, and lowest productivities are extremely well represented, but they account for a very small proportion of Canada's area overall and in protection. However, protectedness is not evenly distributed, and results vary widely when stratified by IUCN category, PA size, or ecozone. The spatial and environmental correlates of anthropogenic pressures (proximity of roads and settlements in the greater park ecosystem) to PAs in the boreal forest were evaluated with partial linear regression models. Threats were strongly spatially structured. Environmental variables shared about half of this spatial structure (explaining ~25% of the variation in threat distributions), but had weak independent effects. Small and productive PAs tend to occur closer to roads and human populations, and are thus expected to face greater threats to biodiversity. Patterns with elevation were weaker. Proximity to roads was unrelated to elevation, however, high elevation PAs generally occurred farther from settlements. These analyses highlight considerations for the management of existing parks and the expansion of Canada's protected area network.

Keywords: Biodiversity surrogates, Boreal, fPAR, MODIS, Protected areas

168. The biodiversity assessment framework: Indicating Washington's biodiversity
Authors: Walters, Steven Walters, University of Washington; John Marzluff, University of Washington; Heather Cornell, University of Washington
Offered Presentations: Conservation Biology 1 - Monday (2011-04-04): 16:20 - 16:40 - Broadway 1
Abstract: Biological diversity underpins a region's ecological health, determines the services humans obtain from the natural world, and indicates the myriad ways people have influenced nature. Globally, biodiversity is declining. Moreover, a systematic monitoring of biodiversity - its elements, services and responses to people - is lacking. To remedy this void, we began developing a program to measure and monitor biodiversity in Washington State. The effort aims to assess the status of biodiversity, provide management guidance, and inform and engage the citizenry in understanding the importance of biodiversity. The Biodiversity Assessment Framework comprises the groundwork for the first comprehensive assessment of all facets of Washington's biodiversity. Our approach assesses landscape and ecosystem conditions that support biodiversity, in addition to the diversity of species themselves. Additionally, it consists of indicators of ecosystem conditions, as well as the interactions between socioeconomic systems and the environmental processes they impact and upon which they depend. It provides information on the status of Washington's biodiversity, environmental factors that affect the quality of life for Washingtonians, and the level of engagement in conserving biodiversity. The analytical underpinnings of the framework significantly contribute to research on biodiversity assessment. It has at its core a conceptual model that explicitly recognizes the integral linkages between biodiversity and human well-being. This comprehensive design expands upon broader national and international approaches by addressing human-biodiversity interactions in an explicitly integrated, coupled human-natural systems perspective.
Keywords: Biodiversity, Indicators, Coupled human-natural systems

169. A bird's eye view: Analyzing multi-scale landscape characteristics of stopover sites for migrating whooping cranes
Authors: Belaire, J. Amy Belaire, University of Illinois at Chicago; Betty Kreakie, University of Texas at Austin; Emily Minor, University of Illinois at Illinois; Timothy Keitt, University of Texas at Austin
Offered Presentations: Conservation Biology 1 - Monday (2011-04-04): 16:40 - 17:00 - Broadway 1
Abstract: Migration between breeding and nonbreeding habitats is a major part of the annual cycle for many birds, but we often know very little about what happens en route between those two destinations. Here we focus on migratory stopover site characteristics for the whooping crane (Grus americana), a federally-listed endangered species. Its migratory flyway cuts through the Great Plains of the United Statesâ€”an extremely windy region that is the focus of much attention for potential wind energy development. Our objectives are twofold: 1) identify landscape characteristics at multiple scales that are commonly associated with whooping crane stopover sites, and 2) develop maps of potential stopover habitat to help guide site selection for future wind energy infrastructure or other development in the migratory flyway. We use maximum entropy (Maxent) modeling to identify the landscape characteristics (e.g., wetland cover, agricultural land cover, stream density) at multiple scales (ranging from 1km2 to 75km2) of whooping crane stopover sites. Preliminary results indicate that â€œecotoneâ€ habitats (e.g., within 200m of both agricultural land and wetland) and landscape characteristics at a broad scale (e.g., high percentage wetland cover within 50km2) are commonly linked to stopover sites, indicating that whooping cranes may be using a hierarchical decision-making process at multiple scales during stopover site selection. This has implications for future wind energy projects and other development in the flywayâ€”decisions about site selection should take a bird's eye view perspective to identify relevant habitat elements beyond the parcel scale.
Keywords: Migration ecology, Conservation, Maxent

170. Comparing plant functional type and individual species distribution models under climate change: results for eastern US trees

Authors: Matthews, Louis Iverson, Northern Research Station, US Forest Service; Anantha Prasad, Northern Research Station, US Forest Service; Matthew Peters, Northern Research Station, US Forest Service; Ronald Neilson, Pacific Northwest Research Station, US Forest Service; Raymond Drapek, Pacific Northwest Research Station, US Forest Service

Offered Presentations: Global Change 1 - Monday (2011-04-04): 15:40 - 16:00 - Council Suite

Abstract: The development of models to evaluate potential responses of biota to climate change are essential as we consider management options. Whether working from a mechanistic or statistical framework, we must consider model limitations and evaluate uncertainties. To this end, many efforts are underway to integrate these different approaches. In order to properly frame the underling ecological questions, we must return to the principles of plant distributions and organization. The perspective of individually mediated or community-driven processes in shaping species distributions are critical to our understanding of how species distributions may change. We demonstrate that the information from empirical statistical distribution models (DISTRIB) and mechanistic biophysical models (MAPSS) can be used to identify geographically varying regions of uncertainty with respect to potential climate-induced changes in the forests of the eastern US. Next, we compare leaf area index (LAI), a key driver determining plant functional types in MAPSS, with importance value (index of abundance, IV) from the DISTRIB models. White oak and sugar maple demonstrate different patterns, with the maximum mean IV of sugar maple increasing towards higher LAI values, while white oak reaches its maximum at lower LAI, as expected. After projecting these models onto the MIROC A2 climate model, sugar maples' overall IV was reduced but a persistent pattern of higher mean IV with increased LAI remained. However, white oak shows a reversal with its lowest mean IV occurring at LAI levels where it is presently most abundant. By considering both modeling approaches, we are opening pathways to help reduce uncertainty in assessing climate change impacts.

Keywords:

171. Forecasting climate-induced distribution shifts for the pinyon-juniper complex of the Western U.S.

Authors: Gibson, Thomas Edwards, Jr., US Geological Survey; Gretchen Moisen, US Forest Service, Rocky Mountain Research Station; Tracey Frescino, US Forest Service, Rocky Mountain Research Station

Offered Presentations: Global Change 1 - Monday (2011-04-04): 16:00 - 16:20 - Council Suite

Abstract: Pinyon and juniper vegetation types cover >30% of the Colorado Plateau. Two species and one variety of pinyon pine (Pinus monophylla, edulis, monophylla var. fallax) and four species of juniper (Juniperus osteosperma, monosperma, deppeana, arizonica) are dominant, and comprise a mosaic of overlapping distributions arranged primarily across a gradient of seasonal precipitation. Individual species have been found to respond uniquely to climate changes, causing shifts in the co-occurrence of species. This is reflected in the differential mortality among species caused by recent droughts, which appear to indicate long-term distribution shifts have already begun. We developed bioclimatic distribution models and applied climate change scenarios to gauge potential shifts in the distributions of individual species and their co-occurrence. The application of climate change scenarios resulted in, for each species / variety, the spatial depiction of currently inhabited areas no longer suitable for regeneration as well as currently uninhabited areas becoming suitable for colonization. Our results suggest individualistic responses of species to climate change will likely cause shifts in their spatial co-occurrence. For example, J. osteosperma is predicted move northwest whereas J. monosperma is predicted to move northeast resulting in a decrease of co-occurrence. P. edulis is predicted to increasingly co-occur with J. osteosperma while P. monophylla is predicted to decrease or increase depending on the climate change scenario. The character of individual species

distributions shifts and their resulting changes in co-occurrence will be largely determined by changes in the summer monsoon rains and in the minimum winter temperatures.
Keywords: Climate change, Pinyon pine, Junipers, Species distribtuion models

172. Modelling species migration potential for multiple species in the eastern US
Authors: Prasad, Anantha Prasad, US Forest Service; Louis Iverson, US Forest Service; Stephen Matthews, The Ohio State University & US Forest Service; Matthew Peters, US Forest Service
Offered Presentations: Global Change 1 - Monday (2011-04-04): 16:20 - 16:40 - Council Suite
Abstract: The image processing technique of convolution using Fast Fourier Transforms (FFT) in a MATLAB environment breathed new life, in terms of increased processing speed, to the spatially explicit cell-based model SHIFT, which uses an inverse power function to calculate colonization probabilities of tree species. We achieved several thousand-fold increase in processing speed which enabled us to model the colonization probabilities of multiple tree species in the eastern US in a reasonable amount of time. Our previous non-FFT attempts were prohibitively expensive in terms of time, especially because the modelling process involves iterative parameterization to obtain an approximate migration rate of 50km/century under pre-settlement forest conditions. This modelling exercise builds on our previous effort where we used an empirical-statistical model (DISTRIB) based on decision tree techniques to predict suitable habitats under current and future climates. Tree species ensembles modelled by SHIFT allow us to constrain the suitable habitats predicted by DISTRIB under current fragmented landscapes and explore the possibility of assisted migration under future climatic disruptions on natural migration.
Keywords: Fast fourier transforms, MATLAB, Spatially expicit cell-based, Climate change, Convolution

173. Response of plant functional types to land use change, climate change and altered fire regimes in a Mediterranean-type ecosystem
Authors: Franklin, Janet Franklin, Arizona State University; Helen Regan, University of California Riverside; Alexandra Syphard, Conservation Biology Institute; Rebecca Swab, University of California Riverside; Erin Conlisk, University of California Riverside
Offered Presentations: Global Change 1 - Monday (2011-04-04): 16:40 - 17:00 - Council Suite
Abstract: Mediterranean-type ecosystems (MTEs) support exceptional plant species richness, but their biodiversity is threatened by multiple factors operating at the landscape scale. Although land use change has been the primary driver of extinction risk, climate change is predicted to shift the distribution of suitable habitat for many species. Urban development may impede climate-induced distribution shifts for some species, causing habitat to contract. Anthropogenically altered fire regimes also threaten MTE biodiversity, and this may be exacerbated by climate change. While MTE shrublands are generally resilient to periodic wildfire, obligate seeders (OS) may be sensitive to increasing fire frequency and changing climate because they rely on fire-stimulated germination, while obligate resprouters (OR), which resprout after fire but have greater capacity for dispersal and establishment between fires, may be more resilient. To investigate the impacts of land use change, climate change, and altered fire regimes on these two major fire response plant functional types (PFTs), we integrated urban growth, species distribution and population models for four species from these PFTs in southern California. Increased fire frequency is predicted to be a greater threat than climate change for OS species found in areas not likely to be urbanized. Climate change may be a bigger threat than altered fire regime for OR species, whose dispersal ability is insufficient to buffer populations from shifts in habitat. For some range-restricted OS species found in highly urbanized coastal areas, low levels of habitat fragmentation resulting from future urbanization may actually increase population viability by impeding the spread of large fires across the landscape.
Keywords: Fire, Climate change, Urban growth, Plant functional type, Population persistence

174. Landscape-scale green infrastructure as a climate change adaptation strategy
Authors: Marcucci, Daniel Marcucci, East Carolina University
Offered Presentations: Land Use Planning 1 - Monday (2011-04-04): 15:20 - 15:40 - Forum Suite
Abstract: Over the next century and longer, accelerated climate change will shift the spatial arrangements of bioregions. Climatic conditions will force bioregions to migrate to higher altitudes and latitudes. This paper examines the potential for landscape-scale green infrastructure to provide an adaptation mechanism for these shifts. In particular, I use the socio-political and biogeographical conditions in eastern North America as a reference for discussion. Understanding the science of how these shifts might occur is complex enough. This paper discusses the challenges of modeling bioregional shifts. But the larger question is: do we have the knowledge and will to plan for the landscape shifts that are over 100 years out? At the core of this research is: what is the practicality of using landscape-scale green infrastructure planning for climate change adaptation? The results indicate that it is feasible scientifically, although there are significant gaps in knowledge. Next the paper examines the current state of this form of planning and analyzes prospects for further deployment. Examples exist where strategic landscape assessments have been undertaken, particularly in the Chesapeake Bay Watershed, but implementation of green infrastructure plans is badly lacking. Finally, I prescribe a strategy for long-term landscape planning that describes political and institutional requirements. This strategy requires exchange of knowledge, a willingness to expand the time-frame for planning, and integration of green infrastructure planning into other landscape-scale interests.
Keywords: green infrastructure, bioregion, climate change adaptation, long-term planning, environmental policy

175. An open source" and customizeable program combining connectivity
Authors: Gallo, John Gallo, The Wilderness Society
Offered Presentations: Land Use Planning 1 - Monday (2011-04-04): 16:00 - 16:20 - Forum Suite
Abstract: A customizeable spatial decision support system (SDSS) that combines principles of landscape ecology and conservation planning is now available as open-access modelbuilder and python scripts. The global collaborative and online community for the application and further development of the SDSS welcomes interest and new users. The SDSS uses multi-criteria and multi-objective decision analysis to provide a framework for combining user-defined landscape ecology criteria in a robust and transparent manner. An optimization engine is used to identify sets of sites for conservation or restoration that, taken as a whole give the most â€œbang for your buck.â€ There is a least cost corridor algorithm programmed into the optimization engine, as well as a contiguity analysis. The current algorithm automatically models the corridors between every pair of reserves, and also attempts to prioritize paths not only within a corridor, but among corridors. The principle of representation is met using the novel â€œcontinuous benefit functionâ€ approach rather than relying heavily on conservation targets/thresholds. The end-user determines the shape of the benefit functions by setting parameter values, so targets/thresholds can still be emphasized. Consensus-based approaches to setting the weights that are subjective become a means for developing buy-in and consensus among disparate stakeholders. The SDSS is designed to easily update as new data, criteria, or parameter values become available, thereby allowing adaptation to a dynamic world. Data and results from the Little Karoo, South Africa, one of the pilot studies, will also be presented.
Keywords: Connectivity, Contiguity, Representation, Conservation planning, Model builder

176. Land use legacy maps: integrating groundwater travel time and backcast land use models
Authors: Pijanowski, Bryan Pijanowski, Purdue University
Offered Presentations: Land Use Planning 1 - Monday (2011-04-04): 16:20 - 16:40 - Forum Suite
Abstract: Studies of land use impacts on stream flow and water quality have generally concentrated on the role of surface water runoff. However, in typical upper Midwestern watersheds, a large majority

of annual stream flow is derived from shallow groundwater. Like overland flow, groundwater flow integrates solute inputs from a range of land use types from source areas to streams; groundwater flow however has longer transport times ranging from days to hundreds of years. Therefore, water recharging to streams could be decades old, potentially originating from presettlement landscapes. We have built models that attempt to characterize the influence that long-term groundwater transport has on current water quality signals. This has been accomplished using a backcast model, which creates historical land use/cover maps using a reverse-time driven land change algorithm, coupled to a MODLFOW-based groundwater travel time model. This spatial-temporal model is used to create â€œland use legacy planning maps that link the contribution of historic land uses to the groundwater signal arriving at streams. We summarize the main results of these coupled simulations focusing on (1) how one interprets stream water quality measurements and land use impacts (2) the interaction of spatial and temporal patterns in the historical land use-groundwater system and (3) the spatial variability of using land use legacy maps for land use planning and natural resource management."
Keywords:

177. Landscape agroecology: A multifunctional approach to nonpoint source pollution
Authors: Harden, Noelle Harden, University of Wisconsin-Madison, Agroecology Masters Program; Loka Ashwood, University of Wisconsin-Madison, Department of Community and Environmental Sociology; Michael Bell, University of Wisconsin-Madison, Department of Community and Environmental Sociology; William Bland, University of Wisconsin-Madison, Department of Soil Science
Offered Presentations: Land Use Planning 1 - Monday (2011-04-04): 16:40 - 17:00 - Forum Suite
Abstract: Nonpoint source water pollution and multifunctional agriculture are two topics commonly debated, but often unjoined in practice. There are many demands on the agricultural landscape, from the production of food, fiber, and fuel for direct human needs to the provision of ecosystem and social services. We incorporate these diverse demands into a nonpoint source pollution reduction strategy: landscape agroecology. Landscape agroecology is a process designed to reduce nonpoint water pollution with multiple benefits to communities. Through a democratic process, local communities craft and evaluate strategies for water pollution reduction. This participatory, iterative process brings together four key groups: academics, landowners and farmers, community members, and government employees. This paper details the opportunities and challenges realized in a landscape agroecology approach. We implemented the landscape agroecology approach through a series of meetings and individual interviews in two rural watersheds in Wisconsin and Illinois. In meetings respective to the four groups, these actors identified overlapping pollution reduction strategies. These synergies challenge claims that diverse collaborators have irreversibly divergent interests (Coggins, G. C. 1999.
Keywords: Nonpoint pollution, Multifunctionality, Agroecology, Collaborative planning

178. Restoring (traditional) knowledge and ecosystems through fire management
Authors: Reo, Nicholas Reo, University of Michigan School of Natural Resources and Environment; Robert Grese, University of Michigan School of Natural Resources and Environment; Steven Yaffee, University of Michigan School of Natural Resources and Environment; Eric Clark, Sault Ste Marie Tribe of Chippewa Indians; Kirk Piehler, United States Forest Service
Offered Presentations: Restoration Ecology - Monday (2011-04-04): 15:20 - 15:40 - Studio Suite
Abstract: The upper Great Lakes region includes a wide range of fire-dependent ecosystem types that comprise a large portion of this heavily forested landscape. Fires in forests and openings ignited by lightning strikes and by American Indians were a part of the fabric of the pre-colonial landscape and contributed significantly to shaping the structure and composition of contemporary northern Lake States forests. Since European settlement, forest ecosystems in the region have been altered dramatically, partially through suppression of wildland fire. Today, land managers are reintroducing

prescribed burning into fire dependent ecosystems as part of ecosystem restoration efforts. A few tribal and first nation communities in the region have continuously used fire as a land management tool, although most have ceased using prescribed fire or have recently re-instituted their practices. Our project aims to revitalize traditional ecological knowledge about fire management by linking tribal/first nation communities where this knowledge is active and vibrant with those where it has fallen out of use. We are also involving tribal citizens in fire management planning and implementation on national forests as a means of building cross-boundary, tribal-federal relations and expanding the use of prescribed fire regionally. Repeated in-depth interviews with tribal citizens are used to determine priority locations for future burns on National Forests. Field-based interviews, field trips and workshops are used to revitalize traditional fire management knowledge.
Keywords: Traditional ecological knowledge, Fire ecology, Tribal-federal relations, Knowledge restoration, Ecosystem restoration

179. City, farm and coast: three approaches to giving form to site ecology through landscape architecture
Authors: Todd, Lauren Todd, Stephen Stimson Associates Landscape Architects
Offered Presentations: Restoration Ecology - Monday (2011-04-04): 15:40 - 16:00 - Studio Suite
Abstract: A landscape is the embodiment of a series of layers, both social and natural, always intertwined, and inherently shifting. Within the field of landscape architecture, physical attributes such as topography and infrastructure are always quick to inspire built form. In recent years, however, it is more often the less visible layers of history, culture, and ecology that generate a design process that carefully integrates human use within a restored matrix of site ecology. In response to this, there has been a shift in the practice of landscape architecture to embrace interdisciplinary approaches to analysis and design by engaging a team of allied professionals, often in the related fields of ecology, hydrology, soil science, and wildlife biology. Three projects that vary in scale and context will demonstrate how this multi-layered approach to landscape design redefines ecological restoration according to each project's unique conditions.â€¨â€¨ A 300-acre public park in San Antonio, TX, a 100-acre farm in rural MA, and a 5-acre private residence on Mount Desert Isle, ME each offer a diverse design process for restoration ecology. These three sites share a design philosophy that makes ecology visible through designed expression, rather than simply replicating nature; but all for very different reasons. While the public park is envisioned as a living laboratory of urban ecology for a dense population, the farm has a research and commercial-based incentive, and the private residence is a spatial continuum of the native ecosystem of Acadia National Park. Although ecology and human program have influenced the place-making of each of these projects, the constructed landscapes and ecosystems are restored in distinct ways through a variety of technologies.â€¨â€¨ These projects, spanning both urban and rural environments, exemplify a deliberate need to inform the design process by engaging an interdisciplinary design team and providing a framework for site ecosystems. The evolution of these three projects from schematic design to construction will be traced through research, illustrative drawings, studies, and photos of built work. Through these comparisons, we can gain an understanding of how human use and function can be balanced with ecology that is restored and made legible through a landscape that resonates culturally, in response to context, budget, and client needs.
Keywords: Landscape architecture, Ecological restoration

180. Guiding ecological restoration in invaded landscapes
Authors: Questad, Erin Questad, US Forest Service, Instititue of Pacific Islands Forestry; Susan Cordell, ; Kealoha Kinney, ; Jim Kellner, ; Jarrod Thaxton,
Offered Presentations: Restoration Ecology - Monday (2011-04-04): 16:00 - 16:20 - Studio Suite
Abstract: Ecological restoration is a priority in ecosystems where invasive species are abundant. However, restoration can be difficult when invasive species have had large impacts on ecosystem

properties and land-use has caused significant environmental degradation. Restoration is also challenging in landscapes where resources are limited and plant growth is slow. We developed tools to assess restoration potential and aid restoration planning for a dry forest landscape in Hawaii. This area provides habitat for many threatened and endangered species, is at risk of further damage by fire fueled by invasive grasses, and is the focus of extensive management and restoration efforts. We developed restoration indicator variables from light detection and ranging (LiDAR) and spectroscopic measurements from the Carnegie Airborne Observatory (CAO). Specifically, we used analyses of fire fuels, topography, and tree density derived from the CAO data combined with field microclimate measurements to identify areas with the greatest need for restoration and areas with high potential for restoration success. Areas in need of restoration had conditions favorable to the spread of wildfire. Areas with high potential for restoration success had conditions favorable for plant growth, such as reduced wind speeds, greater water availability, and greater shade. We developed restoration planning tools for three ecosystems and identified areas of the landscape suitable for different restoration targets, including restoration for native biodiversity, endangered plant populations, and fire prevention.
Keywords: Restoration, Endangered species, Remote sensing, Invasive species, Fire

181. Riparian bird habitat association models and management guidelines in Utah
Authors: White, Hillary White, Utah State University
Offered Presentations: Restoration Ecology - Monday (2011-04-04): 16:20 - 16:40 - Studio Suite
Abstract: Approximately 75% of Utah's avian species use riparian habitats at some time during their life cycles and at least 80% of this habitat in Utah has been lost or altered since settlement; less than 1% of land cover in Utah is considered riparian. In 1992, the Utah Division of Wildlife Resources began a statewide neotropical migratory bird (NTMB) and habitat monitoring program to assess the status of bird populations at over 50 riparian survey sites. Many project goals directly address focal species identified as Utah Partners in Flight priority species as well as priority habitat and other avian species listed in the Utah Comprehensive Wildlife Conservation Strategy. Our primary study goals are 1) to assess population trends for focal avian species, 2) describe changes in vegetation over time, and 3) investigate how these two processes are related by creating bird-habitat association models. Recent results from population trend analyses suggest that the patterns of annual variation and regional synchrony seen in riparian-dependent species groupings may be driven by landscape-scale effects on habitat. To better understand these large scale effects, riparian-bird habitat association models have been developed. Multivariate regression trees were constructed for 36 individual bird species as well as for three distinct foraging guilds to assess species-specific and community level habitat associations. Our model results will form the basis for the development of management guidelines that will inform restoration and conservation efforts in Utah. Bird-habitat association model results will be presented and the framework for riparian management guidelines will be discussed.
Keywords: Riparian restoration, Bird-habitat association, Neotropical migrant, Management guidelines, Utah

182. Changes in vegetation structure through time in a tallgrass prairie and implications for avian diversity and community composition
Authors: Olechnowski, Brian Olechnowski, Warren Wilson College; Diane Debinski, Iowa State University; Pauline Drobney, US Fish and Wildlife Service; Karen Viste-Sparkman, US Fish and Wildlife Service; Willam Reed, Iowa State University
Offered Presentations: Restoration Ecology - Monday (2011-04-04): 16:40 - 17:00 - Studio Suite
Abstract: Grassland birds are one of the most endangered taxa in temperate North America. Because many species declines have been linked to habitat fragmentation and loss, large-scale prairie restoration projects have the potential to provide critical habitat for these declining species. We

examined how the structure of restored grassland habitat changes through time and how diversity and community composition of grassland birds respond to these changes. Our study was completed at Neal Smith National Wildlife Refuge, a large-scale prairie restoration in central Iowa. Vegetation composition and structure were measured at 42 restored grassland plots throughout the refuge in 2007. Birds were surveyed at these locations from 1994 to 2007. Survey points were sorted into five categories (out of crop rotation for 1, 2, 3, 4-6, and > 6 y). In the initial phases of restoration, species such as horned larks, red-winged blackbirds, and killdeer were abundant. Other species such as common yellowthroats and dickcissels were more common in established restored points. Henslow's sparrows appeared only at survey points that were out of crop rotation for more than 6 years. Diversity peaked in survey points that were 2-3 years out of crop rotation and points that were more than 6 years out of rotation. Community composition shifted through the chronosequence of prairie plantings. Changes in diversity and shifts in community composition can be explained by changes in vegetative structure. Our results suggest that managing for a variety of restored prairie stages will best maintain the highest levels of avian diversity and abundance.
Keywords: Prairie, Avian, Restoration, Succession, Diversity

183. What size is a biologically relevant landscape?
Authors: Jackson, Heather Jackson, Carleton University; Lenore Fahrig, Carleton University
Offered Presentations: Scaling - Monday (2011-04-04): 15:20 - 15:40 - Broadway 3
Abstract: Species exhibit variation in the distances over which landscape structure influences a population, but the mechanisms underlying variation in this so-called â€œscale of effectâ€□ are unclear. Understanding of these mechanisms is required to inform landscape managers of the distances over which landscape alteration will influence animal populations. Although dispersal ability is commonly mentioned as the species trait most likely to positively influence the scale of effect of landscape on a population, empirical studies provide ambiguous support for this idea suggesting that other factors such as habitat structure and reproductive rate may also play a role. Using a spatially-explicit individual-based simulation model of movement and reproduction, we tested the effects of species-specific traits (birth rate and movement distance) and habitat structure (average habitat amount and average habitat fragmentation) on the spatial scale over which habitat cover in the landscape influences abundance in a focal patch. In preliminary runs, our simulations predicted that, as expected, large movement distances increase the scale of response. The effect of habitat structure, however, was equally influential: low average habitat amount resulted in large scales of effect. Furthermore, both minimally and highly fragmented habitat resulted in large scales of effect when compared to moderately fragmented landscapes. Reproductive rate positively influenced the scale of effect, but to a lesser extent than movement distance or habitat structure. To summarize, these simulations predict that the radius over which landscape influences a focal population will be greatest for vagile species associated with rare habitat that is either minimally or highly fragmented.
Keywords: Scaling, Body-size, Habitat loss, Habitat configuration, Landscape composition

184. The optimal spatial extent for quantifying catchment agriculture on lake nutrients using simple metrics
Authors: Soranno, Patricia Soranno, Michigan State University; Katie Droscha, Michigan State University
Offered Presentations: Scaling - Monday (2011-04-04): 15:40 - 16:00 - Broadway 3
Abstract: Quantifying the effects of agriculture on freshwater nutrients using simple spatial metrics have typically focused on the catchment or riparian spatial extents. However, the optimal spatial extent to measure agricultural effects on lake nutrients has not been identified. In this study, we quantify and compare several spatial extents for examining the effects of agricultural land use on lake phosphorus and nitrogen. We quantified agricultural land use/cover at several spatial extents within 204 lake catchments. We examined the relationship between the different spatial extents and lake

nutrients sampled in both spring and summer in each lake. We found that there is not a single optimum spatial extent with which to meaure lake nutrients. The optimal spatial extent depended on the nutrient and the time of year the nutrient was sampled. However, we found some common patterns that showed the coarsest and finest extents were most strongly related to lake nutrients. However, because these two scales are highly correlated, we cannot determine, which extent is most important mechanistically.
Keywords: Land use, Nutrients, Metric, Spatial extent, Agriculture

185. Can a stratified analysis at the local-scale reduce masking of large-scale pattern by local-scale differences?
Authors: Gavish, Yoni Gavish, Ben-Gurion University of the Negev, Israel; Yaron Ziv, Ben-Gurion University of the Negev, Israel
Offered Presentations: Scaling - Monday (2011-04-04): 16:00 - 16:20 - Broadway 3
Abstract: In the last decades ecological studies shifted much of the focus to patterns and processes at large spatial scales. However, field sampling remained at the local scale of a few meters. Therefore, prior to analysis, raw data are usually scaled-up to objects at the larger focal scale. The scaling-up may result with two masking effects: (1) including within-object variance that masks large-scale patterns; (2) losing between-object variance that is relevant to the large-scale patterns. Stratifying the sampling and analysis according to local-scale conditions may reduce the two masking effects. However, stratified analysis assumes that similar local conditions reduce masking effects at all spatial scales. We explore this assumption for spiders in the fragmented agro-ecosystems of Southern Judea Lowlands, Israel. We sampled 39 patches, 13 within each of three landscapes along Israel's climatic gradient. A total of 742 samples were taken, stratified according to nine a-priori defined habitats. We calculated the community similarity between all samples pairs and divided them to similar-habitat pairs and different-habitats pairs. We compared the similarity according to four distance categories: within patch, between patches in the same landscape, between adjacent landscapes and between distant landscapes. We demonstrate that similar-habitat pairs have higher mean similarity than different-habitat pairs at all distance categories. However, the difference decreases with distance. Finally, we show how the large-scale pattern changes from a gradual ecocline in the non-stratified analysis to a sharp ecotone in the stratified analysis. The sharp ecotone is further supported by vegetation cover analysis.
Keywords: Stratified analysis, Transition zones, Scale-dependent, Analysis of similarity, Ecotone

186. Complex effects of spatial scale on relationships between landscape pattern and avian species diversity
Authors: Bar Massada, Avi Bar Massada, University of Wisconsin - Madison; Eric Wood, University of Wisconsin - Madison; Anna Pidgeon, University of Wisconsin - Madison; Volker Radeloff, University of Wisconsin - Madison
Offered Presentations: Scaling - Monday (2011-04-04): 16:20 - 16:40 - Broadway 3
Abstract: Landscape pattern analysis is widely used for predicting species diversity. However, such analyses are often conducted at a single spatial scale, although both pattern and species are sensitive to scale. The effects of scale on landscape pattern are established, while the relationships between pattern and species are inconsistent. Furthermore, the effects of scale on relationships between landscape pattern and species diversity are relatively unknown. Our objective was to quantify the effects of spatial scale (grain and extent) on relationships between landscape pattern and avian richness and composition in a North American grassland-savanna-woodland landscape. We also evaluated the usefulness of Multiscale Contextual Spatial Pattern Analysis (MCSPA) as an alternative to single-scale landscape metrics. Landscape and MCSPA metrics had quadratic, exponential, or logarithmic relationships with avian richness, and these relationships were consistent across two spatial grains and six spatial extents. The magnitude of the relationships and the

predictive power of metrics were affected by grain and extent. Changing the grain reversed the direction of relationships between extent and the predictive power of metrics. Edge density was consistently the best predictor of avian richness, followed by the standard-deviation of cover across extents. Woody cover and average cover across extents were the best predictors of community composition. Grain and extent had varying effects on the relationships between landscape pattern and community composition. We conclude that scale significantly affects the relationships between landscape pattern and species diversity, often in complex ways which constrain the efficacy of using landscape metrics to predict the diversity of organisms.
Keywords: Landscape pattern, Scale, Grain, Extent

187. Using high accuracy geodesy to assess risk from climate change in coastal national parks
Authors: August, Peter August, University of Rhode Island; Michael Bradley, University of Rhode Island; Charles LaBash, University of Rhode Island; Nigel Shaw, National Park Service; Tim Smith, National Park Service
Offered Presentations: Global Change 2 - Tuesday (2011-04-05): 09:20 - 09:40 - Broadway 3
Abstract: Coastal National Parks are at risk from climate change impacts of sea level rise and surge caused by large storms. The best estimates of how much sea level will rise, where inundation will be most severe, and the expected frequency and intensity of large storms are changing rapidly as climate scientists and coastal geomorphologists study the dynamics of coastal systems and refine their models. The ultimate goal of our project is to estimate risk at specific locations -- sentinel sites -- in northeastern coastal National Parks. Sentinel sites may be infrastructure such as roads and structures, unique or vulnerable habitats, or locations of special interest such as important cultural or natural resources. Elevations at sentinel sites are obtained using RTK GPS to within 2-4 cm accuracy. Their risk of inundation is assessed using best-available landscape scale models. In order to measure elevations at sentinel sites, a backbone of high-accuracy geodetic control must be established in each coastal park. The first phase of this project is to evaluate the suitability of existing geodetic control from records maintained by a number of federal and state agencies. In this paper we will review our design of backbone control sites in coastal parks and describe how they support risk assessment at sentinel locations.
Keywords: Climate change, National Parks, Sea level rise, Storm surge, Geodesy

188. The influence of climate change, timber harvest, and rural development on forest biomass in Massachusetts, USA
Authors: Thompson, Jonathan Thompson, Smithsonian Institution; David Foster, Harvard Forest; Robert Scheller, Portland State University; David Kittredge, University of Massachusetts
Offered Presentations: Global Change 2 - Tuesday (2011-04-05): 09:40 - 10:00 - Broadway 3
Abstract: Land use and climate change have complex and interacting effects on naturally dynamic forest landscapes. To anticipate and adapt to these changes it's necessary to understand their individual and aggregate impacts on forest growth. We conducted a landscape simulation experiment to evaluate regional forest change in the state of Massachusetts over the next fifty years (2010 to 2060). Our objective was to estimateâ€"assuming a linear continuation of recent trendsâ€"the relative and interactive influence of continued succession, climate change, forest conversion to developed uses, and timber harvest on live aboveground biomass (AGB). We examined twenty years of land-use records in relation to a suite of social and biophysical explanatory variables and used regression trees to create “probability-of-development” and “probability-of-harvest” zones. We then used LANDIS-II, a spatially interactive forest landscape simulator, to model interactions among the twenty-five most abundant tree species as they were affected by the modern land use regime and anticipated patterns of climate change. We conducted a series of simulations in a full-factorial design and found that continued forest succession had the largest effect on total AGB, increasing stores from 181.83Tg to 309.56 Tg over the 50 year period. The increase varied from 49 to 112-percent

depending on the eco-region within the state. Compared to the “growth-only” simulation, forest conversion reduced total AGB by 23.18 Tg over fifty years. Timber harvests reduced total AGB by 5.23 Tg. Climate change had a positive effect on growth, increasing total AGB by 17.3 Tg. Under the naÃ¯ve assumption that future land use patterns will resemble the recent past, we conclude that continued forest growth and recovery will be the dominant mechanism driving forest biomass dynamics over the next fifty years, and that while climate change may enhance the rate of growth this will be more than offset by land-use, primarily forest conversion to developed uses.
Keywords: Forest biomass, Carbon, LANDIS-II

189. Spatial predictive process models give improved forecasts of vegetation response to climate change
Authors: Swanson, Alan Swanson, University of Montana; Solomon Dobrowski, University of Montana
Offered Presentations: Global Change 2 - Tuesday (2011-04-05): 10:00 - 10:20 - Broadway 3
Abstract: Species distribution models (SDMs) relate the presence and absence of plant species to environmental covariates, and are commonly used to forecast climate change impacts on biota. Such models have been used to predict increased extinction risk and dramatic shifts in habitat for many species, but the uncertainty of these predictions has been largely explored. In practice, most SDMs are non-spatial, treating observations as independent even when close in space. This can lead to biased parameter estimates, overconfidence in predictions, and invalid tests of predictor significance. Spatial “predictive process models show promise in increasing both the biological and statistical realism of species distribution models. Predictive process models introduce a spatially autocorrelated covariate into parametric statistical approaches. The spatial process covariate can serve as a proxy to unmeasured factors affecting species distribution, such as dispersal or competition. Implemented in a Bayesian framework, the parameters of the spatial process are estimated concurrently with the conventional model coefficients, and associated uncertainties are propagated through to spatially explicit predictions. These predictions can then be used to distinguish areas where habitat loss is relatively certain from those where predictions are less certain. We tested the efficacy of spatial predictive process models in capturing the true variability of plant distributions by fitting them to historic (1910-1940) vegetation data from the mountain ranges of California. Temporal transferability was assessed using validation data from 1990-2005. Compared to conventional GLMs, these models were able to produce confidence intervals that captured true prevalence values with far greater reliability.
Keywords: SDM, Climate change, Vegetation

190. Using tree ring data in modeling seasonal and annual dynamics of Mediterranean evergreen forests
Authors: Nijland, Wiebe Nijland, Utrecht University, faculty of Geosciences, The Netherlands; Esther Jansma, Rijksdienst voor het Cultureel Erfgoed, The Netherlands; Elisabeth Addink, Utrecht University, faculty of Geosciences, The Netherlands
Offered Presentations: Global Change 2 - Tuesday (2011-04-05): 10:20 - 10:40 - Broadway 3
Abstract: Tree growth in Mediterranean landscapes is limited by the typical summer-dry climate. Forests in these areas are only marginally productive and may be quite susceptible to modern climate change. To improve our understanding of forest sensitivity to annual and seasonal climate variability, we use tree-ring measurements of two broadleaved evergreen tree species combined with forest-BGC model runs. The study includes 34 stems of Quercus ilex and Arbutus unedo from the Peyne study area in southern France and monthly climate data spanning 38 years. Statistical analysis of the tree-ring chronologies with monthly precipitation and temperature data indicates a strong positive response to May and June precipitation, as well as a significant positive influence of early-spring temperatures and a negative response to summer heat. Model simulations of forest development and productivity show good agreement to field data with respect to the long term development of Leaf

Area Index and biomass. However, comparison of yearly and seasonal productivity patterns from the model and tree-ring analysis shows much less similarity. Our results show that tree-ring data from Q.ilex and A.unedo provides valuable information about the response of these tree species to climate variability, leading to a better understanding of climate change effects on Mediterranean ecosystems. The results may be used to enhance ecosystem models towards a better simulation of yearly and seasonal dynamics which will greatly improve their usability for predictive scenario simulations.
Keywords: Tree ring, ForestBGC, Mediterranean, Evergreen

191. LiDAR, Tree Cores, and Snow: Modeling fine-scale tree invasion into a subalpine meadow landscape under future snow scenarios
Authors: Zald, Harold Zald, Oregon State University
Offered Presentations: Global Change 2 - Tuesday (2011-04-05): 10:40 - 11:00 - Broadway 3
Abstract: Climate-driven treeline movement and invasion of subalpine meadows have been documented across the Northern Hemisphere. Large-scale species distribution models (SDMs) suggest climate change may shift species distributions and reduce biodiversity, but some fine-scale SDMs suggest local high-elevation persistence of species. Furthermore, many SDMs do not incorporate plant regeneration and biophysical parameters important for treeline movement and meadow invasion (i.e. dispersal limitations, micro sites, biotic interactions, and disturbances). This study developed a fine-scale (2 m cell size) model of tree invasion into a subalpine meadow landscape in the Oregon Cascades, simulating historical tree invasion from 1950 to 2007, and future invasion from 2007 to 2064. Climate - tree invasion relationships were modeled from regional climate data and tree invasion reconstructions. Light Detection and Ranging (LiDAR) was used to characterize micro sites, biotic interactions, and historical debris flow disturbances. Future invasion was modeled under six different snowfall scenarios, three levels of snowfall reductions from historical means, and two different levels of forced multiyear extreme high or low snowfall. Simulated historical meadow area declined from 82% to 65%. Models of historical area and spatial distributions of tree invasion only agreed with validation data on undisturbed sites. Meadows declined to 36-43% of the study landscape during the 2007 to 2064 time period. Results suggest subalpine meadows in the Pacific Northwest may be invaded with reduced snowfall, persistent extreme snowfall periods may not influence tree invasion, while unfavorable micro sites and recruitment limitations may result in local persistence of subalpine meadows under climate warming.
Keywords: Subalpine, Meadow invasion, Oregon Cascades, Climate change

192. Russia browning: The 2010 heat wave was not an isolated event
Authors: Wright, Christopher Wright, South Dakota State University; Kirsten de Beurs, University of Oklahoma; Geoffrey Henebry, South Dakota State University
Offered Presentations: Global Change 2 - Tuesday (2011-04-05): 11:00 - 11:20 - Broadway 3
Abstract: Russia's 2010 heat wave caused innumerable wildfires, devastated crops, roiled international grain markets, and provoked a vigorous debate as to whether global warming was to blame. Effects of the 2010 heat wave extended beyond Russia across much of the Eurasian wheat belt (EWB), the â€œbreadbasketâ€ of the former Soviet Union. We used Normalized Difference Vegetation Index (NDVI) image time series derived from the MODIS NBAR product to assess how the 2010 crop failures fit within a wider context of contemporary climatic trends and land use change in the EWB. Over the period 2001-2010, we find that over one-third of the region exhibited highly significant negative trends in NDVI. The 2010 heat wave, though extreme, was not an isolated occurrence but rather the most recent event in a decade-long browning trend, consistent with a global pattern of declining terrestrial primary production over the past decade. Food security models predicting that climate-change effects including CO2 fertilization, warmer winters, and longer growing seasons will allow Russia, Ukraine, and Kazakhstan to substantially increase their future wheat production may be too sanguine; the observed browning trend shows that the region's agro-climatic

potential is in decline. Climate change impacts of the type projected to take place much later in the century may already be occurring in the EWB with important implications for regional and global food security.
Keywords: Eurasian wheat belt, NDVI trends, Climate change, MODIS NBAR

193. Future fire activity in Mediterranean-type ecosystems: assessing uncertainty in projected changes
Authors: Batllori Presas, Enric Batllori Presas, University of California, Berkeley; Meg Krawchuk, University of California, Berkeley; Marc-Andr Parisien, Canadian Forest Service; Max Moritz, University of California, Berkeley
Offered Presentations: Global Change 2 - Tuesday (2011-04-05): 11:20 - 11:40 - Broadway 3
Abstract: Fire in Mediterranean-type ecosystems (MTEs) has served over millennia as a regular ecosystem process, likely contributing to the high biodiversity of such ecosystems and determining landscape structure and functioning. Furthermore, climate-induced changes in fire regimes may be much more important for biodiversity and conservation in MTEs than the direct effects of climatic changes. However, there are yet no convincing results to predict spatial patterns of how -and to what extent- fire occurrence will increase or decrease in the future. We assessed the consistency of predicted future fire activity from 16 climate models for two emission scenarios (A2 and B1) in the five MTEs regions. Such regions are ideally suited to comparative study because, although they are distantly distributed across the globe, they share the same climate but have different evolutionary and land-use history, and different management practices. Spatially explicit models of environmental controls of current and near future fire activity were used to evaluate the level of uncertainty in potential changes in the distribution of fire probability. The results showed large spatial heterogeneity both within and among MTEs, but inter-model agreement highlighted susceptible areas likely to experience important ecosystem changes. Major uncertainty is caused in part by the inherent differences between climate projections, both within and between emission scenarios. Such uncertainty is of significant concern when climate projections are to be used to project future ecosystem changes and plan for sustainable ecosystem management.
Keywords:

194. Using a scenario-modeling approach for understanding landscape change and guiding decision making for biodiversity conservation
Authors: Kolb, Melanie Kolb, CONABIO
Offered Presentations: Global Change 2 - Tuesday (2011-04-05): 11:40 - 12:00 - Broadway 3
Abstract: Land use and cover change (LUCC) determines the persistence of biodiversity on the landscape level and understanding its patterns and processes in space and time is important for taking into account the ever stronger human impacts in systematic conservation planning. LUCC models are considered to be a tool for increasing the understanding of LUCC processes and their consequences. Contrary of using static historical data, simulations under future scenarios of LUCC exploring the potential effects in priority sites for conservation allow for improving the effectiveness of conservation on the long term. In this study, potential refuges for biodiversity from habitat destruction are assessed for the mega-diverse Grijalva-Usumacinta watershed in southern Mexico, part of the Mesoamerican Biological Corridor, with special attention to priority sites for conservation established by the National Commission for the Knowledge and Use of Biodiversity (CONABIO, Mexico). Based on a historical analysis of LUCC, deforestation, forest degradation, establishment of pastureland, natural regeneration and the tendencies of these dominant change processes are simulated with a LUCC model so as to establish the probability of change and persistence of biodiversity. Three different LUCC scenarios for a more sustainable use of natural resources, social and economic development and biodiversity conservation demonstrate the consequences of implementing or not policy options. Detailed vegetation classes in combination with the scenario approach are used to

generate geographic and ecological conservation criteria which allow for adjustments in priority sites for conservation and to influence conservation and land use related policies.
Keywords: Land use and cover change, Modeling, Conservation planning, Biodiversity, Policy options

195. Can mammals keep pace with a changing climate?
Authors: Schloss, Carrie Schloss, University of Washington; Tristan Nunez, University of Washington; Joshua Lawler, University of Washington
Offered Presentations: Conservation Biology 2 - Tuesday (2011-04-05): 09:20 - 09:40 - Broadway 4
Abstract: Recent climatic changes have already caused shifts in the distributions of flora and fauna. Future range shifts are projected to be significantly more extensive. Changes in future species distributions and range sizes depend both on changes in suitable climatic space and on the species' abilities to track these changes in their climatic niches. Here, we assess the differential ability of 493 mammals to keep pace with climatic changes. We used projected-future ranges of 493 mammals generated by existing bioclimatic models to determine future potential-species distributions in the face of climate change. We then limited modeled range-shifts by each species' dispersal ability. The dispersal models incorporated body mass, diet type, and the period of time between successive generations to investigate the potential for species to track changes in their climatic niches. We also used projected changes in average annual temperature to evaluate each species' ability to track projected changes in local temperature. Preliminary results indicate that mammalian dispersal potential severely limits the ability of species to keep pace with changes in local temperature and their climatic niches. Our results also project reductions in the size of many mammalian ranges in the next century. These range reductions largely result from the inability for species to track their climatic niches, rather than a decrease in the availability of suitable climate space.
Keywords: Dispersal, Climate change, Mammals

196. A new future for polar bears
Authors: Marcot, Bruce Marcot, US Forest Service, Pacific Northwest Research Station; Steven Amstrup, Polar Bears International
Offered Presentations: Conservation Biology 2 - Tuesday (2011-04-05): 09:40 - 10:00 - Broadway 4
Abstract: As part of a larger Polar Bear Science Team effort with USDI Geological Survey, analyses were made of historic, current, and future (next century) habitat and populations of polar bears in four ecoregions throughout their global distribution. Habitat carrying capacity was modeled using a simple analytic framework, projecting future capacity as a function of present polar bear crude and ecological densities. Population outcomes were modeled based on potential effects of environmental conditions, prey and foraging habitat availability, and anthropogenic stressors, in a Bayesian network. All future projections were made using minimum, maximum, and ensemble mean values of sea ice conditions summarized from a suite of 10 general circulation models under 4 greenhouse gas (GHG) concentration scenarios. Polar bear populations were projected to decline during the 21st century throughout their range, and severity of decline depended on future ice floe availability. In 2 ecoregions, under the â€œbusiness as usualâ€ GHG scenario, the most likely population outcomes were extirpation within 45-75 years, resulting in overall potential loss of about two-thirds of the world's current polar bear population by mid-century. The main factor accounting for such declines is loss of sea ice habitat. However, under other GHG mitigation scenarios, future declines in sea ice habitat and polar bear populations might not be nearly as severe, and up to a point could be reversible without â€œtipping pointâ€ thresholds otherwise pushing the species to imperiled or extirpated status.
Keywords: Climate change, Polar bears, Bayesian networks, Stressor modeling, Population viability

197. Potential population-level effects of climate change and land-use change on an endangered bird

Authors: Lawler, Joshua Lawler, University of Washington; Betsy Bancroft, Southern Utah University; Nathan Schumaker, US EPA
Offered Presentations: Conservation Biology 2 - Tuesday (2011-04-05): 10:00 - 10:20 - Broadway 4
Abstract: Climate change and land-use change are poised to be two of the largest drivers of ecological change over the next century. We explored the potential effects of these two forces on a population of Red-cockaded Woodpeckers (Picoides borealis) at Fort Benning in Georgia, USA. We used a spatially explicit population-modeling platform, HexSim, to simulate population responses to 1) climate-driven changes habitat availability and reproductive output, 2) the development of additional troop training facilities, and 3) the current age structure and early senescence of pine forests on the base. Climate change, at least in terms of its effects on habitat and one behaviorally mediated aspect of reproduction, had relatively little affect on simulated populations. In contrast, populations showed strong negative responses to increased development on the base and the aging of the pine forests. Our results indicate that alternative development strategies and intensive forest management practices have the potential to off-set the population declines that will likely result from development and forest aging.
Keywords: Population modeling, Landscape change, Birds, Land use, Climate change

198. Estimating and validating connectivity of red-cockaded woodpecker populations in Sandhills ecoregion of North Carolina
Authors: Trainor, Anne Trainor, University of North Carolina; Dean Urban, Duke University; Jeffrey Walters, Virginia Polytechnic Institute and State University; Aaron Moody, University of North Carolina
Offered Presentations: Conservation Biology 2 - Tuesday (2011-04-05): 10:20 - 10:40 - Broadway 4
Abstract: Human activities have drastically altered the configuration of landscape and fragmented once extensive and contiguous and ecosystems, resulting in reduced biodiversity and diminished wildlife populations. Preserving remaining populations requires that individuals can move between habitat patches. Due to the difficulty of obtaining movement data, especially for rare and federally protected species, few studies have evaluated the uncertainties in connectivity estimates or validated connectivity models with independent dispersal data. In contrast, the federally endangered red-cockaded woodpecker (RCW, Picoides borealis) has been extensively monitored for over 30 years, and its demography and dispersal behavior is well documented. However, connectivity has yet to be assessed for RCW. In this study, we estimate connectivity for RCW populations in the North Carolina Sandhills using graph-theoretic approach. The influence of intervening landscape features between territories was assessed by creating resistance surfaces that combined LIDAR-derived forest structure and pre-dispersal prospecting movements. Observed dispersal events were used to validate connectivity estimates and determine which network variables best explained dispersal behavior. Within forest patches, RCW more often dispersed to territories that were effectively closer and had more direct connections to surrounding territories. Minimal connectivity existed between groups surrounded by agriculture or development. Moreover, we found that a drastic transition from highly connected to disconnected populations occurred when dispersal ability was reduced below 50%. These results will help in identifying areas necessary for maintaining RCW habitat connectivity and implementing effective management strategies. Further, our approach provides a basis for evaluating connectivity based on species-specific responses to intervening landscape features.
Keywords: Picoides borealis, LiDAR, Graph theory, Dispersal, Connectivity

199. Habitat overlap for Northern Spotted Owls and Barred Owls in the Eastern Cascades, Washington
Authors: Singleton, Peter Singleton, US Forest Service, Pacific Northwest Research Station
Offered Presentations: Conservation Biology 2 - Tuesday (2011-04-05): 10:40 - 11:00 - Broadway 4
Abstract: Interactions with Barred Owls are widely believed to be contributing to the decline of the Northern Spotted Owl population in Washington. Understanding landscape-scale habitat association

patterns for these two species may contribute to Northern Spotted Owl conservation planning by identifying areas where Spotted Owls are least likely to be impacted by interactions with Barred Owls. I developed provincial-scale habitat suitability maps for Barred Owls and Spotted Owls in the Eastern Cascades of Washington, and compared those maps to evaluate patterns of habitat overlap between the two species. I developed the Barred Owl habitat suitability map using radiotelemetry movement data from 17 Barred Owls collected from 2004 to 2006. I developed the Spotted Owl habitat suitability map by evaluating characteristics at 241 historic Spotted Owl activity centers recorded in the Okanogan-Wenatchee National Forest from 1990 to 2006. I used the same topographic and vegetation characteristics spatial data for both maps. Habitat suitability was highly correlated for the two species, but there were also substantial differences in some areas. Both species were associated with areas that had larger trees and moderate to closed forest canopy, but Spotted Owl habitat suitability was better than Barred Owl habitat suitability in moderately steep, mid-slope areas. I will discuss how this information can be used in on-going population assessments for the two owl species and other conservation planning activities.
Keywords: Wildlife, Spotted owl, Forest management, Modeling, Habitat

200. Can the Giant Panda survive climate change?
Authors: Tuanmu, Mao-Ning Tuanmu, Center for Systems Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University; Andr Vi, Center for Systems Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University; Julie Winkler, Department of Geography, Michigan State University; Zhiyun Ouyang, State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences; Jianguo Liu, Center for Systems Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University
Offered Presentations: Conservation Biology 2 - Tuesday (2011-04-05): 11:00 - 11:20 - Broadway 4
Abstract: Both observations and simulated projections have indicated that global biodiversity has been and will be further threatened by human-induced climate change. Shifts in species' distributional ranges driven by climate change pose a particular challenge to biodiversity conservation. However, information on species' responses to climate change is seldom incorporated into conservation planning. This is true even for a global icon of biodiversity conservation, the giant panda (Ailuropoda melanoleuca) in China. While the decline of habitat quantity and quality due to human activities, a major threat to the giant pandas in the 20th century, has been halted or even reversed because of conservation practices, the potential negative effects of climate change on giant pandas in the 21st century are unclear. Using bioclimatic envelope modeling, we show that the survival of one of the densest and best protected populations of giant pandas may be severely threatened by climate change due to a potentially significant reduction of their food resources (i.e., understory bamboo). An ensemble of different climate models, CO2 emission scenarios and species dispersal scenarios shows that a considerable amount of bamboo on which the giant pandas depend today may disappear by the end of the 21st century. Our results suggest the urgent need for the integration of climate change impact assessments into conservation planning. It is essential to develop and implement adaptive management strategies to cope with these impacts, not only for the conservation of giant pandas but also of many other endangered species.
Keywords: Biodiversity conservation, Climate change, Giant panda, Understory bamboo, Wildlife habitat

201. Altidunal migration in Galapagos Tortoises: The role of landscape heterogeneity and climatic variability
Authors: Yackulic, Charles Yackulic, Princeton University; Stephen Blake, Max Planck Institute of Ornithology; Fredy Cabrera, Charles Darwin Foundation; Anne Guezou, Charles Darwin Foundation; Patricia Jaramillo, Charles Darwin Foundation; Martin Wikelski, Charles Darwin Foundation

Offered Presentations: Conservation Biology 2 - Tuesday (2011-04-05): 11:20 - 11:40 - Broadway 4
Abstract: Climate on Santa Cruz Island is characterized by a cool dry season and a hot wet season. The timing and intensity of these seasons are highly sensitive to the El NiÃ±o-Southern Oscillation. Every year a portion of the Galapagos Tortoises populations on these islands undertake seasonal migration during the cool dry season, traveling from the arid lowlands to upland feeding grounds. Here we present the results of the first two years of a study of migration in two separate populations - one located on the moister side of the mountain, the other in its rain shadow. These differences in average climatic conditions lead to huge differences in the landscape structure in these different portions of the island, affecting the timing and cost of tortoise migrations. In addition, these difference in habitat structure, may lead to different sensitivities of the two populations to interannual variation in climate. Using GPS collar data we show that individuals show remarkable site and route fidelity. We also link differences in the timing of migration to differences between populations and between years in the amount of precipitation received and average temperatures. Population transects support past assertions that migratory behavior is biased to larger individuals, and older males in particular, and indicate radically different distributions of these megaherbivores during the dry and wet seasons. We conclude by discussing the role that the Tortoise migrations play in seed dispersal.
Keywords:

202. Using distribution models to predict fine-scale resource use in a northern temperate rattlesnake
Authors: Spear, Stephen Spear, The Orianne Society; Mark Anderson, University of Wyoming; Doug Keinath, University of Wyoming; Josh Parker, Clayton State University; Charles Peterson, Idaho State University; Lisette Waits, University of Idaho
Offered Presentations: Conservation Biology 2 - Tuesday (2011-04-05): 11:40 - 12:00 - Broadway 4
Abstract: Researchers are increasingly using species distribution models to map the occurrence of a species, identify important environmental variables, or predict how global climate change might shift a species' range. However, the accuracy of model output can vary depending on several factors, and few studies independently validate distribution models. We used occurrence data from the midget faded rattlesnake (Crotalus oreganus concolor) in Wyoming to predict its fine-scale distribution using the maximum entropy modeling approach. Midget faded rattlesnakes require rocky outcrops for denning sites, but also migrate away from the den for foraging and mating. Known denning sites were used to develop a den model and radio-telemetry points from foraging snakes were used to model foraging sites. Model selection based on AIC indicated only two variables predicted denning areas: distance to rock outcrops and temperature range between warmest and coldest months. We conducted field surveys to validate predicted denning areas and found support for the two-variable model chosen by AIC (true skill statistic = 0.7), suggesting that model selection based on AIC is suitable if independent validation data are not available. Thus, we used AIC to determine the best model for predicting foraging habitat without validation data; this model also contained only two variables: distance to rock outcrops and mean temperature during the wettest quarter. Our models demonstrate that a small number of variables can accurately predict the distribution of this species, and suggests how future climate change will shift suitable habitat for both denning and foraging for this snake.
Keywords: Species distribution model, Western rattlesnake, Climate change, Hibernacula

203. Incorporating landscape components into GIS riparian models to identify relative buffer effectiveness in the Albemarle-Pamlico and Cape Fear watersheds
Authors: Christensen, Jay Christensen, US EPA, Office of Research and Development, Landscape Ecology Branch
Offered Presentations: Riparian Landscapes - Tuesday (2011-04-05): 09:20 - 09:40 - Galleria 1
Abstract: Conservation incentive programs encourage the use of riparian buffers to reduce non-point source nutrient pollution but these programs typically do not include a watershed assessment that

could inform managers of current spatial distributions, relative buffer effectiveness, and targeted buffer placement. Previously-developed Geographic Information System (GIS)-based riparian models connect riparian buffers to agriculture at the watershed scale via surface flows but assume equal buffer effectiveness. Landscape position, sub-surface flows, soil properties, and variable agricultural nutrient loads can all influence a buffer's ability to attenuate nitrogen. The Albemarle-Pamlico and Cape Fear watersheds include portions of the Piedmont and Coastal Plain ecoregions and vary in sub-surface flows, soils, and agricultural practices. The objective of this study is to enhance GIS-based riparian models to better identify relative riparian buffer effectiveness for watershed assessments. To this end, we incorporate landscape position, indicators of subsurface flows, soil properties of buffers, and variable agricultural nitrogen sources into a riparian model. Output maps compared with several field studies fit well though a few field sites indicated higher attenuation due to hydric or organic soils that were not present in the soil data layers. Overall, the enhanced GIS-based riparian model produced maps that accounted for spatial variation in buffer effectiveness. Such maps can be used to generally target and inform conservation and management, though field verification or more detailed land cover or soils data would be needed with the siting of specific buffers in incentive programs.
Keywords: Riparian buffers, Targeting, Soils, Nitrogen

204. Projecting riparian vegetation and salmonid habitat responses to alternative land-use and restoration practices
Authors: Wondzell, Steven Wondzell, US Forest Service, Pacific Northwest Research Station; Agnieszka Przeszlowska, US Forest Service, Pacific Northwest Research Station; Miles Hemstrom, US Forest Service, Pacific Northwest Research Station; Peter Bisson, US Forest Service, Pacific Northwest Research Station
Offered Presentations: Riparian Landscapes - Tuesday (2011-04-05): 09:40 - 10:00 - Galleria 1
Abstract: Interactions between land-use and ecosystem change are complex, especially in riparian zones. To date, few models are available to project the influence of alternative land-use practices, natural disturbance and plant succession on the likely future conditions of riparian zones and aquatic habitats across large spatial extents. We utilize a state-and-transition framework to model the effects of various management and restoration practices on conditions of riparian forests, channel morphology, and salmonid habitat. State classes in our models are defined by channel morphology and riparian vegetation. Transitions are defined by plant succession, natural disturbances (hydro-geomorphic, wildfires, native ungulate browsing), management (fuels treatments, timber harvests, livestock grazing) and restoration practices (planting riparian hardwoods, exclusion of domestic livestock and/or native ungulate browsing). Habitat suitability rankings for anadromous salmonids (migration, spawning, winter rearing, summer rearing) are derived from channel and vegetation attributes associated with each state in the models. We present results of model analyses for two watersheds: the upper Middle Fork John Day River and the Wilson River, Oregon. We focus on critical habitat for spawning and rearing of salmon and how habitat quality might be influenced by alternative land-use practices over the next 50 years, especially contrasting the outcomes of passive vs. active restoration strategies.
Keywords: Riparian vegetation, Salmonid habitat, Management, Land-use, State-and-transition model

205. Spatial narratives of the St. Louis River estuary: Deep mapping in estuarine research
Authors: Smith, Vincent Smith, UW-Madison; Janet Silbernagel, UW-Madison
Offered Presentations: Riparian Landscapes - Tuesday (2011-04-05): 10:00 - 10:20 - Galleria 1
Abstract: The St. Louis River Estuary, a recently designated National Estuarine Research Reserve, is a complex mosaic of high quality aquatic habitat intermingled with areas of heavy industrial use, contaminated sediments, and effluents from the surrounding urban landscape. The estuary is Lake Superior's largest tributary and home to the Duluth-Superior international seaport. The NOAA Sea

Grant Program plays a significant role in promoting education, outreach and stewardship in Great Lakes coastal communities and environments. Geospatial thinking can enhance Sea Grant's objectives, yet few tools exist to foster such an approach on a regional scale. We illustrate the use of spatial narratives and deep maps as socially and spatially rich tools for meeting these objectives through a joint Wisconsin/Minnesota Sea Grant project. Our research connects aquatic science research on human-based stressor gradients in the watershed with spatially explicit vignettes of local resource issues and place-based games around those local issues to enhance spatial awareness and stewardship of the estuary. We will discuss our work in integrating two seasons of local informant interviews with stressor gradient data to develop â€œdeep mapsâ€ for the estuary, and demonstrate how spatial narratives and deep maps feed into design of innovative place-based learning, including â€œgeo-questsâ€ and ship-based tours. We will conclude by arguing that spatial narratives are valid tools to capture social and spatial complexity of place for research, literacy and stewardship.
Keywords: St. Louis river estuary, Deep map, Stewardship, Spatial narrative, Stressor gradient

206. Associations among watersheds, water chemistry, and fish assemblages in West Virginia streams
Authors: McManus, Michael McManus, U.S. EPA National Center for Environmental Assessment; Michael Griffith, U.S. EPA National Center for Environmental Assessment; Louis Reynolds, U.S. EPA Region 3
Offered Presentations: Riparian Landscapes - Tuesday (2011-04-05): 10:20 - 10:40 - Galleria 1
Abstract: We tested whether land cover patterns in watersheds in West Virginia (WV) were associated with the ionic concentrations and conductivity of waters at monitoring sites at the outlets of those watersheds and if that land cover pattern was associated with fish assemblage composition at those sites. By intersecting shapefiles of urban areas (UA), surface mining permit polygons (SMPP), and the WV stream network, watersheds were classified into four types: 1) streams intersecting neither SMPP nor UA (n = 44), 2) streams intersecting only UA (n = 7), 3) streams intersecting only SMPP (n = 27), and 4) streams intersecting both SMPP and UA (n = 17). Given the known effects of UA on streams, we focused on comparing water chemistry of sites from watersheds with streams intersecting neither SMPP nor UA to those of sites from watersheds having streams only intersecting SMPP using a stratified multiple response permutation procedure (MRPP). Watersheds were stratified into small, medium, and large size classes. The stratified MRPP analysis indicated the two watershed types were significantly different in ionic concentrations and conductivity, and parallel coordinate plots showed that sites from watersheds with streams intersecting SMPP tended to have calcium concentrations, sulfate concentrations and conductivities higher than the other sites. A similar analysis on fish community composition showed that the two watershed types differed only in the medium watershed class (73-115 km2). Our findings detected ionic concentrations and conductivity differences associated with surface mining at a larger spatial extent than found in previous studies.
Keywords: Water quality, Multivariate, Spatial, Analysis

207. Is the past present? Historical splash-dam mapping and stream disturbance detection in the Oregon Coastal Province
Authors: Miller, Rebecca Miller, Fisheries and Wildlife Department Oregon State University; Kelly Burnett, US Forest Service, Pacific Northwest Research Station
Offered Presentations: Riparian Landscapes - Tuesday (2011-04-05): 10:40 - 11:00 - Galleria 1
Abstract: Splash damming was a common method of log transport in the Oregon coast range from the 1880s through 1950s. Splash dams created an upstream reservoir in which water and logs were stored before being released in large freshets to downstream lumber mills. Much historical anecdotal evidence and recent literature suggest that these practices heavily scoured streams and left behind

little in-channel complexity. However, such â€œrural legendsâ€ have not been quantitatively confirmed at a regional scale nor have the locations of splash dams been comprehensively mapped. In this study, all known splash dam sites were included in a geo-database and mapped in GIS at the 1:24,000 scale. Splash dam sites were located through intense literature, museum and field searches, and interviews. The GIS map was overlaid with available continuous and probabilistic stream surveys to compare habitat characteristics upstream and downstream of splashed dams and between splashed and non-splashed basins. Only dam sites in sedimentary rock types were analyzed. Areas below splash dams had more bedrock but less cobble and key large wood than areas above splashed dams. Likewise, streams in splashed basins contained more bedrock but less key large wood and fewer deep pools than streams in non-splashed basins. Basin area and gradient were similar between streams in splashed and non-splashed basins. This study demonstrates that activities taking place 50-130 years ago may still affect stream characteristics and the importance of including archival information in modern-day studies.
Keywords: Historical ecology, Environmental legacy, Splash dam, Log drive, Oregon Coastal Province

208. Predicted effects of climate change on the distribution of invasive threats to amphibians in north-central Idaho
Authors: Goldberg, Caren Goldberg, University of Idaho; Erica Bree Rosenblum, University of Idaho; Dan Davis, U.S. Forest Service; William Bosworth, Idaho Fish and Game; Lisette Waits, University of Idaho
Offered Presentations: Riparian Landscapes - Tuesday (2011-04-05): 11:20 - 11:40 - Galleria 1
Abstract: Disease is a leading causative factor in global amphibian population declines. The newly-emerged amphibian chytrid fungus, Batrachochytrium dendrobatidis (Bd), is now the largest infectious disease threat to global biodiversity, with 92.5% of amphibians listed as critically endangered undergoing “enigmatic” declines likely linked to this pathogen. The American Bullfrog (Lithobates catesbeianus) is a carrier of this pathogen as well as an invasive species throughout the western United States, where it outcompetes and preys on native amphibians. Both of these invasive species have been documented in warmer areas of north-central Idaho, but physiological limitations are likely to preclude them from colder sites under current climate conditions. To assess threats and locate potential sources of invasion for both species into the colder regions of this area, we documented their presence through field surveys and quantitative PCR testing (for Bd), modeled the regional ecological niche for each using MaxEnt, and predicted their distribution under two emissions scenarios realized using 10 downscaled climate models. We found that Bd presence was associated with areas of higher minimum winter temperatures and bullfrog distribution was associated with areas of higher minimum winter and summer temperatures, as predicted by physiological limitations. Both species were associated with areas of higher winter precipitation, which may indicate greater persistence of wetlands through the summer season. Under these climate warming scenarios, both invasive species are predicted to expand their range, increasing threats to native amphibian species and populations in this area.
Keywords: Invasive species, Amphibian, Disease, Bullfrog, Climate change

209. Modeling and mapping hydrologic thresholds for plant and soil properties along the Upper Mississippi River Floodplain, USA.
Authors: De Jager, Nathan De Jager, USGS; Yao Yin, USGS; John Nelson, USGS
Offered Presentations: Riparian Landscapes - Tuesday (2011-04-05): 11:40 - 12:00 - Galleria 1
Abstract: Fluvial-geomorphic processes create a stunning diversity of landforms, soil types, and community compositions along large floodplain rivers. Yet it is often difficult to quantify how various plant and soil properties relate to specific flood durations, or determine how such flood durations are distributed across large floodplain landscapes. In this study, we examined relationships between the

average number of days (per growing season) that sites along the Upper Mississippi River were flooded over the past 30-years and current soil texture and overstory tree community composition. The full range of tree community compositions and soil textures were found at sites that were inundated for less than ca. 68 days. Beyond this threshold, soil texture was almost exclusively silt and clay (>70%) and the overstory tree community was dominated by a single species, Acer saccharinum. These results suggest that long periods of inundation (>68 days) correspond with distinct patches of plant and soil properties, but that other factors in addition to flooding control plant and soil properties in areas with shorter durations. We then modeled and mapped the probability that any given floodplain elevation will be flooded for > 68 days of the growing season by linking high resolution elevation data (LIDAR) with historic USGS gauge data for the Upper Mississippi River. We then used this modeling framework to examine changes to landscape patterns of plant and soil properties under various hydrologic regimes.
Keywords: Floodplain landscape, Plant community composition, Soil texture, Flood inundation, Hydrology

210. Fine-grain analyses of landscape controls on average forest phenology for mid-Atlantic forests
Authors: Elmore, Andrew Elmore, University of Maryland Center for Environmental Science; Steven Guinn, University of Maryland Center for Environmental Science
Offered Presentations: Remote Sensing - Tuesday (2011-04-05): 09:40 - 10:00 - Galleria 3
Abstract: The timing of spring green up, trajectories of summer leaf area and photosynthesis, and the timing of fall senescence have profound impacts to the water, carbon, and energy balance of ecosystems, and are expected to be influenced by global warming. Although landscape patterns of forest phenology are routinely investigated at the scale of entire continents, such analyses miss fine-grain variation that could be important for predicting the impact of climate and land-use changes. Here we present results from a new method for deriving average forest phenological parameters at a grain-size of 30m. We use inverse modeling to fit duel sigmoid logistic curves, connected by a sloped line, and validate these model fits against independent observations from air photography. We found that for mid-Atlantic forests, elevation, distance to tidal water, distance to impervious surface, and latitude all influence forest phenology. However, in most cases residual variance is high, suggesting the large role of tree species have in determining phenology. We also quantify trends in summer greenness, and show that for most forest stands, greenness begins declining shortly after full leaf out, pre-dating leaf senesces and abscission by several months. These, fine-grained spatial patterns in summer green down suggest the role of aspect and drainage (e.g. soil moisture) in determining the ability of forests trees to maintain photosynthesis throughout the summer. These observations have profound implications for predicting how spatial patterns of forest phenology and productivity might change with global climate and land-use changes.
Keywords: Forest Ecology, Phenology, Remote sensing

211. Remote sensing of aboveground woody biomass resources in the Western Chitwan Valley, Nepal
Authors: Zvoleff, Alex Zvoleff, San Diego State University; Li An, San Diego State University
Offered Presentations: Remote Sensing - Tuesday (2011-04-05): 10:00 - 10:20 - Galleria 3
Abstract: The Western Chitwan Valley, in southern Nepal, offers an ideal setting for studying linkages between population and environment. The valley is a rapidly developing agricultural area bordering a national park and its buffer zone that provides habitat for several endangered species as well as ecosystem services (such as fuelwood) that support the population. Concerns regarding the close proximity of the population to the national park, and local need for forest resources, led to the establishment in 1996 of a community managed buffer zone surrounding the park. In spring 2010, we conducted a survey of 58 sample plots (20 m x 20 m) to examine spatial patterns in both live aboveground woody forest biomass and woody detritus on the forest floor. To enable a broader scale

mapping of woody biomass, we compare two approaches to recovery of aboveground woody biomass from concurrently captured IKONOS-2 imagery: a multiple regression approach and a neural network approach. Our field survey found an almost complete absence in the buffer zone of coarse woody detritus (likely due to domestic use of fallen woody materials). Drawing on existing demographic data from the long-term longitudinal Chitwan Valley Family Study, and an additional survey of 80 households we conducted in fall 2009, we explore linkages between biomass collection and aboveground live woody biomass. We also discuss the potential for scaling up the most predictive of our IKONOS (4 m spatial resolution) derived approaches for application to multi-temporal Landsat imagery (30 m spatial resolution).
Keywords: Biomass, Modeling, Nepal, Fuelwood, Remote sensing

212. Comparison of ASTER-derived vegetation indices and surface temperature in detecting forest successions
Authors: Mondal, Pinki Mondal, University of Florida; Jane Southworth, University of Florida; Tim Fik, University of Florida
Offered Presentations: Remote Sensing - Tuesday (2011-04-05): 10:20 - 10:40 - Galleria 3
Abstract: Successional forests differ in their average height and basal area, the stand volume and basal density, and physiognomic characteristics. Quantification of specific forest parameters is important to better understand the impact of different successional stages on ecosystem changes, specifically water and nutrient cycling and carbon sequestration. The first step to this quantification would need detailed mapping of different successional stages. Several remote sensing indices, such as the tasseled cap indices, primarily developed for Landsat sensors, have been widely used for mapping and monitoring subtle changes in vegetation condition. However, successional differences are more likely to correlate with canopy geometry, and surface temperature theoretically holds more potential to effectively detect forest successions. While moderate resolution satellite images, such as those from Landsat, have been successfully used for such mapping purposes, technical issues related to longevity and quality of Landsat sensors warrant for assessment of alternate moderate resolution satellite images. Although ASTER has comparable spatial, spectral and temporal resolutions making it an effective replacement for Landsat, few studies report the capability of ASTER-derived vegetation indices or thermal indices in detecting tropical forest successions. This study compares ASTER-derived vegetation indices, and surface temperature in detecting tropical forest successions. Specifically, this study seeks to identify the degree of association of the remote sensing indices to different forest successions derived from historical land cover maps.
Keywords: Remote sensing, Forest succession, Vegetation structure, Tropical forest

213. High resolution change mapping where it counts with 1-m NAIP data in Puget Sound
Authors: Pierce, Kenneth Pierce, Wa. Dept. Fish & Wildlife; Kirk Krueger, Wa. Dept. Fish & Wildlife; Timothy Quinn, Wa. Dept. Fish & Wildlife; David Price, Wa. Dept. Fish & Wildlife
Offered Presentations: Remote Sensing - Tuesday (2011-04-05): 10:40 - 11:00 - Galleria 3
Abstract: Managers often assume that monitoring land-cover change is sufficiently precise to inform most policy relevant issues. However, questions such as â€œwhere is the urban fringe fragmenting?â€□ or â€œare wetland and riparian protection zones being developed?â€□ are too fine-grained to be answered using 30-m Landsat-based change detection. We explored the use of recently acquired 1-m NAIP data to detect fine-scale changes between 2006 and 2009. Because 1-m data is too locally-heterogeneous to perform pixel-based change detection, we used image segmentation followed by classification to map locations of major vegetative loss. While broader-scale change mapping primarily finds forest clearing and major developments, a large portion of our changes involved single housing lots. We used common sources of error (e.g., shadows) to improve change detection. Using a new software system to rapidly sample and review segment locations, we eliminated commission error by reviewing all segments predicted to be change. We then sampled

roughly 3-5% of the non-change polygons to estimate our omission error. For example, in our largest study area of about 1.2 million acres (4,900 km2), we verified and mapped 2,803 locations as change out of roughly 500,000 polygons. The total area for those locations was 10,100 acres. Of the 3,836 polygons we sampled for omission errors, we found 29 errors, which covered 0.4% of the sampled area. From this we estimated unmapped change to be about 4,848 acres. The analysis for this region took about 6 weeks for a single analyst.
Keywords: Change detection, Puget Sound, NAIP imagery, eCognition, Natural resource management

214. LiDAR intensity for mapping landscape heterogeneity of urbanizing environment
Authors: Singh, Kunwar Singh, University of North Carolina at Charlotte; John Vogler, University of North Carolina at Charlotte; Ross Meentemeyer, University of North Carolina at Charlotte
Offered Presentations: Remote Sensing - Tuesday (2011-04-05): 11:00 - 11:20 - Galleria 3
Abstract: Spatially heterogeneous patterns of land use in urban environments have long posed a challenge to remote sensing. Due to its height-above-ground component, which is unaffected by shadows, Light Detection and Ranging (LiDAR) data are increasingly being used as an alternative to passive sensors. However, LiDAR's intensity component is infrequently utilized in urban studies presumably because its range of digital number values, similar between urban impervious and tree canopy covers. Previous investigations have concentrated on mapping either tree canopy or buildings using local-scale normalization procedures but the use of normalized intensity to map multiple land-use types in a heterogeneous urban landscape at a regional-scale has received little attention. Our approach uniquely utilizes normalized intensity data in combination with structural components derived from LiDAR data using maximum likelihood estimation of land-use classes along urban-rural gradients in the rapidly urbanizing region of Charlotte, NC. To create normalized intensity of LiDAR for regional-scale analyses, we normalized distance between object and sensor to a user-defined standard range of 1000m. ML classification of integrated LiDAR intensity with structural components showed an overall accuracy of 96.7% with a Kappa coefficient of 0.95. Producer's accuracies for urban tree canopy, impervious surfaces, and managed-clearings were found 92.98%, 96.42% and 100%, respectively, which show that our approach accurately distinguishes impervious surfaces and tree canopy over broad metropolitan contexts. In summary, we found that normalized intensity integrated with surface models significantly improves discrimination between urban impervious and tree canopy covers over large regions improving our ability to map heterogeneous urban landscapes.
Keywords: LiDAR data, Intensity, Normalization, High resolution, Urban and landscape heterogeneity

215. Evaluating habitat suitability and change along the Northeastern Appalachian Trail using remote sensing and in situ observations
Authors: Clark, John Clark, Department of Natural Resources Science, University of Rhode Island; Y.Q. Wang, Department of Natural Resources Science, University of Rhode Island; Peter August, Department of Natural Resources Science, University of Rhode Island; Roland Duhaime, Department of Natural Resources Science, University of Rhode Island; Peter Paton, Department of Natural Resources Science, University of Rhode Island
Offered Presentations: Remote Sensing - Tuesday (2011-04-05): 11:20 - 11:40 - Galleria 3
Abstract: The Appalachian National Scenic Trail (A.T.) spans more than 2,175 miles from Georgia to Maine and incorporates 250,000 acres of protected lands. The A.T. provides a unique cross-section of the Eastern United States, facilitating the examination of a full gradient of forest and alpine ecosystems and the surrounding landscape. Of particular importance, the A.T. serves as a migratory corridor for numerous rare and endangered mountain and migratory breeding birds. The high elevation setting of the A.T. provides an ideal barometer for the early detection of undesirable trends driven by climate change, human encroachment, or invasive species. This presentation will report a study evaluating habitat suitability and change along the Northeastern states of the A.T. using remote

sensing data and products from the Terrestrial Observation and Prediction System (TOPS) and in situ data collected from 38 monitoring plots established along the A.T. in Vermont, New Hampshire and Maine. Key datasets include high resolution National Elevation Data, vegetative indices, land cover type, and phenology. We integrated the in situ measurements with the TOPS datasets to evaluate the suitability of conditions along the trail for selected indicator bird species. The resulting mosaics are used to detect trends in the composition and configuration of habitat throughout the northern A.T. corridor by examining the total area, proximity to urban areas, and connectivity of key habitat over time.
Keywords: Habitat, Suitability, Migratory, Configuration, Composition

216. 3D modelling bird habitat resources in Great Western woodlands, southwestern Australia using multiple satellite-borne datasets
Authors: Lee, Peter Lee, Australian National University; Brendan Mackey, Australian National University; Chris McElhinny, Australian National University; Sandra Berry, Australian National University
Offered Presentations: Remote Sensing - Tuesday (2011-04-05): 11:40 - 12:00 - Galleria 3
Abstract: Great Western Woodlands (GWW, around 16 million ha) is a critical habitat supporting approximately 200 bird species in semi-arid southwestern Australia. However, the abundance of the birds is decreasing due to the decline in woodland habitats. This study aimed at (1) investigating the relationship between vegetation structure and woodland bird habitat resources and (2) predicting potential bird habitat resources using satellite-borne data. Based on vegetation structure-related habitat resources collected from published literature, bird habitat functional groups were classified. Datasets from four satellite-borne sensors including MODIS, ASTER, PALSAR and GLAS were used in mapping four structural variables: (1) NDVI using ASTER imagery; (2) foliage density using MODIS imagery; (3) understorey vertical layering using ASTER imagery; (4) vegetation volume using PALSAR imagery; and (5) vegetation height using GLAS data. Spatial variations of foliage density and understorey layering showed strong relationships with MODIS and ASTER data, and models developed for estimating vegetation volume and height were highly correlated with PALSAR and GLAS data. These five thematic layers were combined to generate a comprehensive system to predict potential bird habitat resources of GWW bird species. A combined final model was considered to be useful in predicting bird habitat resources and then managing habitat resources-based functional groups in the GWW region.
Keywords: Vegetation structure, GIS modeling, Remote sensing, Bird habitat resources

217. Sustainable transition, resiliency, and landscape icons: The debate about what to plant for enhancing landscape sustainability
Authors: Musacchio, Laura Musacchio, University of Minnesota
Offered Presentations: Sustainable Management - Tuesday (2011-04-05): 09:20 - 09:40 - Parlor BC
Abstract: Landscape icons include plant species that have cultural saliency as images of nature and metaphors for a region's cultural identity and contribute to its distinctive sense of place. For example in the Corn Belt, corn (Zea mays L. subsp. mays Rydb.) is one of the most visible and recognizable landscape icons, but it has recently become more controversial in the news media, scientific circles, and the public's mind for a number of reasons, and this conflict represents shifting environmental attitudes, perceptions, and values in the region as well as the nation. This presentation will examine this complex issue about a complex regional system: how and why particular plant species, which represent shifting landscape icons in the American Corn Belt, are at the center of the debate about which plants are most suitable for cultivation across the region for the goal of transitioning toward a higher level of environmental security and landscape sustainability. This debate centers around two groups with strong farming traditions: (1) farmers who have federal policy and global market incentives to plant just two speciesâ€" corn and soybeanâ€"as the dominants in their fields and (2)

the emergence of local food advocates (e.g., local foodies, permaculturalists, and seed savers) who emphasize the planting of a broad range of heirloom and local species in community gardens, yards, and small farms. In addition, I will discuss why this debate about what to plant represents dualistic forces of increased interconnectedness and radicalization across scales and cultures.
Keywords: Landscape icons, Plant species, Culture and nature interactions, Environmental attitudes, beliefs, and perceptions, Landscape sustainability

218. Development of the New Zealand Land-use Database: using semantic approaches to promote more flexible, adaptable, and enduring methods for land use characterisation and classification
Authors: Rutledge, Daniel Rutledge, Manaaki Whenua Landcare Research NZ Ltd; Robbie Price, Manaaki Whenua Landcare Research NZ Ltd; Fraser Morgan, Manaaki Whenua Landcare Research NZ Ltd; Reece Hill, Environment Waikato; Jeromy Cuff, Environment Canterbury
Offered Presentations: Sustainable Management - Tuesday (2011-04-05): 09:40 - 10:00 - Parlor BC
Abstract: Robust, rich, and enduring information on land use is an essential ingredient underpinning the sustainable management of dynamic landscapes. Much effort is expended on the process of land use classification, usually with the same result: the resulting classification is useful for its intended purpose but is inadequate for many other purposes or is quickly superseded by the â€œlatest and greatest,â€ creating significant issues for landscape change analysis. Most vexing of all, the processes used to generate a classification are usually lost or at least difficult to access and recreate, which violates a key tenet of the scientific process. Overcoming those limitations requires new approaches that can draw upon varied sources of information for land-use characterisation and provides frameworks that support generation of and comparison among different land-use classifications and, most importantly, retain the knowledge for generating those classifications. We are applying those new approaches to the development of the New Zealand Land Use Database (LUDB) in collaboration with the Regional Council Land Monitoring Forum, which is a group of land management scientists representing the 16 regional councils and unitary authorities across New Zealand. The LUDB seeks to overcome the problems identified above and develop a common, publically accessible database to which one can contribute information and data on land use, develop rules and procedures to generate purpose-built land-use classifications, and produce various geospatial land-use information outputs to support a variety of policy development, planning, resource management, and reporting needs.
Keywords: Land use, Classification, New Zealand

219. Governance of coupled human and natural systems: The role of social capital
Authors: Yang, Wu Yang, Michigan State University; Wei Liu, Michigan State University; Andr Vi, Michigan State University; Guangming He, Michigan State University; Jianguo Liu, Michigan State University
Offered Presentations: Sustainable Management - Tuesday (2011-04-05): 10:00 - 10:20 - Parlor BC
Abstract: Many previous environmental governance efforts failed because they treated human and natural systems as separate components rather than as coupled human and natural systems (CHANS). The separation neglected human-nature interactions such as effects of social capital on environmental governance. To understand the role of social capital in the governance of CHANS, we selected the implementation of Natural Forest Conservation Program (NFCP) in China's Wolong Nature Reserve (WNR) for giant pandas as our study landscape. The NFCP aims to protect and restore natural forests through means such as logging bans. WNR was established in 1975 with a current size of 200,000 ha, and 4,900 local residents in 1,200 households. In 2001, approximately 40,000-ha forest was assigned to ca.1,100 households for monitoring (with payment) to prevent illegal logging. Of which, 9,000-ha forests have been monitored by unbundled households (one household monitors a forest parcel), while 31,000-ha forests have been monitored by bundled households (two or more households monitor a parcel). By integrating various factors that can affect

forest cover, we developed statistical models to detect the causes behind the rates of change in forest cover from 2001 to 2007. Our results suggest that the bundled approach has achieved a significantly higher forest recovery rate than the unbundled approach. The role of social capital displays because logging in bundled-monitoring parcels would be at higher risks of being caught and deteriorating social relationships with more households than in unbundled-monitoring parcels. Our findings may also provide insights to achieve ecological sustainability in many other landscapes.
Keywords: CHANS, Conservation policy, Social capital, Sustainable management, Wolong Nature Reserve

220. Landscape ecological approaches applied to forest management in South Patagonia
Authors: Soler Esteban, Rosina Soler Esteban, CADIC-CONICET; Guillermo Martinez Pastur, CADIC-CONICET; Maria Vanessa Lencinas, CADIC-CONICET
Offered Presentations: Sustainable Management - Tuesday (2011-04-05): 10:20 - 10:40 - Parlor BC
Abstract: Productive human activities (e.g., harvesting and livestock) produce environmental changes, increasing the heterogeneity at the landscape level. This modifies biological and ecological processes. To attain sustainable forest management it was requires knowledge of key aspects of these processes. Our work aims to understand the changes that occur at the landscape scale due to logging and cattle grazing in Nothofagus forests at southern Patagonia. During the last 3 years we studied flowering and seeding patterns, natural regeneration and understory dynamics, in primary forests, harvested and silvopastoral stands of Nothofagus antarctica (Ã±ire) and N. pumilio (lenga). Since 2008 we used traps to collect flowers and seeds, monitor regeneration permanent plots and understory transects. Also, we made indirect estimation of landscape uses by native (Lama guanicoe) and domestic herbivores (cattle and sheep) through the study of diet composition. Flowering and seeding was influenced by management and years, but also by their landscape distribution. Recruitment was influenced by seed availability, but also for the management and the micro-environments inside the stand. Only the unmanaged stands showed exclusive native species in the understory, and silvicultural practices increased coverage and richness of exotic species (potential competition with seedlings of Nothofagus). However, some practices (e.g., aggregate retention) remain part of the heterogeneity of unmanaged stands, including the diversity of understory plant species. Finally, native and domestic herbivorous alternate the uses of different environments. Native species preferred N. pumilio forests, except in winter, where domestic species had major predominance. These ecological studies improve forest management aimed at conservation.
Keywords: Forest management, Heterogeneity, Natural regeneration, Herbivory, Nothofagus

221. Spatial and temporal scaling of beta diversity in grazed temperate grasslands
Authors: Goslee, Sarah Goslee, USDA-ARS
Offered Presentations: Sustainable Management - Tuesday (2011-04-05): 10:40 - 11:00 - Parlor BC
Abstract: Grazed grasslands contribute greatly to the economy and environment of the northeastern United States, though their ecology has not been extensively studied. Plant community composition was sampled in five to seven fields in each of five grazing farms: two in New York, two in Pennsylvania, and one in Maryland. A modified Whittaker plot permanently located in each field was sampled three times per year for three years, with 224 plant species identified. This sampling scheme offers multiple hierarchical spatial scales for examining beta diversity: within-field, within-farm, within-state, and overall. Few studies of beta diversity explicitly incorporate changes over time; we have both year and season of sampling as hierarchical temporal variables. Permutation-based tests of the multivariate homogeneity of group dispersions were used to compare the variance of both presence- and abundance-based dissimilarity metrics at each of these spatial and temporal scales. Within-farm beta diversity varied significantly by state and by season. Abundance-based dissimilarities were more sensitive than frequency-based dissimilarities. Grazing management tends to favor certain species, ensuring that the dominants are similar across farms, while subordinate species composition is more

variable. Managed systems such as these grazed temperate pastures offer a valuable context for studying patterns of plant diversity and composition: within this region they comprise a known set of species with similar management regimes. Improved understanding of diversity may translate directly into improved management for ecosystem services that provide food, fuel, and indirect services.
Keywords: Agroecosystems, Beta diversity, Plant community, Spatial scaling, Temporal scaling

222. An environmental assessment of United States drinking water watersheds
Authors: Wickham, James Wickham, US EPA; Timothy Wade, US EPA; Kurt Riitters, US Forest Service
Offered Presentations: Sustainable Management - Tuesday (2011-04-05): 11:20 - 11:40 - Parlor BC
Abstract: Recent assessments have shown that natural lands and their conservation are important elements of a sustainable drinking water infrastructure. We conducted a watershed-level environmental assessment of the 5,265 surface drinking water watersheds in the conterminous United States using data on land cover, hydrography and conservation status. The watersheds were defined by the spatial location of the surface drinking water intakes. We found that U.S. drinking water watersheds: 1) covered approximately 78% of the conterminous U.S.; 2) tended to have a high proportion of natural vegetation (median = 77%); 3) only a small proportion of natural lands were set aside for conservation (median = 3%); 4) land-cover compositions tended to be temporally dynamic, and; 5) urbanization was often an important component of land-cover change. These patterns suggest that the status of source water protection will change as a result of inevitable changes in natural vegetation and that the rate of urbanization will likely outpace the rate of new lands set aside in conservation.
Keywords: Conservation, Land cover change, Land use, Sustainability

223. Predicting the effect of underwater noise from offshore wind turbines on the marine environment
Authors: Vigness-Raposa, Kathleen Vigness-Raposa, Marine Acoustics, Inc.; James Miller, University of Rhode Island; Robert Kenney, University of Rhode Island; Gopu Potty, University of Rhode Island; David Casagrande, University of Rhode Island; Lisa Miller, University of Rhode Island; Jeffrey Nystuen, University of Washington; Peter Scheifele, University of Cincinnati Medical Center
Offered Presentations: Sustainable Management - Tuesday (2011-04-05): 11:40 - 12:00 - Parlor BC
Abstract: Ecosystem-based management and marine spatial planning are gaining traction as effective techniques for balancing ecosystem services and protected resources. Rhode Island has adopted the nation's first Ocean Special Area Management Plan that considers the many uses of state waters, including potential development of offshore renewable energy. As part of the planning process that informed decision making, we predicted underwater construction noise from pile driving and operational noise radiated from wind turbines being considered in an area south of Rhode Island. We also mapped the spatial and temporal distributions and relative abundances of marine mammals and sea turtles in the region. Survey effort was quantified and sighting frequencies were corrected for differences in effort, producing an index termed sightings-per-unit-effort (SPUE). The SPUE data were analyzed using the kriging function in Geostatistical Analyst ArcGIS 9.2 to produce interpolated GIS maps of seasonal relative densities, contoured in deciles, for all of the species with sufficient sightings during surveys. Contours of sound received levels corresponding to 180 dB, 160 dB, and 120 dB re 1 ÂµPa were also constructed and mapped into a GIS layer. These received levels correspond to the Zone of Responsiveness for cetaceans and pinnipeds, and the Zone of Masking for all species, respectively. Intersecting the predicted underwater noise field with the seasonal relative abundance of marine species can inform decision makers of regions with spatial and temporal ecological sensitivities and identify those regions most suitable for human uses.
Keywords: Marine spatial planning, Geospatial analyses, Environmental effects

224. Identifying the spatial structure of the regeneration niche: A multi-scale, hierarchical approach using desert tree species
Authors: Karam, Sarah Karam, University of Nevada
Offered Presentations: Landscape Change - Tuesday (2011-04-05): 09:20 - 09:40 - Council Suite
Abstract: Seedling establishment is the crucial demographic process influencing the spatial distribution of trees in arid landscapes. At Ash Meadows National Wildlife Refuge, gradients in water availability and soil salinity correspond to gradients in tree community composition, with Fraxinus velutina on wetter sites, Prosopis pubescens on intermediate sites, and P. glandulosa on drier sites. We performed a hierarchical series of greenhouse and field experiments across landscape-scale water stress gradients to determine the effects of water stress and biotic interactions on seedling establishment. The greenhouse experiment isolated a significant negative effect of soil salinity on F. velutina survival and a significant bimodal effect of the salinity x water availability interaction on growth. Both Prosopis species had a significant unimodal interaction effect on survival and a significant negative effect of water availability on growth. Effects were not concordant with the species distributions on the landscape, so the field experiment additionally considered plant community interactions using vegetation removal treatments. Presence of vegetation generally decreased soil water content early and increased it later in the growing season, showing potential competition and facilitation. Vegetation showed a net negative effect on F. velutina seedling survival and growth and a net positive effect on seedling emergence, with a significant interaction of position along the water stress gradients. Results will be used to model how changes in groundwater availability and soil salinity due to climate change and groundwater pumping will result in changes in population dynamics and the spatial distribution of desert tree species.
Keywords: water stress, salinity, ecological gradients, plant-plant interactions, desert springs

225. Investigations of land use legacies on hydrologic processes and vegetation community distribution in Canaan Valley, WV
Authors: Young, John Young, USGS Leetown Science Center; Danny Welsh, Canaan Valley Institute; Sarah Deacon, Canaan Valley Institute; Ken Sturm, Canaan Valley National Wildlife Refuge
Offered Presentations: Landscape Change - Tuesday (2011-04-05): 09:40 - 10:00 - Council Suite
Abstract: Historical antecedents often dictate the state and direction of landscape evolution. In much of the eastern U.S., logging operations completely removed the original forest cover prior to the end of the nineteenth century. In some cases, recovering ecosystems were set on different ecological trajectories due to altered hydrologic, edaphic, and microclimatic conditions. In addition, legacies of past human alterations to the landscape continue to influence current conditions. We are conducting a study of the relationship between historical land alteration and current hydrologic and vegetation community composition in Canaan Valley National Wildlife Refuge, West Virginia. Indications are that this area was once a wet eastern hemlock and red spruce forest but was stripped of its forest cover and repeatedly burned prior to 1920. Although the vegetation on the valley floor has recovered and now represents one of the most extensive wetland complexes in the eastern U.S. with diverse (and some rare) taxa, the ecosystem now is primarily one of wet meadows, bogs, marshes, and shrub habitats. An historic railroad embankment bisects the refuge and is suspected to have continuing influences on hydrologic processes and vegetation community patterns. We are using a combination of hydrologic field studies, detailed mapping with LiDAR and close-range aerial photography, and spatial modeling to investigate the relationship between past land uses and current patterns of ecosystem elements. The results of this study will assist the U.S. Fish and Wildlife Service in designing management strategies to mitigate impacts of past land uses on wetland communities.
Keywords: Wetlands, Historic land use, Hydrology, LiDAR

226. Planning for sea level rise in coastal Georgia: How grain size affects forecasted impacts on development and conservation areas

Authors: Hardy, R. Dean Hardy, River Basin Center, University of Georgia; Timothy Carter, Center for Urban Ecology, Butler University
Offered Presentations: Landscape Change - Tuesday (2011-04-05): 11:20 - 11:40 - Council Suite
Abstract: Global climate change models forecast significant acceleration of sea level rise for coastal regions in temperate latitudes, which is further intensified for Georgia by the presence of a low gradient coastal shelf. Georgia has an extensive salt marsh ecosystem comprising nearly one third of that found along the Atlantic Coast and is considered relatively undeveloped compared with other states in the east. Conservation managers, policy-makers, and planners are all dependent upon model forecasts for informing critical decisions that will ultimately affect the availability of sites for future development as well as natural habitats for species. We selected two sites in the fastest growing county in Georgia (Glynn County, which has grown over 20% in the past decade) that have fragile salt marsh ecosystems, which are highly vulnerable to sea level rise. Given the rising popularity and increased ease of use, we chose to model sea level rise using the Sea Level Affecting Marshes Model (SLAMM) version 6.0.1. Due to variation in data quality and availability in many locations, we assessed the effect of raster data grain size on model outputs. We present results of a comparative analysis of the effect of grain size on forecast land cover estimates and processing time, as well as preliminary analyses of the estimated impacts on critical habitats and economic and population vulnerability at the sites. A critical node in modeling climate change is conveying the results to stakeholders. We present visualizations utilized to share our results with county planning staff and coastal conservation managers.
Keywords: Sea level rise, Climate change, Coastal planning, SLAMM 6.0.1, Grain size

227. Assessing dynamic landscapes by Forest Change Curvature Profile (FCCP)
Authors: Ferraz, Silvio Ferraz, University of SÃ£o Paulo (USP); Rodrigo Begotti, Graduate course - Forest Resources - USP; Carla Cassiano, Graduate course - Forest Resources - USP; Katia Ferraz, University of SÃ£o Paulo (USP); Thais Azevedo, Graduate course - Ecology - USP
Offered Presentations: Landscape Change - Tuesday (2011-04-05): 10:20 - 10:40 - Council Suite
Abstract: Tropical regions are considered very dynamic landscapes since their natural ecosystems still remain, they have being modified by human occupation at different rates and besides that, high speed of secondary growth quickly modifies abandoned and/or degraded lands. These landscape changes over time create a mixed landscape composed by patches of natural forest, secondary forest at different stages of regeneration, and degraded forest patches, both of which are very difficult to be identified analyzing only landscape structure at present time. This paper describes a dynamic landscape analysis using the Forest Change Curvature Profile (FCCP), which is based on historical forest proportion data. It could be quantified by its shape parameters such as inclination, height and maximum/minimum intercept. Parameters calculation is performed in landscape units based on land use classes' proportion for each year, extracted from local land-use maps. Two different landscapes of Brazil were used to test the methodology: central RondÃ´nia (Amazon region) characterized by recent deforestation (after 1970s) and central SÃ£o Paulo (southeastern region), a high developed region (more than 200 years of human occupation) where natural vegetation is increasing in recent years due to reforestation enforced by Brazilian environmental law. Results showed that FCCP is able to distinguish regions based on its historical forest change, isolating areas presenting same forest proportion at current time but have different historical disturbance process. The analysis allowed better understanding of ecological functions developed by forest patches on current time and observed performance of environmental services by the landscape.
Keywords: Deforestation, Brazil, Landscape dynamics, Indicators

228. Calibrating and validating a forest landscape model using forest inventory data in Boston Mountains, Arkansas

Authors: Wang, Wenjuan Wang, University of Missouri-Columbia; Hong He, University of Missouri-Columbia; Marty Spetich, US Forest service; William Dijak, US Forest service; Stephen Shifley, US Forest service
Offered Presentations: Landscape Change - Tuesday (2011-04-05): 10:40 - 11:00 - Council Suite
Abstract: The validation of the forest landscape model LANDIS PRO is to quantify the reliability and confidence of model prediction. This is accomplished through comparison of model results to independent experimental data. This requires an iterative process which calibrates model input parameters until acceptable results are achieved. A problem concerning the validation of forest landscape model results is that independent time series data are typically not available. However, recent advances in Forest Inventory and Analysis (FIA) data collection procedures make annual forest inventory data available which provides more time series data than before. We used FIA as independent spatial-temporal data to validate the forest landscape model LANDIS PRO at landscape and land type scales in Boston Mountains, Arkansas. Specifically, number of tree (trees /acre), basal area (ft2/acre) and age distribution of each species were used as the response variables to conduct comparison. The landscape initialization validation showed that the number of trees simulated by LANDIS PRO at landscape scale were within 15% of the FIA results for white oak group (Quercus spp.), while other species were within 10%. The basal area simulated by LANDIS PRO at landscape scale was within 10% of the FIA results for each species. We also showed acceptable predictive performance for each land type when compared to FIA data, although slight discrepancies still exist. Further model calibration will be further conducted using FIA data before running multiple iterations of LANDIS PRO. Insights gained through this study could provide a credible basis for the use of this model as an aid in decision-making.
Keywords: Forest landscape model, Calibration, Validation, Model credibility, LANDIS Pro 7.0

229. Proximity and root causes of temperate forest transition - The case of Wolong Nature Reserve, China
Authors: Liu, Wei Liu, Michigan State University; Andres Vina, Michigan State University; Jianguo Liu, Michigan State University
Offered Presentations: Landscape Change - Tuesday (2011-04-05): 11:00 - 11:20 - Council Suite
Abstract: Few have explored the proximity and root causes of forest transition at local scale. We investigated the forest cover dynamic in Wolong Nature Reserve, China across five time periods between 1965 and 2007. Local knowledge on past fuelwood collection behaviors was integrated into GIS to delineate a historical domestic timber extraction zone. Forest cover changing rates inside and outside the zone at each period were evaluated. We found that forest transition started inside since 1990s, while its onset outside occurred in early 2000s. A full evaluation of all possible proximity causes of forest loss revealed the contribution of illegal logging to past deforestation in the reserve. While the early forest transition inside the zone was mostly from active reforestation, the recent forest gain across the reserve is largely from natural regeneration. A portfolio of socioeconomic, institutional and policy drivers at multiple scales are identified to explain this trend of forest transition. While it was hoped that the forest gain would help restore panda habitat, no evidence has been found to support it. We discuss the importance of understanding patterns and processes behind land cover changes on the long-term sustainability of forests and biodiversity.
Keywords: Forest transition, Proximity cause, Root cause, LULCC, China

230. Land survival analysis: A new paradigm for characterizing and understanding land change
Authors: An, Li An, San Diego State University; Ninghua Wang, San Diego State University; Daniel Brown, University of Michigan; Sarah Wandersee, San Diego State University
Offered Presentations: Landscape Change - Tuesday (2011-04-05): 10:00 - 10:20 - Council Suite
Abstract: Characterizing and understanding temporally continuous land change remains highly challenging for many reasons, including limitations from traditional spatial data models and analytical

frameworks. As a result, land change analysis usually suffers a lack of adequate consideration and appreciation of temporal variability in land change processes. We propose a new paradigm to handle this problem, the land survival analysis framework, which revolutionizes the way we handle temporal variability in land change processes. We first compare and contrast the traditional use of survival analysis (e.g., in medical sciences) and the land survival analysis we propose here. In particular, we demonstrate that any land change analysis would likely suffer biased or misleading results when not adequately addressing the impacts from imprecise land change time stamps, the temporally changing environment, and/or competitiveness of multiple land-change types. To demonstrate the usefulness and power of this framework, we use a land change pseudo-history approach. This approach exposes machine-generated land change maps to different analytical frameworks (e.g., logistic analysis, survival analysis), determining the ability of these frameworks to recover the machine-generating rules. Through analyzing land change trajectories generated by an agent-based model, we show that the land survival analysis framework has outperformed traditional analytical frameworks such as logistic and multivariate regression analysis. We tentatively conclude that land survival analysis holds significant advantages when land change data face information uncertainty or low temporal resolution. This framework deserves special attention in land change analysis, and more efforts should be invested to explore strengths and limitations of this framework.
Keywords: Temporal variability, Survival analysis, Land change

231. Land cover changes in the Puget Lowlands, WA, 1986-2002
Authors: Fuentes, Tracy Fuentes, University of Washington; Hossein Estiri, University of Washington
Offered Presentations: Landscape Change - Tuesday (2011-04-05): 11:40 - 12:00 - Council Suite
Abstract: The Puget Lowlands are the most rapidly changing ecoregion in the US, as a result of forestry management and urbanization. However, it is unlikely that the processes driving land cover changes are uniform across the entire Puget Sound lowlands. To better explore land cover changes in this area, we selected the Puget Lowlands of the Duwamish-Green and Snohomish watersheds as a paired case study. Both lower watersheds are part of the rapidly urbanizing Seattle Metropolitan Area and have very similar geomorphology. However, the flood regime of the Duwamish-Green has been extensively altered by past river re-plumbing and by dam construction and operation. From our raster analysis of land cover data from 1986 to 2002, we found that 34,573 ha (49% area) changed land cover types in the Green-Duwamish, while 92,400 ha (52% area) changed in the Snohomish. Four of the five most common land cover changes in the Green-Duwamish are related to urbanization, while four of the five top land cover changes in the Snohomish are related to forestry. The most common transition in both lower watersheds was from vegetated to urban types. However, the second most common transition type in the Green-Duwamish was from urban to more heavily urban, while the second most common transition type in the Snohomish was from one forest class to another forest class. Finer scale analyses may be needed to better understand human and ecological processes driving land use and land cover trends.
Keywords: Land cover change, Puget Lowlands, Urbanization, Forest management, Geospatial analysis

232. Spatial and temporal fire - spruce budworm interactions in Ontario
Authors: James, Patrick James, University of Alberta; Rich Fleming, Canadian Forest Service; Mike Wotton, Canadian Forest Service; Dave Martell, University of Toronto
Offered Presentations: Disturbance 1 - Wednesday (2011-04-06): 09:20 - 09:40 - Broadway 3
Abstract: Periodic outbreaks of the spruce budworm (Chorisoneura fumiferana) in eastern Canada create large patches of standing dead spruce and fir forest. Of particular concern to forest and fire managers is whether these patches of standing dead timber represent areas of significantly greater fire risk, for how long such increased risk persists, and how these relationships vary through space and time. Using historical geographically referenced fire ignitions and spruce budworm defoliation

sketch maps we examined the relationship between defoliation and the number of ignitions in the province of Ontario, Canada. Previous work in Ontario has suggested a temporary increase in flammability in budworm-killed forests but regional and seasonal variability in these relationships has not been examined. Using Poisson regression, we modelled the number of fires per 10 km pixel between 1960 and 2004 for both lightning and human caused fires on the spring and summer fire seasons. Results indicate that human caused ignitions are driven by proximity to roads and regions of high population density and defoliation does not play a role. In contrast, the number of lighting ignitions was influenced by recent SBW activity, climate, and varies significantly among ecoregions. In the context of recent increases in the extent and severity of insect outbreaks in northern forests, these results indicate the potential for increased insect-related lightning-caused fire risk that may be further exacerbated by drier and warmer conditions.
Keywords: Disturbance interactions, Regression, Insect defoliation

233. Biogeochemistry of subalpine forest soils following multiple, interacting disturbances
Authors: Wessman, Carol Wessman, University of Colorado; Kendra Morliengo-Bredlau, University of Colorado; Brian Buma, University of Colorado; Julie Hayes, University of Colorado
Offered Presentations: Disturbance 1 - Wednesday (2011-04-06): 09:40 - 10:00 - Broadway 3
Abstract: We studied disturbances, both singular and multiple, and their impact on soil properties within subalpine forest in the Rocky Mountains of northern Colorado. The Routt National Forest experienced blowdown, salvage logging and fire within a 5 year period from 1997 to 2002, leading to a spatially heterogeneous landscape of varied disturbance histories. Plots were established in green, intact forest and in areas that had experienced all disturbance combinations (blowdown, blowdown+logged, fire only, blowdown+fire and blowdown+logged+fire). Soil samples (0-10cm) were acquired in 2007-2008 and analyzed for available ammonium and nitrate, nitrification and mineralization potential, and other biogeochemical properties. Soil moisture and vegetation cover were measured monthly in 2008 and 2009. Multiple analysis of variance was used to evaluate the significance of â€œtreatment effectsâ€□ (defined as the pre-burn conditions present: blowdown, logged blowdown, and undisturbed) and â€œburn effectâ€□ (burned or unburned) on selected soil properties. The main effects of blowdown and logging disturbances indicated that the treatment type significantly affected the soil's total phosphorous, ammonification potential and available nitrate. Evaluation of the effects of burned versus non-burned sites showed that fire significantly affected total extractable phosphorous, bulk density, soil organic matter content, available nitrate and ammonium, and C, N, Ca and Mg content. Soil moisture and vegetation cover were also significantly affected by fire, however the extent of the effect was dependent on disturbance history. Results indicate that disturbance interactions are complex, with some (blowdown+fire) producing more dramatic impacts, while other disturbance combinations (blowdown+logging+fire) reduce the impact of the cumulative disturbance.
Keywords: Disturbance, Fire, Blowdown, Salvage logging, Subalpine forest

234. Long-distance dispersal of eastern spruce budworm in Minnesota (USA) via the atmospheric pathway
Authors: Sturtevant, Brian Sturtevant, US Forest Service; Gary Achtemeier, US Forest Service; Dean Anderson, Manaaki Whenua - Landcare Research; Joseph Charney, US Forest Service; Barry Cooke, Canadian Forest Service
Offered Presentations: Disturbance 1 - Wednesday (2011-04-06): 10:00 - 10:20 - Broadway 3
Abstract: Long-distance dispersal is thought to play an important role in synchronizing disparate populations of forest insect defoliators, but its importance relative to other factors remains unclear due to the difficulty of quantifying dispersal. In a large spatial network of spruce budworm pheromone traps in northern Minnesota and adjacent Ontario we observed a pulse in moth captures in areas where moths had not yet emerged, suggesting long-distance dispersal from phenologically advanced

areas with high population density. We applied an insect phenology model to identify sites with late phenology - due to localized cooling on the shoreline of Lake Superior - relative to “source” areas further inland where a localized population outbreak was in progress. We then coupled a high-resolution (1-km) atmospheric model with a spruce budworm adult flight behavior model to evaluate the likelihood that budworm adults emerging from the source area dispersed over 150 km to moth collection sites near the north shore of Lake Superior. Flight behavior parameters from New Brunswick, Canada, were used to parameterize the flight behavior model that interfaced with 4-dimensional output (i.e., temperature, wind speed, and precipitation) from the atmospheric model. Landings were dependent in part on the availability of suitable host, mapped using remote sensing. Results indicated that while the distance from the outbreak region to the lake shore was well within the flight capability of budworm adults, meteorological conditions limited the dates under which such immigration was possible. Our study illustrates the value of aerobiology to understand long-distance dispersal vectors for actively dispersing insect populations.
Keywords: Choristoneura fumiferana, Long-distance dispersal, Aerobiology, Agent-based modeling, Minnesota

235. Multiple disturbances in a subalpine forest, impact on resilience mechanisms, and implications for ecosystem recovery
Authors: Buma, Brian Buma, University of Colorado; Carol Wessman, University of Colorado
Offered Presentations: Disturbance 1 - Wednesday (2011-04-06): 10:20 - 10:40 - Broadway 3
Abstract: Multiple disturbances, or compounded perturbations, potentially cause ecological surprises and rapid shifts in land cover and are thus an important topic of study. Actual landscape-scale study systems, however, are rare and often not ideal. In Colorado, a 1997 blowdown (~10,000 ha) coupled with a 2002 wildfire (~12,500 ha) created a mosaic of disturbance magnitudes and interactions in a subalpine forest composed of Engelmann spruce, subalpine fir, and lodgepole pine. Salvage logging (~800 acres) from 1998 - 2001 functions as a de facto experimental treatment (reducing blowdown magnitude prior to the fire). By investigating the ecosystem response along a gradient of disturbance magnitudes and histories, disturbance interaction phenomena (e.g. novel conditions) and cumulative severity can be assessed. It appears the interaction of high-magnitude blowdown and fire overcame the resilience of the subalpine coniferous ecosystem through specific and novel ways. Lodgepole typically recovers post-fire through cone serotiny, whereas spruce and fir rely on dispersal from residuals. The combination of severe blowdown and fire significantly increased both the burn times (consuming serotinous cones) and the distance to lower magnitude fire areas (increasing required seed dispersal distances), resulting in significantly less conifer recruitment than fire-only treatments ($p < 0.05$). Salvage logging partially ameliorated the disturbance severity, likely by reducing coarse woody debris levels prior to the fire. Thus these interactions created, in effect, a novel disturbance. Disturbance interactions can overwhelm ecosystem resilience mechanisms, reduce recovery rates, increase future landscape heterogeneity, and potentially push the ecosystem onto different successional trajectories.
Keywords: Disturbance, Forest, Fire, Resilience, Compounding perturbation

236. Simulating Southern Appalachian forest landscape change: Effects of herbivory by Southern Pine Beetle
Authors: Zeng, Szu-Hung Chen, Texas A&M University; Charles Lafon, Texas A&M University; David Cairns, Texas A&M University; Andrew Birt, Texas A&M University; Robert Coulson, Texas A&M University
Offered Presentations: Disturbance 1 - Wednesday (2011-04-06): 10:40 - 11:00 - Broadway 3
Abstract: The outbreaks of Southern Pine Beetle (SPB) (Dendroctonus frontalis) are major disturbances to Southern Appalachian forest. Large events of this disturbance can significantly change composition and structure of forest landscape by setting off successional dynamics

throughout forest landscape. It is very important to understand a variety of possible consequences of its outbreaks in forest landscapes under different scenarios, e.g. fire regimes and climate change. The simulations are carried out using LANDIS-II, a spatially explicit forest landscape simulation model, to explore these successinoal dynamics to assess the impact of SPB on the composition and structure of forest landscapes. The study area is Grandfather Forest District in Southern Appalachian Mountain. This model is calibrated using establishment coefficients based in plot data from Carolina Vegetation Survey (CCS) and other established parameters of tree species in Southern Appalachian Mountain. The scenarios we explored include a set of fire regimes and SPB outbreaks as well as their combinations under different climate change settings. Analysis of simulation results illustrates the effects of various SPB disturbances and of combined SPB and fire disturbances on forest landscape dynamics. Our findings provide theoretical and practical supports for development of effective restoration strategies and plans to cope with future impacts of SPB and other disturbances on forest landscapes.
Keywords: Herbivory, Disturbance, Forest landscape, LANDIS-II, Successional dynamics

237. Evaluating the economic costs and benefits of slowing the spread of Emerald Ash Borer in Ohio and Michigan
Authors: Bossenbroek, Jonathan Bossenbroek, University of Toledo; David Finnoff, University of Wyoming; Charles Sims, Utah State University; Shana McDermott, University of Wyoming
Offered Presentations: Disturbance 1 - Wednesday (2011-04-06): 11:00 - 11:20 - Broadway 3
Abstract: The emerald ash borer was first discovered in Detroit in 2002 and in a matter of only a few years has destroyed all ash trees within the Detroit Metropolitan area and spread through much of lower Michigan and northern Ohio. We integrate economic and ecological models to assess what would have been the economic benefits of having used different policy options during the spread of emerald ash borer. For the spread of the emerald ash borer, we use a model that includes natural and human dispersal, which is driven by roads, campgrounds and population centers. The economic models consist of a Computable General Equilibrium model, which quantifies the damages to a regional economy based when a shock such as an invasion occurs, and a Real Options model, which determines the optimum timing for investments in different policy options. Policy options that were incorporated into our scenarios included changing the number and intensity of eradication efforts, both at the wave front of the invasion and at the long-distance outbreaks. Our models suggest that without an control, the emerald ash borer will spread throughout the states of Ohio and Michigan within the next 25 years. Our economic analyses suggest that the annual welfare lose in Michigan and Ohio will exceed $110 million and that it would have been worth over $1 billion to have stopped the spread of the emerald ash borer when it was first detected. Integrating these models allows us to explore the implications of different policy scenarios.
Keywords: Invasion, Spread, Dispersal, Economics, Models

238. Interactions between bark beetle outbreaks and wildfire potential in Douglas-fir forests of Greater Yellowstone
Authors: Donato, Daniel Donato, University of Wisconsin - Madison; Monica Turner, University of Wisconsin - Madison; Brian Harvey, University of Wisconsin - Madison; William Romme, Colorado State University; Martin Simard, University of Wisconsin - Madison
Offered Presentations: Disturbance 1 - Wednesday (2011-04-06): 11:20 - 11:40 - Broadway 3
Abstract: Wildfires and bark beetle outbreaks are key disturbances affecting western forests, but their interactions have received little study. Bark beetle epidemics are reaching unprecedented levels in Rocky Mountain landscapes, and it is often presumed that such outbreaks increase the probability of active crown fire by generating abundant dead trees. Published research on bark beetle effects on fire in pine forests has reached variable conclusions, and almost no data exist for more fuel-limited forest types with mixed-severity fire regimes, such as Rocky Mountain Douglas-fir (Pseudotsuga

menziesii v.glauca). We sampled fuel loads and stand structure across a chronosequence of Douglas-fir forests affected by the Douglas-fir beetle (Dendroctonus pseudotsugae) in Greater Yellowstone, evaluating how fire potentials change with time since beetle outbreak. The chronosequence (n=20 plots) included undisturbed conditions and stands affected by active (0-2 yr post-attack), recent (3-5 yr), and old (20-30 yr) outbreaks. Stands ranged from open parkland to dense closed-canopy forest, with mean basal area 46 m2/ha (range 27-81 m2/ha) dominated (93%) by Douglas-fir. Beetle mortality averaged 51% of basal area (range 38-81%), primarily in stems >20 cm diameter. Mechanisms of snag-fall and surface fuel accumulation included fragmentation and whole-tree falling, with 44% of snags broken-topped and 24% fallen by 20-30 years post-outbreak. Post-outbreak canopy fuels became very sparse and discontinuous in parkland stands, and markedly reduced in dense stands. Tree regeneration increased from median 51 to 809 stems/ha over the chronosequence. Initial analysis of fuel profiles suggests the likelihood of active crown fire may be diminished following beetle outbreak.
Keywords: Wildfire, Bark beetle, Douglas-fir, Rocky Mountains, Disturbance interaction

239. Habitat use by and behavior of three tropical forest songbirds in dynamic landscapes
Authors: Withey, John Withey, Smithsonian Tropical Research Institute
Offered Presentations: Fragmentation - Wednesday (2011-04-06): 09:20 - 09:40 - Galleria 1
Abstract: The degree to which tropical forest songbirds use lands in the matrix (modified habitats surrounding forested areas) is not well known. I radiotracked three relatively common species (Cercomacra tyrannina, Habia fuscicauda, and Xiphorhynchus susurrans) in forested landscapes undergoing fragmentation in central Panama. Across all species, the majority of land cover within home ranges was tropical semi-deciduous forest, as expected. Relative to other non-forest habitat types within their home ranges, one or more species used 1) forest gaps more, 2) impervious surfaces less, and 3) areas covered with an invasive grass (Saccharum spontaneum) less, depending on the scale of analysis used (local, neighborhood, or territory-based). One species was observed foraging more often than expected along hard forest edges (e.g. forest/impervious or forest/invasive grass edges). Finally, all species were observed in patches smaller than predicted by minimum home range size.
Keywords: Avian ecology, Fragmentation, Habitat selection, Resource selection

240. Invertebrates in old forest remnants in the Cascade mountains of Southern Washington
Authors: Marcot, Bruce Marcot, US Forest Service, Pacific Northwest Research Station
Offered Presentations: Fragmentation - Wednesday (2011-04-06): 09:40 - 10:00 - Galleria 1
Abstract: Invertebrates were sampled in 17 old-forest remnant patches, in 35 adjacent young-forest plantations and in 200-m transects bisected by the forest/plantation edge, and in 4 extensive unharvested forest controls in mixed conifer forest of the Cascade Mountains in southern Washington, using beat-and-sweep, pitfalls, and soil excision with Berlese funnels. The forest remnants ranged 0.2-45 ha and 69-338 yrs in age; the plantations ranged 4-51 ha and 4-47 yrs since clear-cutting; and the forest controls ranged up to 473 ha and 173-334 yrs old. 179 taxa of spiders (including sex and age classes) and over 600 taxa of other arthropods were identified. Multiple patterns of occurrence were identified with various taxa showing obligate occurrence in the old forest remnants, plantations, or extensive old forest controls, with few taxa appearing to occur as edge specialists and many more taxa showing more facultative or general distributions among forest and plantation conditions. Most habitat obligates pertained to plantations. All categories of invertebrate functional groups (parasitoid, shredder, herbivore, omnivore, predator, and fungivore) occurred in forests, plantations, and edge environments alike, generally with equal proportions of numbers of taxa, but with each functional role represented by different sets of taxa. Implications for management of old-forest remnants for invertebrates is discussed.

Keywords: Invertebrates, Habitat fragmentation, Forest remnant, Plantation forestry, Functional groups

241. Modeling the effects of landscape pattern on avian distributions across time and space
Authors: Zuckerberg, Benjamin Zuckerberg, Cornell Lab of Ornithology; Daniel Fink, Cornell Lab of Ornithology
Offered Presentations: Fragmentation - Wednesday (2011-04-06): 10:00 - 10:20 - Galleria 1
Abstract: Species-habitat relationships change and evolve through time, and migratory species exploit different habitats at different times of the year. Most studies assessing the effects of habitat fragmentation on bird populations focus on the breeding season, but migratory species are potentially influenced by landscape pattern at multiple spatio-temporal scales. This spatiotemporal variation needs to be accounted for in any modeling of species' distributions and is essential for developing regional conservation strategies. We employ a novel species distribution modeling methodology to analyze and explore dynamic patterns of species occurrence from broad-scale survey data and assess the relative importance of habitat composition and pattern at multiple scales. The SpatioTemporal Exploratory Model (STEM) is a multi-scale, semiparametric model that differentiates between local and global-scale spatiotemporal structure. The model accounts for spatial and temporal patterning at the local level that is then allowed to â€œscale upâ€ via ensemble averaging to larger scales. This adds essential spatiotemporal structure to existing techniques for assessing species-environment relationships. Using data from eBird (http://www.ebird.org), an online citizen science bird-monitoring project, and associated land cover data we assessed the relative importance of forest composition and configuration on the predicted occurrence of 12 forest-breeding migrants across their intra-annual migrations throughout the eastern United States. We found seasonal variation in habitat association and influences of landscape pattern on species' distributions. Our methodology provides valuable information for generating hypotheses and making inference about the processes driving dynamic distributional patterns.
Keywords:

242. Functional connectivity of calcareous grassland communities
Authors: Rico, Yessica Rico, University of Toronto; Hans Juergen Boehmer, Interdisciplinary Latin America Center (ILZ); Helene Wagner, University of Toronto
Offered Presentations: Fragmentation - Wednesday (2011-04-06): 10:20 - 10:40 - Galleria 1
Abstract: Ecological networks aim to counteract negative effects of habitat loss and fragmentation by restoring structural landscape connectivity that facilitates seed dispersal and gene flow among plant communities (functional landscape connectivity). In Central Europe, abandonment of transhumance sheep grazing and natural reforestation led to a dramatic decline of calcareous grasslands and increased isolation of remaining habitat patches, resulting in reduced seed dispersal and pollen flow. In the Southern Franconian Alb in Bavaria, Germany, a conservation project started in 1990 aimed to restore and reconnect impoverished abandoned patches by rotational sheep grazing. Although sheep grazing has been suggested as the main dispersal vector for most calcareous grassland plants, the effect of sheep grazing connectivity on patch colonizations (i.e. functional connectivity) compared to geographic distance alone has not been investigated with empirical data. We tested the link between sheep grazing connectivity and species dispersal (i.e. patch colonization rates for 48 characteristic species). Based on the 2008/2009 repetition of the baseline survey of 1989/1990, we fitted an incidence function model (IFM) to the observed numbers of colonizations and local extinctions among 48 characteristic plant species. Colonizations were significantly correlated to connectivity by rotational sheep grazing, whereas extinctions were related to patch area. Sheep grazing was more important than geographic distance, which suggests that rotational sheep grazing is an effective strategy for maintaining long-term calcareous grasslands diversity at the landscape scale. Further analysis will use molecular genetic methods to identify the sources of observed colonization events.

Keywords: Structural connectivity, Funtional connectivity, Calcareous grasslands, Dispersal vectors, Incidence function model

243. Has island biogeography died on the mainland? A test using species distribution models
Authors: Betts, Matthew Betts, Oregon State University
Offered Presentations: Fragmentation - Wednesday (2011-04-06): 10:40 - 11:00 - Galleria 1
Abstract: Recent evidence suggests that habitat loss rather than fragmentation is the primary cause of species declines worldwide. I used species distribution models to define landscape composition and pattern from the perspective of 15 individual bird species and then tested for the independent effects of habitat loss and fragmentation. I also used a hierarchical modeling approach to test the hypothesis that life history traits influence the sensitivity of species to these two variables. Though there was some evidence for life history effects, habitat loss and fragmentation were both important predictors of occurrence across all species considered; the effects of fragmentation intensified in landscapes with low proportions of habitat. I suggest that the previously observed weak fragmentation effects may be partly attributed to the way landscapes have been measured rather than reduced species response to landscape pattern.
Keywords: Habitat loss, Fragmentation, Birds, Life history traits, Thresholds

244. Unexpected co-benefits: forest connectivity and property tax incentives
Authors: Locke, Christina Locke, University of Wisconsin - Madison; Adena Rissman, University of Wisconsin - Madison
Offered Presentations: Fragmentation - Wednesday (2011-04-06): 11:00 - 11:20 - Galleria 1
Abstract: Sustainable management of private forestland is crucial for preserving the social and ecological benefits of intact forest patches. Longstanding property tax incentives were created to enhance on-site sustainable forest management, but their contributions to forest connectivity have not been examined. To determine if forests enrolled in tax incentive programs provide connectivity with public forests, we used landscape metrics to characterize the spatial distribution of enrollments in the Managed Forest Law and Forest Crop Law programs across a forest cover gradient in Wisconsin, United States. The programs' contribution to connectivity varied regionally and depended on enrollment type (industrial versus nonindustrial enrollment). Economically and ecologically sound forest management will depend on cohesive management plans that cross ownership boundaries and are sensitive to regional differences in ownership structure and landscape characteristics.
Keywords: Forest management, Conservation strategies, Cross-boundary coordination, Tax incentives, Fragmentation

245. Looking to the future: Housing growth and landuse change around the National Wildlife Refuge system
Authors: Hamilton, Christopher Hamilton, University of Wisconsin - Madison; Sebastian Martinuzzi, University of Wisconsin - Madison; Patricia Heglund, U.S. Fish and Wildlife Service; Anna Pidgeon, University of Wisconsin - Madison; Volker Radeloff, University of Wisconsin - Madison
Offered Presentations: Fragmentation - Wednesday (2011-04-06): 11:20 - 11:40 - Galleria 1
Abstract: Wildlife conservation relies heavily on protected areas to provide habitat for fish and wildlife populations. The United States National Wildlife Refuge System (NWRS) of protected areas conserves habitat for migratory birds and endangered species and provides other ecological benefits. However, the refuges are typically surrounded by private land, a substantial portion of which has been developed and continues to be an attractive amenity for future housing growth. Development activities may significantly impair efforts to maintain the ecological integrity of the NWRS. Our goal was to quantify the threat posed by development to conservation efforts in National Wildlife Refuges. We quantified current and predicted future housing density and landcover class in the vicinity of all Refuges in the U.S and used these values as a threat indicator. Our results show that while much of

the land surrounding Refuges is unfavorable to dispersal, opportunity does exist to secure or reestablish connectivity to and from most refuges. Over 95% of NWRs still have “escape routes” (i.e. corridors that pass through contiguous areas of low density housing) that extend at least 25 km. In addition, the area of these routes averages over 77% of the total buffer area within 25 km of the refuges. These spatially explicit analyses reveal a more detailed picture than simple indices using buffer averages. Our results provide managers with important information to address this conservation challenge.
Keywords: Protected areas, Landuse, Housing, Corridor, Connectivity

246. Scale-dependent effects of habitat area and fragmentation on community patterns in experimental fractal landscapes
Authors: With, Kimberly With, Kansas State University; Daniel Pavuk, Bowling Green State University
Offered Presentations: Fragmentation - Wednesday (2011-04-06): 11:40 - 12:00 - Galleria 1
Abstract: The effects of habitat area and fragmentation are confounded in many studies because a decrease in habitat area alone may lead to decreased patch size and increased patch isolation. We designed an experimental model landscape system, founded on fractal neutral landscape models, to study arthropod community responses in red clover plots, in which we adjusted the level of fragmentation (clumped vs. fragmented) independently of habitat area. At the plot scale, habitat area had a greater and more consistent effect on species richness than fragmentation. Fragmentation effects were subtle and transient, with higher species richness in clumped 40-50% landscapes but higher in fragmented landscapes at 60-80% habitat in initial or early-season surveys. Local-scale diversity (within 1-m2 clover cells) was unaffected by landscape context, in terms of either the amount or fragmentation of habitat within the plot. Thus, local-scale diversity did not scale-up directly to plot-scale diversity. In a different survey, community similarity within clover cells was 40%, indicating a high degree of species turnover among cells (i.e., high beta-diversity). Interior cells had significantly more species than did edge cells, and arthropod communities within edge cells were significantly different from those in interior cells. Thus, although fragmentation generally did not have a direct effect on overall species richness within plots, it may have had an indirect effect by contributing to greater edge habitat, resulting in greater species turnover among cells, and thus potentially higher diversity in fragmented landscapes with abundant habitat (60-80%), as observed in some surveys.
Keywords: Fragmentation, Scale, Species-area relationships, Edge effects, Community responses

247. The correlation between urban landscapes and an invasive species distribution
Authors: Weaver, Jennifer Weaver, University of Toronto; Tenley Conway, University of Toronto; Marie-JosÃ©e Fortin, University of Toronto
Offered Presentations: Urban Landscapes 1 - Wednesday (2011-04-06): 09:20 - 09:40 - Galleria 3
Abstract: The spread of invasive exotic species is a growing concern in conservation biology due to the significant impact that they have on native ecosystems. In many cases, little is known about invasive species’ movement in their non-native ecosystems, yet this information is necessary to effectively plan and manage current and future invasions and range expansions. This study examines the relationship between landscape structure and the invasive mute swan’s distribution in southern Ontario, specifically exploring the role of urban development in its invasion. Mute swan data is obtained from the 2001-2005 Ontario Breeding Bird Atlas survey. The correlation between mute swan’s distribution and several landscape variables was determined using a generalized linear model, with relationships between the original landscape variables explored using a PCA. The effects of the surrounding landscape were considered at three spatial scales (140m, 3km and 5km buffers), based on the ecology of the mute swan. At the two larger scales, the percentage of water covering the land is, not surprisingly, the landscape variable that is the most highly correlated with mute swan distribution. At all scales, the distance to urban areas, presence of zebra mussels and longitude are

the landscape variables that explain the majority of variability in mute swan distribution. The presentation will end with a discussion of the management implications of these results.
Keywords: Invasive species, Urban landscapes, Swans, Spatial analysis

248. The Chicago Area Pollinator Study; a citizen science project investigating bee species distribution in an urban landscape
Authors: Shierk, Clifford Shierk, University of Illinois at Chicago; Caroline Gottschalk-Druschke, University of Illinois at Chicago; Jennifer Howell-Stephens, University of Illinois at Chicago; Emi Kuroiwa, University of Illinois at Chicago; Carrie Seltzer, University of Illinois at Chicago
Offered Presentations: Urban Landscapes 1 - Wednesday (2011-04-06): 09:40 - 10:00 - Galleria 3
Abstract: The Chicago Area Pollinator Study (CAPS) is a citizen scientist research project examining the large-scale effects of urban land use on the abundance and richness of bees in the Chicago area. While recent research shows a general decline in pollinator populations around the world, little is known about the causes and mechanisms behind these declines. The goal of this study is to examine how different anthropogenic processes and land use characteristics may influence pollinator communities in a highly urbanized landscape. For this study, both non-scientists and scientists collected pollinators on four different dates during the summer of 2009. Collections were performed using a standardized pan trapping method at more than 60 sites throughout the Chicago metropolitan region. Nearly 80 bee species were found, and sampling from a variety of site types, including backyards, community gardens, and forest preserves, allowed for a comparison of how local variables (e.g., floral resources and nesting substrate) influence pollinator richness and abundance. While local variables were shown to be important determinants of pollinator richness, landscape-level variables (e.g., impervious surface and tree canopy within a given buffer) also contributed to differences in pollinator communities between sites.
Keywords: Pollinators, Bees, Citizen science, Urban ecology

249. Shifting direct and indirect effects of land use, vegetation, and floral resources on pollinators across an urbanized landscape
Authors: Matteson, Kevin Matteson, University of Illinois at Chicago; Emily Minor, University of Illinois at Chicago
Offered Presentations: Urban Landscapes 1 - Wednesday (2011-04-06): 10:00 - 10:20 - Galleria 3
Abstract: Humans have multiple direct and indirect impacts on biological communities. These effects, however, vary greatly in direction and magnitude across heterogeneous landscapes such as cities. To evaluate shifting direct and indirect effects across an urbanized landscape, we used structural equation models (SEM) to identify factors influencing pollinator abundance and richness in a variety of land uses across New York City. Specifically, we compared the impacts of floral resources, surrounding vegetation, and building density on pollinators in both open spaces (e.g. parks, gardens, cemeteries; n = 42) and developed neighborhoods (e.g. mixed/commercial, high- and low-density residential zoning; n = 55). Floral resources were influential in both settings, but the magnitude of the effect was greater in open spaces. In addition, while there was seven-fold more surrounding vegetation in open spaces than in developed neighborhoods (in a 30 m radius surrounding transects), open spaces did not have significantly greater floral resources, partially reflecting the abundance and diversity of ornamental flower beds present in low-density residential neighborhoods. Nevertheless, floral resources decreased with increasing building density in developed neighborhoods, indirectly resulting in pollinator declines. Surrounding vegetation had mixed impacts on floral resources, exhibiting a positive effect in developed neighborhoods but a negative effect in open spaces, perhaps due to differences in relative amounts of canopy versus herbaceous cover. Overall, these results indicate the degree to which direct and indirect effects can shift across urban landscapes, suggesting that this may be a common phenomenon in other heterogeneous landscapes as well.
Keywords: Heterogeneity, Urban, Pollinators, Land use, Biodiversity

250. Exurban development: barrier effects on wildlife movement
Authors: Shrestha, Namrata Shrestha, University of Toronto; Tenley Conway, University of Toronto
Offered Presentations: Urban Landscapes 1 - Wednesday (2011-04-06): 10:20 - 10:40 - Galleria 3
Abstract: In exurban landscapes, isolated buildings and associated roads can physically fragment the landscape through perforation, incision and dissection. In addition, these structures may create functional constraints to wildlife movement through barrier effects that extend beyond their actually footprint. While large scale fragmentation is usually evident through analyses of moderate resolution (30 m) land cover data, the barrier effects of exurban buildings and roads is often not fully captured due to their small size and isolated nature. In this study, we assessed the functional effect of exurban built structures on the landscape by developing a spatially explicit model to estimate their overall barrier effect in different wildlife movement scenarios. In particular, relative weights were given to exurban buildings and the associated road network, based on their own characteristics and the specific wildlife response scenario. This information was then combined with 30m land cover data to determine the overall barrier effect for each scenario. The model is based on data for Peterborough County, Ontario. The results present the spatial distribution of the potential barrier effects in the landscape for each wildlife response scenario, highlighting the extent of the impacted area that is overlooked when detailed building structure and road data are not included in land cover-based assessments of exurban landscapes. However, this simple and effective approach provides an ecologically calibrated tool for conservationists, planners, and other decision makers to assess the implications of existing or proposed exurban development. Moreover, the model developed here can be easily modified for different species.
Keywords: Exurban, Roads, Barrier effect, GIS

251. Do birds and beetles show similar responses to urbanization?
Authors: Gagn, Sara Gagn, University of North Carolina at Charlotte; Lenore Fahrig, Carleton University
Offered Presentations: Urban Landscapes 1 - Wednesday (2011-04-06): 10:40 - 11:00 - Galleria 3
Abstract: To date, the vast majority of studies in urban areas have been carried out on birds yet it is not known whether the responses of birds to urbanization are congruent with those of other taxa. In this paper, we compared the responses of breeding birds and carabid beetles to urbanization specifically asking whether the emerging generalizations of the effects of extreme levels of urbanization on birds could also be applied to beetles. Bird and beetle community data were collected in Ottawa, Ontario and Gatineau, Quebec, Canada in two groups of sites: developed sites representing the predictor variable within-site housing density and forested sites adjacent to development representing the predictor variable neighboring housing density. Breeding birds and carabid beetles do not respond similarly to increasing within-site housing density but do exhibit some similar responses to increasing neighboring housing density. Birds displayed strong declines in diversity, compositional changes and community simplification in response to within-site housing density. Forest and introduced species of birds and beetles responded similarly to increasing housing density within a site, but responses of overall diversity and open-habitat species richness and patterns of community simplification differed between the taxa. Increasing neighboring housing density resulted in increases in the abundances of introduced birds and beetles and similar patterns of community simplification in both taxa. To better understand and mitigate the effects of urbanization on biodiversity, we suggest that, in addition to the responses of birds, future research should focus on the responses of other taxa in the urban matrix.
Keywords: Urban gradient, Urban biodiversity, Biodiversity congruence, Indicator taxon, Forest fragment

252. GIS-based ecological connectivity assessment along urban modification gradient: Phoenix, Arizona metropolitan landscape
Authors: Park, Sohyun Park, Arizona State University; Edward Cook, Arizona State University
Offered Presentations: Urban Landscapes 1 - Wednesday (2011-04-06): 11:00 - 11:20 - Galleria 3
Abstract: While most ecological connectivity research has focused on natural areas (Bunn et al., 2003; JordÃ¡n et al., 2007), due to perceived lesser importance of natural areas and data deficiencies, limited research has been undertake for urban landscapes. Nevertheless, conserving ecological connectivity in an urban context is becoming crucial to maintain urban biodiversity and secure critical habitat levels and configurations with constant pressures from anthropogenic activities. This study aims to assess current and future ecological connectivity for a group of species representing the urban desert landscape in the metro-Phoenix, Arizona area. The indicator species were chosen based on the consultation with regional biologists and include key avian species and terrestrial mammals with differing degrees of fragmentation sensitivity and habitat requirements. We used GIS-based landscape modeling relying on two indices: Absolute Ecological Connectivity Index (ECIa) and Barrier Effect Index (Marulli and Mallarach, 2005). To estimate the impacts of both imminent and potential long-term urban developments on ecological connectivity, we considered actual urban footprints of major urban development and new road plans in different stages. The resultant change in connectivity values were examined for different zones in the urban gradient, such as urban, suburban, and rural. Boundaries were delineated using the criteria of human population density and urban land cover. With an attempt to link landscape ecological approach with current urban planning practice, this study provides practical guidance on alternative arrangement of future land use that ultimately can contribute to enhancing ecological connectivity and landscape sustainability in urban setting.
Keywords: Ecological connectivity, Metropolitan landscape, Urban modification gradient, Phoenix

253. Effects of urban development and forest cover patterns on Garry oak (Quercus garryana) acorn dispersal processes
Authors: Michalak, Julia Michalak, University of Washington
Offered Presentations: Urban Landscapes 1 - Wednesday (2011-04-06): 11:20 - 11:40 - Galleria 3
Abstract: Expanding residential and commercial development in Western Washington has led to an increasing number of Garry oak woodlands embedded in an urban landscape. Garry oaks are the only native oak in this region and are a conservation priority. Urbanization removes and fragments forest cover and alters the animal community in forest patches. Changes to animal communities may alter critical ecological functions such as trophic interactions and foraging behavior, with potential consequences for plant-animal mutualisms. Garry oak acorns provide an important food resource for jays and squirrels which in turn are important vectors for acorn dispersal. Development may disrupt this mutualism because urbanization alters forest cover patterns and the distribution and abundance of animal dispersers. Subsequently, animal-mediated dispersal may differ in urban versus non-urban oak stands with consequences for oak regeneration. I placed experimental acorn plots in oak, conifer and open grassland habitats within urban and non-urban oak woodlands to test whether dispersal processes differ depending on forest cover and urbanization. A subset of acorns was attached to fluorescent flags to facilitate relocation of dispersed acorns without altering dispersal behavior. Dispersal activity was higher under forest cover than in open grasslands, suggesting that forest cover facilitates dispersal. In urban plots, more acorns were removed, more removed acorns were eaten and dispersal distances were shorter than in non-urban plots. Consequently, acorn dispersal services appear to be inferior in urban compared to non-urban landscapes. This suggests that changes to forest cover patterns and animal communities driven by urbanization have consequences for plant-animal mutualisms.
Keywords: Seed dispersal, Urbanization, Conservation biology, Landscape ecology, Urban forestry

254. Spatial analysis of open space planning and community agriculture in Madison, WI: A landscape ecology approach to urban policy assessment
Authors: Greene, Robbie Greene, University of Wisconsin-Madison, Dept. of Landscape Architecture; Janet Silbernagel, University of Wisconsin-Madison, Dept. of Landscape Architecture
Offered Presentations: Urban Landscapes 1 - Wednesday (2011-04-06): 11:40 - 12:00 - Galleria 3
Abstract: In recent years, cities in the U.S. and abroad have seen a rapid increase in the utilization of urban open space for agriculture. In the urban area of Madison, Wisconsin, community gardens constitute a large and highly visible component of this trend and have garnered financial and social support from both citizens and municipal authorities. Over the past decade, the City of Madison has attempted to integrate community gardens into existing land use planning and policy, yet there has been no detailed study of corresponding spatio-temporal change in community agriculture. My research investigates ten years of land use policy and open space planning in the urban area of Madison, and examines how shifts in planning strategies have changed available land resources and the spatial distribution of community gardens. I employ a mixed methodology of policy and plan reviews and geospatial analysis to analyze this interaction. Results demonstrate a relationship between explicit references to community gardens in planning documents and the establishment of community gardens around the City. Furthermore, an increase in small scale, neighborhood-based planning activities corresponds with clustering of community gardens. These results are presented through a series of maps coupled with narratives so that the spatial and temporal dimensions of green space configuration and community garden distribution can be understood alongside a corresponding urban planning framework. In light of this, the broader implications of the study are discussed in the context of both scientific research and utility for landscape planning and design.
Keywords: Landscape planning, Urban agriculture, Open space, Community gardens, Spatial analysis

255. A comparison of alternative approaches for ecological network design based on sustainability-related indicators
Authors: Bernier, Amélie Bernier, Département de Géomatique Appliquée, Centre d'Applications et de Recherches en TélédÉtection (CARTEL), Québec, Canada; JérÃ´me Théau, Département de Géomatique Appliquée, Centre d'Applications et de Recherches en Télédétection (CARTEL), Québec, Canada; Richard Fournier, Département de Géomatique Appliquée, Centre d'Applications et de Recherches en Télédétection (CARTEL), Québec, Canada
Offered Presentations: Conservation Biology 3 - Wednesday (2011-04-06): 09:20 - 09:40 - Parlor BC
Abstract: Ecological networks are designed to maintain biodiversity and ecological processes by protecting habitats and their linkages. By considering the functional role of the landscape, the ecological network model allows to integrate conservation planning with human activities. Although all ecological networks share the same global objective, a large number of approaches can be used to spatially delimitate their components. Choosing an approach can be a major source of uncertainty in the design of an ecological network as it has implications for the spatial configuration, ecological value and ease of implementation of the resulting network. In our study, we applied different approaches for the development of an ecological network to one area, the St-FranÃ§ois river watershed (8 700 km2), located in southern QuÃ©bec, Canada. The approaches used are either single-species, multi-species or landscape-based. Single-species approaches are based on specific species requirement while multi-species approaches combine different species to integrate greater habitat diversity and ecological processes in the networks. In contrast, landscape-based approaches consider the landscape structure and configuration rather than species requirements. All resulting ecological networks were evaluated using ecological, economical and social spatial indicators chosen for their relevance to sustainable territorial management. This allowed to quantitatively assess the implications of each approach and establish their relative performance within a common framework. In addition to support evaluation of alternative conservation scenarios, our results also provide

guidelines on the trade-offs that can be made regarding methodological complexity, data requirements and conservation objectives when choosing an approach to implement an ecological network.
Keywords: Ecological networks, Conservation planning, GIS, Sustainable management, Spatial indicators

256. The Washington Connected Landscapes Project: Making connectivity models work for conservation
Authors: McRae, Brad McRae, The Nature Conservancy; Joanne Schuett-Hames, Washington Department of Fish and Wildlife; Kelly McAllister, Washington Department of Transportation; Peter Singleton, US Forest Service; D Pierce, Washington Department of Fish and Wildlife; Karl Halupka, US Fish and Wildlife Service; Brian Cosentino, Washington Department of Fish and Wildlife
Offered Presentations: Conservation Biology 3 - Wednesday (2011-04-06): 09:40 - 10:00 - Parlor BC
Abstract: Maintaining and restoring well-connected landscapes has become a key strategy for wildlife conservation and climate adaptation. However, translating connectivity models into products that can inform conservation planning for multiple species at regional scales has been challenging. The Washington Wildlife Habitat Connectivity Working Group (WHCWG) has completed an extensive assessment of wildlife connectivity across Washington State and adjacent areas. We developed new GIS tools that combine least-cost corridor modeling with graph theory to rapidly identify and model linkages between thousands of core habitat areas. We then mapped areas important for connectivity conservation using a combination of focal species- and landscape integrity-based models. These produced linkage networks for 16 representative species, plus lands exhibiting high degrees of ecological integrity (relatively intact areas with low levels of human modification). Taken together, these networks represent our best understanding of areas important for maintaining functioning, connected landscapes in Washington State. Our effort is the first to compare results from both species- and integrity-based approaches; simple binary comparisons indicate strong overlaps among species and integrity networks, with one integrity map containing between 69% and 99% of habitat areas and linkages identified for individual focal species. Future efforts will incorporate areas important for maintaining connectivity under climate change, as well as finer-scale analyses to help prioritize detailed linkage designs and conservation actions. This work is the result of the highly collaborative efforts of the WHCWG, a science-based organization composed of representatives from land and resource management agencies, non-profit conservation organizations, and universities.
Keywords: Landscape connectivity, Conservation planning, Wildlife, Corridors, Graph theory

257. Spatial conservation planning for salmon strongholds
Authors: Miewald, Tom Miewald, US Fish and Wildlife Service; Michael Schindel, The Nature Conservancy; Gordon Reeves, US Forest Service; Amber Gladieux, Wild Salmon Center
Offered Presentations: Conservation Biology 3 - Wednesday (2011-04-06): 10:00 - 10:20 - Parlor BC
Abstract: Salmon Strongholds represent watersheds that have high anadromous salmonid abundance, productivity, and diversity, as well as habitat quality or other biological attributes important to sustaining viable populations of wild Pacific salmon throughout their range. The North American Salmon Stronghold Partnership (NASSP) is a voluntary, incentive-based, public private partnership whose mission is to accelerate the conservation of wild salmon strongholds in North America. NASSP has adopted an approach for salmon strongholds identification based on expert judgment, spatial and empirical data and decision support tools. This presentation explains the methodology used in the identification of six salmon strongholds in California (CA). This process may be summarized as follows: First, a project team consisting of state, federal, and NGO representatives approved eco-regional boundaries, reviewed the stronghold identification methodology, and established a working list of CA salmon experts to engage in an evaluation of the state's wild populations. Second, these salmon and steelhead experts provided their assessments of the

biological status of 507 populations, which yielded a map of strong populations. Third, the project team analyzed the strong population data, along with Trout Unlimited's Conservation Success Index (CSI) by using a conservation decision support tool called Marxan to identify high conservation value watersheds. Finally, the project team presented the methodology and results of this process to the Stronghold Partnership Board, which approved the CA Salmon Stronghold map. This presentation will focus on the use of expert opinion scores, landscape-scale watershed condition data, and Marxan to prioritize areas for salmon conservation.
Keywords: Salmon, Prioritization, Marxan, Conservation planning, Watershed assessment

258. Testing network theory assumptions with empirical data: sensitivity analysis of spatial landscape genetic network models
Authors: Naujokaitis-Lewis, Ilona Naujokaitis-Lewis, University of Toronto; Yessica Rico, University of Toronto Mississauga; John Lovell, Colorado State University; Marie-Jos Fortin, University of Toronto; Melanie Murphy, University of Wyoming
Offered Presentations: Conservation Biology 3 - Wednesday (2011-04-06): 10:20 - 10:40 - Parlor BC
Abstract: Network analyses are becoming a prominent approach to model connectivity among habitat patches, prioritize sites for conservation, and more recently to identify landscape features influencing gene flow. Although network analyses provide a conceptually strong framework and a computationally efficient approach, network model uncertainty is often not quantified and may result in unreliable predictions. Using a complete sample of all possible breeding ponds in the study area for the Columbia Spotted Frog (Rana luteiventris), we performed spatial landscape genetic network analyses where nodes represent breeding ponds and links between nodes represent genetic distance (eight microsatellite loci, 29 ponds, n = 442). Testing the assumption of complete nodes within a network, sensitivity analyses identified variation in sampling intensity as the most influential parameter on network centrality indices. As there are several possible criteria for establishing links, making it possible to evaluate alternative hypotheses regarding the incidence of gene flow among nodes, we tested the effect of missing links by varying the algorithm used to connect nodes. Although Mantel correlations appeared more robust to variation than network centrality indices, we demonstrate that the network algorithm has a clear influence on the inferences made regarding the role of landscape variables on gene flow. Our results underscore the importance of accounting for uncertainty in model structure and explicit testing of assumptions so that outcomes of network analyses are robust in their application and interpretation.
Keywords: Network theory, Functional connectivity, Genetic distance, Amphibians, Uncertainty

259. Spatial and temporal patterns of the bank swallow on the Sacramento River, California
Authors: Hatfield, Dawn Garcia, CSU Chico; Joe Silveira, Sacramento Wildlife Refuge, US Fish and Wildlife Service; Adam Henderson, California Department of Water Resources
Offered Presentations: Conservation Biology 3 - Wednesday (2011-04-06): 11:40 - 12:00 - Parlor BC
Abstract: Though the bank swallow (Riparia riparia) is widely distributed, it is a state threatened species in California due to declining populations resulting from bank protection projects along erodable river banks where the birds nest. More than 50% of the California nesting bank swallow population occurs on a 100-mile stretch of the Sacramento River. However, an estimated 48% of main channel and levy banks have been armored. Because the bank swallow requires natural river processes for breeding habitat, it is considered a focal and indicator species for the Sacramento River. Annual surveys were implemented on the Sacramento River in 1986 and this 24-year data set provides an invaluable resource to assess the species status. However, the annual survey data was comprised of raw, unchecked data lacking spatial integrity. We spatially rectified the last 11 years of data and evaluated the spatial and temporal trends in colony dynamics and associated physical setting. The Sacramento River bank swallow population remained relatively stable but at 60% of the 1987 population estimates. Larger colonies tended to be located in the upstream river reaches and

whereas colonies were more numerous the downstream reachs. Larger colonies persisted the longest (8-10 years) but small to medium sized colonies that persisted 1-2 years were more common. Erosion activity was also positively associated with colonies persistence. Insights gained from this study (eventually including all 24 years of survey data) are critical to river and resource management interests to ensure bank swallow population persistence, a barometer of river processes integrity.
Keywords: Bank swallow, Spatial trends, Temporal trends, River processes

260. Do neighbors and neighborhood matter? The role of landscape matrix & propagule pressure in predicting species distribution
Authors: Thomas, Shyam Thomas, Iowa State University; Kirk Moloney, Iowa State University
Offered Presentations: Conservation Biology 3 - Wednesday (2011-04-06): 11:00 - 11:20 - Parlor BC
Abstract: Understanding distribution pattern of an invasive species across a landscape is a formidable challenge given the non-equilibrium nature of such spatial distributions. I address this challenge for Purple Loosestrife (Lythrum salicaria L.), an invasive wetland plant, by analyzing systematically the spatial distribution pattern of loosestrife with the help of GIS read land use land cover raster (NLCD2001) and nearly 20 years of survey data (presence only records) obtained from MN-DNR. In this ongoing study, I will explore the role of habitat, landscape matrix and propagule pressure in determining the potential distribution of loosestrife across the landscape of MN. Habitat preference of loosestrife was identified by finding the key land use land cover (LULC) types. Selecting loosestrife occurrence from the most heavily invaded regions as calibration data and comparing it with 100 iterations of randomly simulated loosestrife distributions indicated strong habitat preference, namely herbaceous wetlands, open water and developed open spaces. Chi-square analysis showed that the proportion of actual loosestrife occurrence within these preferred LULC types is significantly higher than the proportions resulting from random simulation of loosestrife occurrence irrespective of the availability of these LULC types. Next, landscape matrix around the invaded habitats will be compared with similar habitats that are devoid of loosestrife presence to discern if there exists a scale specific matrix composition for invaded habitats. Lastly, role of propagule pressure will be analyzed using the nearest neighbor function or other similar neighborhood function to evaluate if loosestrife occurrence is influenced by presence of loosestrife invaded sites in vicinity.
Keywords: Spatial pattern, Invasive, Loosestrife, Scale, GIS

261. The science of random forest: new paradigm shifts favor open access, data mining, GIS, modern ecology and predictions
Authors: Huettmann, Falk Huettmann, University of Alaska
Offered Presentations: Conservation Biology 3 - Wednesday (2011-04-06): 11:20 - 11:40 - Parlor BC
Abstract: Random Forest (RF) is one of the ensemble modeling methods that enjoys wide popularity and which can be used in most disciplines of science. This non-parametric tree-based modeling algorithm is already widely used in landscape ecology. It has major advantages but also received some criticisms. Here I will show several major publications that use RF, and which make the pros and the cons clearer, e.g. in quantitative and spatial terms. However, in this presentation I will focus more on a summary of these studies, and emphasize what it means for the underlying science model we pursue in landscape ecology and sustainability science. RF affects not only how we have to sample, and how to infer knowledge, but also how we deal with certainty and with complex and “messy” and interacting data sets typically found in ecology. RF deals with all sorts of data, and is particularly strong in predictions and data-mining, a discipline that is urgently needed when dealing with data-hungry online databases for instance. I provide strong evidence that RF promotes a general paradigm shift in the sciences, modifies the traditional notion of single-species studies and hypothesis testing, for the underlying funding and publication concepts, and for adaptive management. Finally, I show how RF affects the philosophy of science (e.g. K. Popper and R.A. Fisher), landscapes overall, the precautionary principle and institutions and universities.

Keywords: Random forest, Philosophy of science, GIS, Data mining, Sustainability

262. Comparing Sandhill crane flight avoidance behaviors with land cover near power lines to assess collision risk

Authors: Ness, Kim Ness, University of Wisconsin at Madison; Janet Silbernagel, University of Wisconsin at Madison; Mike Engels, International Crane Foundation

Offered Presentations: Conservation Biology 3 - Wednesday (2011-04-06): 10:40 - 11:00 - Parlor BC

Abstract: Power lines pose flight hazards to large, broad-winged birds, such as cranes. Cranes may strike power lines when line visbilitiy is low or when lines bisect preferred habitats. As a result of frequently flying near power lines located between foraging fields and roosting wetlands, cranes may suffer serious injuries or death by striking the line mid-flight. Recent spatial models correlated habitat preference of cultivated crops to known locations where cranes died from striking power lines. However, these models could only predict collision risk based on presence or absence of cultivated land; thus excluding the important explanatory variables of weather and season. Our project focused on measuring crane's abrupt flight reactions near power lines during different weather types, season, and land covers. We used this more active method for identifying collision risk by recording abrupt flight avoidance behaviors near power lines as the indicator of risk. Given similar weather and seasons, we compared land cover under mapped crane flight paths. We found clustered locations where more cranes showed abrupt reactions near pasture hay and row-crop agriculture, with some wetlands. I will discuss crane migration scenarios with different levels of collision risk that link crane reactions and land cover to different weather types and seasons. This research will inform future risk assessments of collision risk across the national power grid. Electric utilities and agencies can use this flight behavior assessment to more safely site new power lines or retrofit existing power lines with markers to increase visibility to cranes across the landscape.

Keywords: Flight reactions, Grus canadensis, Power line collisions, Risk assessment, Spatial analysis

263. Forest type influences ecosystem response to bark beetle disturbance

Authors: Griffin, Jacob Griffin, University of Wisconsin; Monica Turner, University of Wisconsin; Martin Simard, University of Wisconsin

Offered Presentations: Disturbance 2 - Wednesday (2011-04-06): 13:00 - 13:20 - Broadway 3

Abstract: Western North American forests are currently experiencing widespread outbreaks of multiple native bark beetle species. Though bark beetle disturbance initiates similar changes in canopy condition and forest structure, forests dominated by different tree species have unique biogeochemical properties, which may result in different ecosystem responses to this common disturbance. We compared changes in forest structure, litter-soil microclimate, and the nitrogen (N) cycle of lodgepole pine (Pinus contorta) and Douglas-fir (Pseudotsuga menziesii) forests following outbreaks of the mountain pine beetle (Dendroctonus ponderosae) and the Douglas-fir beetle (Dendroctonus pseudotsugae), respectively. Both disturbances reduced live stand basal area by >50% and initiated a pulse of litterfall, yet only in lodgepole pine did this alter litter-soil microclimate. In both forest types bark beetle disturbance increased the N content of needle litter, the total litter N pool size, and approximately doubled soil inorganic N pools and fluxes. In the canopy of both forest types, N pool size declined with beetle-killed basal area, but the N content of composite foliage in unattacked trees increased approximately 20%. However, only in lodgepole pine forests were increases in soil N positively related to the foliar N of current year needles. Our results suggest that beetle disturbance causes similar changes in litter and soil N cycling within both forest types, but has differing effects on litter-soil microclimate and the response of undisturbed vegetation to increased nutrient availability. These differences in ecosystem response to a similar disturbance likely result from differing pre-disturbance N capital, N-limitation status, and understory vegetation dynamics.

Keywords: Disturbance, Nitrogen cycling, Pinus contorta, Pseudotsuga menzesii, Dendroctonus bark beetles

264. Effects of recent mountain pine beetle infestation on fire severity and post-fire regeneration in a lodgepole pine forest of Greater Yellowstone
Authors: Harvey, Brian Harvey, University of Wisconsin - Madison; Monica Turner, University of Wisconsin - Madison; Daniel Donato, University of Wisconsin - Madison; William Romme, Colorado State University; Martin Simard, University of Wisconsin - Madison
Offered Presentations: Disturbance 2 - Wednesday (2011-04-06): 13:20 - 13:40 - Broadway 3
Abstract: Stand-replacing fires and mountain pine beetle (Dendroctonus ponderosae) outbreaks are important natural disturbances in lodgepole pine (Pinus contorta var. latifolia) forests of western North America. Both disturbances have increased in severity and extent in recent decades and are predicted to continue this trend in a warming climate over the next century, raising questions about their potential interactions. Recent studies suggest that beetle infestation may reduce fire severity, but this interaction has seldom been tested empirically. During summer 2010, we conducted field studies in a beetle-infested lodgepole pine forest that burned in 2008 to determine how landscape heterogeneity in recent beetle disturbance affected fire severity and post-fire tree establishment. We sampled 100 circular plots (30-m diameter) that burned in the ~6,000-ha New Fork Lakes Fire on the Bridger-Teton National Forest, Wyoming. Burn severity and post-fire tree seedling density were evaluated against field measures of pre-fire beetle activity and severity, pre-fire stand structure, topography and fire weather conditions. Initial analyses indicate that fire severity declined with severity of pre-fire bark beetle infestation (which ranged from 0 to 80% basal area with evidence of pre-fire beetle attack); pre-fire basal area and the day and time of burn were also significant. Post-fire lodgepole pine seedling density was abundant (median density >30,000 ha-1), was positively correlated with the pre-fire percentage of canopy trees bearing serotinous cones, and was greatest in plots of moderate-severity burn. These results suggest that recent beetle outbreak neither increased fire severity nor compromised post-fire establishment of lodgepole pine seedlings.
Keywords: Mountain pine beetle, Dendroctonus ponderosae, Lodgepole pine, Pinus contorta var. latifolia, Disturbance interactions

265. Modeling the effects of bark beetles, climate, and topography on fire occurrence in Western U.S. forests
Authors: Bisrat, Simon Bisrat, OSU; Michael White, USU; Barbara Bentz, US Forest Service
Offered Presentations: Disturbance 2 - Wednesday (2011-04-06): 13:40 - 14:00 - Broadway 3
Abstract: The complex interaction between bark beetles and fire in western U.S. forests is not yet well understood. Even though the conventional wisdom suggests that bark beetle-caused tree mortality predisposes forests for an increased fire risk, the existing scientific evidence to date is either inconclusive in some forest types or non-existent in others. In order to bridge this knowledge gap, we conducted a study using data from spruce-fir, lodgepole pine, Douglas-fir, and ponderosa pine forests in contiguous western U.S. forests. We employed a retrospective research approach by comparing previously remotely observed fire occurrences (from MODIS satellite) for 2001 to 2005 fire years and bark beetle outbreaks (from USFS aerial detection survey data) for 2000 to 2005. We used random forest classification algorithm to evaluate the role of bark beetle-caused tree mortality in influencing fire occurrence relative to other climate and topography-derived predictors. When our models - with an accuracy within the range of well-performing models - are fitted for all fires that occurred in each forest type, climate and topography-derived predictors were overwhelmingly the most selected predictors to influence fire occurrence in all forest types and fire years while bark beetle-caused tree mortality showing no or little importance to influence fire occurrence. When only areas with bark beetle activity included, the results were largely unchanged. Our results generally do not support the hypothesis that bark beetle-caused tree mortality increases the likelihood of fire occurrence in western U.S. forests.
Keywords: Fire, Bark beetles, Western US forests, MODIS

266. Contrasting the landscape ecology of bark beetle and defoliator impacts on tree mortality and fire hazard in the PNW Region
Authors: Meigs, Garrett Meigs, Oregon State University; Robert Kennedy, Oregon State University
Offered Presentations: Disturbance 2 - Wednesday (2011-04-06): 14:00 - 14:20 - Broadway 3
Abstract: Forest insects are important disturbance agents, catalyzing ecosystem change at multiple spatiotemporal scales. This study combines field, aerial survey, and satellite observations to investigate and compare the effects of bark beetles and defoliators on tree mortality and surface fuels. We stratified the Pacific Northwest study region by forest type, time since insect disturbance, and insect agent (bark beetle: mountain pine beetle [Dendroctonus ponderosae] vs. defoliator: western spruce budworm [Choristoneura occidentalis]). We compared field measurements at federal inventory plots with Landsat TM/ETM+ spectral trajectories since 1985 and with cumulative mortality estimates from forest health aerial detection surveys (ADS) since 1980. Many insect disturbances appeared as persistent mortality signals evolving across space and over many years, making it critical that insect mapping methods capture a wide range of potential signals. The spatial patterns of both bark beetles and defoliators were strongly associated with the spatial patterns of host trees. Insect impacts were manifested as larger patches during outbreak years and across more homogenous landscapes, and defoliator effects tended to be more diffuse than bark beetles at landscape scales. Overstory tree mortality ranged widely and was generally partial to moderate (well less than 100% tree mortality) at the plot scale. These results demonstrate a wide range of physical, spectral, and spatial manifestations of insect activity in Pacific Northwest conifer forests. Given the likely increase of fire and insect activity in the western U.S., the accurate characterization of insect effects on tree mortality, fuel profiles, and fire hazard will become increasingly important.
Keywords: Bark beetle, Defoliator, Disturbance, Insect outbreak, Remote sensing

267. Landscape patterns of balsam woolly adelgid occurrence and subalpine fir mortality, Olympic Peninsula, WA
Authors: Hutten, Karen Hutten, School of Forest Resources, University of Washington; Christian Torgersen, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Cascadia Field Station; Andrea Woodward, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Olympic Field Station; Robert Kennedy, Department of Forest Ecosystems and Society, Oregon State University; Justin Braaten, Department of Forest Ecosystems and Society, Oregon State University
Offered Presentations: Disturbance 2 - Wednesday (2011-04-06): 14:20 - 14:40 - Broadway 3
Abstract: We are investigating spatial and temporal patterns of tree mortality and occurrence of balsam woolly adelgid (Adelges picea) in relation to physical geography and associated disturbance agents on the Olympic Peninsula, WA. The balsam woolly adelgid (BWA) is an exotic herbivorous insect first documented on the Peninsula in 1969. Aerial surveys and satellite imagery were used to identify areas of tree mortality within the range of the subalpine fir host. We hypothesized that tree mortality would be correlated with annual weather, aspect, elevation, and presence of BWA. Preliminary data indicate that BWA has affected subalpine fir trees of all ages across the peninsula, but distribution is patchy and severity is variable. The most severe gouting and defoliation occur on trees on south-facing slopes and adjacent to meadows at low elevations. Western balsam bark beetle (Dryocoetes confusus) and burl deformation appear to be more prevalent in mortality areas than previously documented.
Keywords: Balsam woolly adelgid, Tree mortality, Landscape disturbance, Insect and disease, Exotic insect

268. Within-stand variation in aboveground cover and nitrogen availability following stand-replacing fire in subalpine forests of Greater Yellowstone

Authors: Turner, Monica Turner, University of Wisconsin; WIlliam Romme, Colorado State University; Erica Smithwick, Pennsylvania State University; Daniel Tinker, University of Wyoming; Jun Zhu, University of Wisconsin
Offered Presentations: Disturbance 2 - Wednesday (2011-04-06): 14:40 - 15:00 - Broadway 3
Abstract: Natural disturbances affect the magnitude and spatial structure of variability in ecosystems, but variability within disturbed patches has not been well researched. We studied burned conifer forests in Greater Yellowstone to address two questions: (1) How do within-stand variability and spatial structure of aboveground cover and soil N availability change during the first four years following stand-replacing fire? (2) At fine scales (within stands), is N availability related to aboveground cover? Aboveground cover and soil N availability were measured annually from 2001-2004 using a spatially explicit sampling design (n = 81 cores/plot) in four 0.25-ha plots that burned during summer 2000. Within-stand variability (based on the coefficient of variation) in postfire vegetative cover declined with time since fire, whereas variability in abiotic cover was greatest 2-3 yrs postfire. The soil nitrate pool was more variable than the soil ammonium pool, but annual net nitrification rate was less variable than annual net N mineralization rate. Spatial structure (based on semivarograms) was observed at multiple scales in many response variables, but there was no obvious congruence in spatial scales of autocorrelation for aboveground cover and soil N availability. Nevertheless, significant Spearman correlations at the core level indicated that aboveground cover and soil N were coupled following severe fire, and that the dominant influence was from aboveground cover to soil N, rather than vice versa. Initial patterns of fire severity and re-vegetation contributed to dynamic fine-scale heterogeneity in soil N availability for at least four years after severe wildfire.
Keywords: Wildfire, Succession, Soils, Pinus contorta, Picea engelmanii

269. Exploring urban structure through 3-dimensional city modeling
Authors: Robinson, Kimberly Robinson, Purdue University; Bryan Pijanowski, Purdue University
Offered Presentations: Urban Landscapes 2 - Wednesday (2011-04-06): 13:00 - 13:20 - Council Suite
Abstract: Throughout the past few decades, there have been a growing number of researchers focused on the development of 3-dimensional data for urban areas. The demand for such data stems from multiple municipal, commercial, and scientific communities in the filed s of city planning, telecommunications, microclimate investigation, municipal and commercial infrastructure services, public safety, and disaster planning. Here, I present a simple methodology used for building identification, extraction, and 3-dimensional large-scale urban city modeling from Digital Elevation and Surface Models for the Indianapolis metropolitan area. Results from the building extraction process are compared to actual building footprints digitized from orthophotography to access accuracy and extraction method reliability across an urban-rural gradient. Additionally, the 3-dimensional city model was used to develop urban-structure and canyon metrics across multiple urban classifications, for future integration into a coupled land use/cover change prediction, hydrologic flow, and regional atmospheric model. The coupled model system makes use of urban energy budgets to study the effects of large metropolitan areas on storm event hydrologic and atmospheric dynamics.
Keywords: Building extraction, 3-dimensional city model, Urban-rural gradient, Urban energy budget

270. Modeling exurban development: comparison of a pattern-based model and a spatially explicit econometric model
Authors: Suarez-Rubio, Marcela Suarez-Rubio, University of Maryland Center for Environmental Science; Todd Lookingbill, University of Richmond; Lisa Wainger, University of Maryland Center for Environmental Science
Offered Presentations: Urban Landscapes 2 - Wednesday (2011-04-06): 13:20 - 13:40 - Council Suite
Abstract: People's decisions to convert rural lands into exurban development affects landscape patterns, with potentially negative consequences on natural wildlife and ecosystem services. Pattern-based models have been very successful in modeling urban growth but these models do not account

for decision making of individuals. It is unclear whether the approach would be as successful in the exurban environment. In contrast, spatially-explicit econometric models are formulated based on economic transactions and individual decisions are aggregated to describe changes in regional pattern. However, econometric models are data hungry and difficulties in linking their parcel-based information to raster-based data limit their widespread application within landscape ecology. The objective was to assess how different these models are in modeling exurban development in northern Virginia and western Maryland. We used SLEUTH (Slope, Land use, Exclusion, Urban extent, Transportation, and Hillshade) as our pattern-based model and forecasted exurban growth over a 23 year period. We parameterized a complementary log-log hazard model as our econometric model and used risk of conversion to create a map of development pressure. The TM pixel was the unit of observation to allow comparison between models. The performance of the models was evaluated using ROC curves. The econometric model performed significantly better than the pattern-based model (area under the curve was 0.67 for SLEUTH and 0.94 for the econometric model). Although econometric models require knowledge on how individuals maximize expected profits of converting their land, information on individual's decisions plays an important role when the land is converted to exurban development.
Keywords: Low-density residential development, SLEUTH, Hazard model, Land-cover change, Mid-Atlantic

271. Assessing avian species richness and sensitivity to urban landscapes
Authors: Iglecia, Monica Iglecia, USGS Cooperative Fish and Wildlife Research Unit, North Carolina State University; Jaime Collazo, USGS Cooperative Fish and Wildlife Research Unit, North Carolina State University; Alexa McKerrow, Biodiversity and Spatial Information Center, North Carolina State University
Offered Presentations: Urban Landscapes 2 - Wednesday (2011-04-06): 14:00 - 14:20 - Council Suite
Abstract: The urbanization process transforms natural habitats into impervious surfaces, threatening many species. A greater understanding about how these changes influence species richness, composition, and occurrence can inform conservation planning. We integrated the North American Breeding Bird Survey and the National Land Cover Dataset to assess species responses to varying levels of urbanized habitat in the southeastern United States. We asked if: (1) species richness differed between sampling units containing high versus low levels of urban habitat, and (2) species' response conformed with expected sensitivity to urbanization. Species were categorized according to their sensitivity to urban habitats into exploiters, adapters, or avoiders. We used occupancy models to gauge responses of 16 focal species based on the direction (positive/negative) and strength (95% CIs do not overlap zero) of the beta parameter relating percent urban habitat to occupancy probability. We expected the relationship to be positive and strong for exploiters, and negative and strong for avoiders. As predicted, species richness was higher in low-urban route-segments than in high-urban segments. Also as predicted, 2 of 3 urban exploiters were positively and strongly associated with increasing urbanized landscapes. In contrast, there was no support for a strong, negative relationship for urban avoiders. Results suggest that urban adapters and avoiders are adept at using the low-levels of urbanized habitat characterizing BBS routes. Options to relocate BBS routes will diminish with increasing urbanization. Thus, BBS routes provide future opportunities to assess responses of urban avoiders, a group that contains many species of conservation concern in most states.
Keywords: Urbanization, Birds, Occupancy modeling, Southeastern United States, Species richness

272. Local and watershed controls on the thermal regime of urban streams
Authors: Somers, Kayleigh Somers, Duke University; Emily Bernhardt, Duke University; Dean Urban, Duke University; James Grace, USGS
Offered Presentations: Urban Landscapes 2 - Wednesday (2011-04-06): 14:40 - 15:00 - Council Suite

Abstract: Cities create â€œheat islandsâ€ with air temperatures up to 12ËšC greater than surrounding areas and impervious surface reaching temperatures 50ËšC greater than the air. Streams that drain urban areas tend to be hotter at baseflows, due to warmer urban air temperatures and decreased riparian canopy cover. Urban stormflows route precipitation over hot impervious surfaces and through storm drains directly into streams, with the potential for creating rapid changes in stream temperatures. The thermal regime of stream ecosystems is an important driver of biogeochemical processes and determinant of habitat quality. Yet current urban stream restoration and management efforts fail to consider thermal regimesâ€"indeed several common approaches intensify thermal pollution. To more effectively mitigate these trends, we need to better understand how reach- and catchment-scale characteristics interact to determine stream temperature regimes. In summer 2009, we collected continuous (15-minute interval) temperature data for 61 streams, spanning a land use gradient across the Piedmont of North Carolina. We used structural equation modeling to explore how a variety of reach- and catchment-scale attributes interact to determine maximum temperatures and rates of temperature change associated with stormflows. We found that the best predictive model of baseflow temperatures (R2=.421) includes strong correlations with reach-scale factors (canopy cover and stream width) and weak correlations with road density at catchment scale. In contrast, the best predictor for maximum rate of change is the percentage of impervious surface cover in the catchment, with only weak correlations with reach scale factors of local buffer area and stream width (R2=.556).
Keywords: Urban, Stream, Thermal, SEM, Stormwater

273. Revisiting the foundations of spatial network analysis
Authors: Fletcher, Robert Fletcher, University of Florida; Miguel Acevedo, University of Florida; Brian Reichert, University of Florida; Kyle Pias, University of Florida; Wiley Kitchens, Florida Fish and Wildlife Research Unit
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 13:00 - 13:20 - Forum Suite
Abstract: A growing concern in network analysis is how network representations are constructed and the reliability of data used in making inferences on networks. This concern is strikingly relevant to spatial ecology, where, due to the difficulty of collecting reliable data on movement, most network analysis proceeds with assumptions regarding movement rather than using direct observations on movement to construct spatial networks. We confront two common approaches to constructing spatial networks with limited dataâ€"using the maximum known dispersal distance or using an assumed dispersal kernelâ€"to model-based inference from empirical movement data to ask the degree to which recent approaches can quantify observed network structure and predict linkages with limited data. Our model uses a Bayesian latent space formulation to not only test formal hypotheses regarding network structure but also predict missing and spurious linkages in a flexible manner. We applied these network constructions to two mark-recapture datasets that vary in several orders of spatial magnitude: within-field movements of a cactus-feeding insect on patchy cactus and breeding-season movements of the endangered Snail Kite (Rostrhamus sociabilis) across wetlands in peninsular Florida. Using the maximum known dispersal distance for constructing networks fails to recover observed network structure; however, using an assumed dispersal kernel can, under some cases, recover observed network structure. Our modeling approach accurately predicts linkages and recovers network properties and can do so even with limited data (only 40% of linkages known), suggesting this approach may be a powerful alternative for interpreting connectivity and spatial population structure in heterogeneous landscapes.
Keywords: Graph theory, Connectivity, Network, Fragmentation, Movement

274. Linking forest spatial pattern analysis and network theory
Authors: Vogt, Peter Vogt, EC-JRC
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 13:20 - 13:40 - Forum Suite

Abstract: The analysis of forest spatial pattern and habitat corridors is an important component in conservation and restoration policies. Morphological Spatial Pattern Analysis (MSPA) provides an intuitive description of image pattern structures as well as a reliable detection of connecting pathways. This pattern analysis can then be transferred for further studies using network theory approaches, which are particularly suited to quantify the importance of the MSPA-detected nodes and links. The free software toolbox GUIDOS is designed to provide appropriate tools for the application of recent research studies to scientists and especially newcomers in the field of landscape ecology. GUIDOS supports generic image processing tasks, MSPA analysis, and network theory examinations based on Conefor Sensinode. The combination of spatial pattern and network analysis is mutual beneficial and adds value in risk assessment studies, landscape planning, and socio-economic sustainability. The key features of MSPA and network analysis in GUIDOS will be illustrated and explained on a sample data set.
Keywords: MSPA, Pattern, Graph-theory

275. The effects of land use disturbance at local and regional scales on wetland effects on lake total phosphorus and water color
Authors: Fergus, C. Emi Fergus, Department of Fisheries and Wildlife, Michigan State University; Patricia Soranno, Department of Fisheries and Wildlife, Michigan State University; Kendra Cheruvelil, Lyman Briggs College, Michigan State University; Mary Bremigan, Department of Fisheries and Wildlife, Michigan State University
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 14:00 - 14:20 - Forum Suite
Abstract: Wetlands surrounding lake bodies are known to affect lake total phosphorus (TP) concentrations and water color (Col). However, it is not well understood whether wetland relationships with TP and color are similar across geographic regions. In addition few studies have examined how human disturbances affect wetland TP and Col relationships and at what spatial scale interactions may occur. To explore these information gaps, we quantified wetland relationships with lake total phosphorus and water color in relation to landscape features at local and regional scales using multilevel mixed effects models on 1,790 north-temperate lakes within 23 ecological regions. We found that wetland relationships with lake TP and Col were not the same across ecological regions. We also found that land use disturbance at the local scale did not interact with wetland-lake TP relationships, but regional agriculture was negatively related to wetland-lake TP slopes. In addition, lake TP and water color were related to similar local lake and catchment characteristics but different regional characteristics. These results demonstrate that lake TP and water color are hierarchically controlled by landscape variables at both local and regional scales and that regional setting influences wetland relationships.
Keywords: Wetlands, Lake TP, Multilevel models

276. Multi- scale assessment of landscape characteristics influencing local grizzly bear abundance
Authors: Graves, Tabitha Graves, Northern Arizona University; Katherine Kendall, USGS Northern Rocky Mountain Science Center; Jeffrey Royle, USGS Patuxent Wildlife Research Center; Paul Beier, Northern Arizona University; Jeffrey Stetz, University of Montana
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 14:20 - 14:40 - Forum Suite
Abstract: Over 1500 genetic samples of 545 grizzly bears (Ursus arctos) collected in 2004 across the ~ 8 million acre Northern Continental Divide Ecosystem in northwestern Montana, USA were formatted as a spatial mark-recapture data set. We used an N-mixture model that simultaneously adjusts for imperfect detection, determines the relative influence of landscape variables on local abundance, and estimates local abundance for each sample unit. We describe the landscape variables most important to abundance of male and female grizzly bears at 3 different scales. We will outline the modeling procedure and compare it to occupancy models. For the median female (10.3 x 10.3 km2) and male (19.7 x 19.7 km2) home range scales, abundance of male and female grizzly

bears is best predicted by the amount of mesic (wet) habitat, the amount of meadow and shrub habitat, historical presence of bears (versus being outside the recovery area), and management level. At the 7x7 km2 scale, avalanche chute area helped explain female abundance along with the variables above, while amount of mesic habitat, precipitation, area recently burned, and hunter density best explained male abundance. At the 7 x7 km2 scale we may be describing habitat selection rather than abundance. Management level reflects differences in land management for roads, attractant storage, attractant enforcement, and human activity cross the range of ownership from national parks to private lands. We will discuss the variables selected in this analysis and the implications for ecology and management of grizzlies in northwestern Montana.
Keywords: Abundance, Density, Bear, Scale, Habitat

277. The use of cyberinfrastructure for the spatial simulation of complex urban-rural land transition
Authors: Tang, Wenwu Tang, University of North Carolina at Charlotte; Douglas Shoemaker, University of North Carolina at Charlotte; John Vogler, University of North Carolina at Charlotte; Monica Dorning, University of North Carolina at Charlotte; Ross Meentemeyer, University of North Carolina at Charlotte
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 14:40 - 15:00 - Forum Suite
Abstract: Urban-rural land transition is a complex spatiotemporal phenomenon driven by multiple biophysical and socioeconomic factors. The simulation of urban-rural transition captures the complexity of coupled urban-rural systems, but requires considerable computing resources and results in a suite of computational issues. Emerging cyberinfrastructure and associated technology provide capabilities for high-performance computing and massive data handling, which offer a means of resolving computational issues associated with complex urban-rural simulation. In this paper, we present a cyberinfrastructure approach that allows us to conduct computationally intensive urban-rural simulation by leveraging advanced high-performance computing resources. The simulation model that we applied was developed specifically to represent complex spatial dynamics of urban-rural land transition in the Greater Charlotte region in North Carolina, USA. We designed a set of experiments to investigate the capability of the cyberinfrastructure approach for simulating coupled urban-rural systems. Experimental results show that cyberinfrastructure provides tremendous support for computationally intensive spatial simulation and, most importantly, enables further insight into the complexity of urban-rural land transition.
Keywords: Urban-rural land transition, Spatial simulation, Cyberinfrastructure, High-performance computing

278. Spatial and temporal dynamics in garlic mustard (Alliaria petiolata) population regulation
Authors: Biswas, Shekhar Biswas, University of Toronto; Helene Wagner, University of Toronto
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 15:20 - 15:40 - Forum Suite
Abstract: Populations and communities are shaped by a combination of processes including environmental filtering and biotic interactions. Although relevant ecological theories that explain population dynamics (e.g., population regulation theory) assume constant processes over space and time, the processes may vary among habitat types and over seasons. We studied the spatial and temporal dynamics in population regulation in Garlic mustard (Alliaria petiolata), an invasive biennial forest understory species. We conducted a density manipulation experiment and a 2-year demographic monitoring study in three contrasting habitat types (11 populations, a total of 400 quadrats of 1m2). We asked whether A. petiolata shows density-dependent survivorship and fitness, and whether the nature and strength of density dependence vary with seasons, with spatial location within populations, and with habitat types. In all cases, we evaluated environmental factors (light, soil moisture and pH) as an alternative. Density-dependent survivorship varied between seasons, with negative effects of density on survivorship in summer but positive effects in winter. After accounting for environmental heterogeneity and patchy distribution of species, we found that the strength of

density dependence varied with relative position within populations and with habitat types. Collectively, our results suggest that density-dependent population regulation varies strongly with seasonal and spatial environmental heterogeneity. This example demonstrates that environmental filtering and biotic interactions may not be additive but interactive factors shaping dynamics of natural populations and communities.
Keywords: Spatio-temporal dynamics, Spatial analysis, Species interactions, Population dynamics

279. Development and use of a hydrologic complexity index as a proxy for nutrient retention at landscape scales
Authors: Allen, Paula Allen, USEPA; Maliha Nash, USEPA; Ann Pitchford, USEPA
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 15:40 - 16:00 - Forum Suite
Abstract: Hydrologic complexity of a watershed is a function of the number, type, spatial arrangement and connectivity of water bodies on the landscape. Despite difficulties in measuring highly variable spatial and temporal de-nitrification rates within and among water body types, the type of water body and its connectivity with others affects water residence time and therefore nutrient processing and retention. The development of indices for determining the relative nutrient processing among watersheds, making nutrient management decisions and gauging tradeoffs among other ecosystem services is therefore an important research goal. Hence, we developed a hydrologic complexity index (HCI) which is a composite of metrics related to hydrologic complexity (number and spatial arrangement of water bodies, stream proximity, water balance, and land cover affecting nitrogen retention). Nitrogen retention was calculated via mass balance (subtracting inputs from outputs) using readily available GIS coverages of nitrogen inputs and outputs to 73 third-order watersheds in four Midwestern states (MN, WI, IL, and IA). We tested the hypothesis that hydrologic complexity has no influence on total nitrogen retention. Results show that total nitrogen retention does increase with hydrologic complexity suggesting our HCI may be useful as a proxy for total nitrogen retention at landscape scales. Further work is needed to evaluate the expanded use of the index to other Midwestern areas and nationally; and to evaluate scale effects of the index by comparing results across multiple watersheds/stream orders.
Keywords: Hydrologic complexity, Landscape metrics, Watershed, Mass balance, Nitrogen retention

280. Local lake and regional landscape factors drive zooplankton communities
Authors: Spence Cheruvelil, Kendra Spence Cheruvelil, Michigan State University; Joshua Booker, Michigan State University
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 16:00 - 16:20 - Forum Suite
Abstract: Aquatic metacommunities are structured by both local and regional factors, but the relative importance of these factors are not clear. The conversation about zooplankton community structure has so far defined regional factors as the spatial configuration of lakes and the related dispersal limitation of individuals. Here, we expand the definition to include landscape features such as land use and watershed attributes. Using data from 54 Michigan lakes, we examined the relative contribution of local lake features (e.g., water chemistry, phytoplankton biomass, macrophyte cover) and regional landscape features (e.g., agriculture in catchment, number of upstream connected lakes) to the variation in lake zooplankton communities using redundancy analysis (RDA). This study incorporates features at different spatial scales in order to learn more about how local aquatic communities are maintained within a connected landscape and has implications for catchment- and landscape-based management and conservation.
Keywords: Metacommunity, Zooplankton, Landscape, Spatial scale, Lake

281. Modeling regional-scale carbon dynamics in Pacific Northwest forests: 1972-2008
Authors: Wallin, David Wallin, Western Washingtion University; Mark Harmon, Oregon State University; Warren Cohen, US Forest Service; Robert Kennedy, Oregon State University

Offered Presentations: Carbon - Wednesday (2011-04-06): 13:00 - 13:20 - Studio Suite
Abstract: Most analyses suggest that balancing the global carbon budget requires a significant sink on land in the temperate zone of the northern hemisphere. Clarifying this issue will require better information on regional carbon budgets. We discuss the use of a simple carbon model, in conjunction with satellite data, to quantify carbon flux from a 49,000 km2 multi-ownership, forested landscape in western Oregon. The model quantifies carbon storage in living, detrital and forest products pools. Between 1972 and 1991, high timber harvest rates resulted in a large net flux of carbon to the atmosphere. After 1991 timber harvest rates on federally managed lands declined by over 90% and the study area became a net sink for carbon. There was considerable spatial and temporal variation in C flux. Spatial variability in C flux was related to site quality and land use with large differences between private and public lands. Temporal variability in C flux was primarily related to changes in timber harvest rates. The largest net release of C to the atmosphere (1.2 Mg C/ha/yr) occurred during 1972-77 and the largest uptake of C occurred during the last few years of the study period. These results are used to illustrate the natural and anthropogenic sources of heterogeneity that can influence carbon budgets at the regional scale and how remotely sensed data can be used to help quantify this heterogeneity.
Keywords: Carbon flux, Landuse, Carbon budget

282. Multi-temporal LiDAR for mapping change in aboveground carbon pools in an actively managed coniferous forest
Authors: Hudak, Andrew Hudak, US Forest Service, Rocky Mountain Research Station; Eva Strand, University of Idaho; Lee Vierling, University of Idaho; Jan Eitel, University of Idaho; Sebasti Martinuzzi, University of Wisconsin
Offered Presentations: Carbon - Wednesday (2011-04-06): 13:20 - 13:40 - Studio Suite
Abstract: LiDAR remote sensing has been shown to facilitate accurate estimation of aboveground biomass; however, much less is known about the accuracy of estimating biomass change from multi-temporal LiDAR surveys with different point densities. We therefore evaluated the accuracy of LiDAR-derived estimates of biomass change between 2003 and 2009 across 20,000ha of an actively managed, mixed conifer forest landscape in northern Idaho, USA. Tree characteristics were measured in 2003 and 2009 within 400m2 forest inventory plots established following a random stratified sampling design. Species-level tree biomass estimates were aggregated to the plot level and then predicted from LiDAR-derived height, density, intensity, and topographic metrics extracted from the plot footprints at both points in time. Using the Random Forest algorithm, independent 2003 and 2009 biomass models were developed to map biomass across the landscape at a 20m x 20m (400m2) resolution. Aboveground biomass maps were then aggregated to the stand level and validated with independent stand exam data. We found that approximately 25% of the landscape has been disturbed by harvest activities during the six-year time period. The >10-fold increase in sampling density between the two LiDAR surveys did not affect the plot-level distribution of canopy heights. Consequently, plot-level aboveground biomass estimates and pixel-level biomass predictions were stable despite the different LiDAR point densities. We conclude that growth and harvest disturbance have offsetting impacts on aboveground biomass stores that are in proportion to their magnitude and scale, and that biomass change and carbon sequestration can be accurately mapped from repeat LiDAR surveys.
Keywords: Biomass, Carbon, Canopy, Forest, LiDAR

283. Characterizing forest recovery in western Oregon using time series of Landsat imageries
Authors: Yang, Robert Kennedy, Oregon State University; Warren Cohen, US Forest Service
Offered Presentations: Carbon - Wednesday (2011-04-06): 13:40 - 14:00 - Studio Suite
Abstract: Characterizing forest recovery following disturbance is critical for understanding the sustainability of forest ecosystems. Detailed knowledge on forest recovery patterns can also improve

models of carbon budgets. Using LANDSAT-based analysis, we examined forest recovery processes in western Oregon from 1985 to 2008. Disturbed forests with at least 10-years of recovery were monitored with spectral trajectory. Recovery processes for each stand were modeled with Chapman-Richard growth functions using tasseled cap indices. Spectral recovery trajectories were analyzed for different recovery patterns in terms of recovery delay and rate. Results showed diverse forest recovery trajectories in western Oregon. The spatial pattern of the recovery process was then summarized for the study and the relationships of forest recovery with social and environmental variables were examined.
Keywords: Forest recovery, Landsat

284. Afforestation under a carbon market in dynamic forest and agriculture landscapes
Authors: White, Eric White, Oregon State University; Gregory Latta, Oregon State University; Ralph Alig, US Forest Service; Darius Adams, Oregon State University
Offered Presentations: Carbon - Wednesday (2011-04-06): 14:00 - 14:20 - Studio Suite
Abstract: In the U.S., there is a lengthy history of land conversion between agriculture and forests. Afforestation of agriculture land is one of the clearest means to sequester additional carbon from the atmosphere. Afforestation for carbon sequestration can also produce the co-benefits of additional wildlife habitat, greater landscape connectivity, and improved water quality. Extensive afforestation of agriculture land can be achieved through government incentive programs (e.g., CRP) or via markets for environmental services, such as for carbon sequestration. The potential magnitude of afforestation under a carbon market within regions of the U.S. is not well known. In this research, we use a dynamic simulation model of the U.S. forest and agriculture sectors to develop regional-level projections of the amount of afforestation under carbon pricing. We report the projected forest types and management intensities on newly afforested lands. We examine projected harvesting activity on afforested landscapes to quantify the persistence of carbon sequestered through afforestation. To examine unintended carbon leakage resulting from afforestation, we test for increased levels of deforestation for agriculture and intensification of management practices within the two sectors. We discuss our results regarding future dynamic landscapes within the context of natural resource management and carbon market policy formulation.
Keywords: Carbon sequestration, Afforestation, Carbon markets

285. Influence of variable fire effects on post-wildfire carbon recovery
Authors: Carlson, Chris Carlson, University of Montana; Solomon Dobrowski, University of Montana; Hugh Safford, US Forest Service
Offered Presentations: Carbon - Wednesday (2011-04-06): 14:40 - 15:00 - Studio Suite
Abstract: There has been an increasing effort to understand how human and natural disturbances impact forest carbon (C) budgets at timescales important to sequestration. Human disturbances such as fuels reduction treatments directly alter the quantity and distribution of forest C stocks and also change wildfire behavior. As such, fuels treatments are understood to influence C fluxes during and after natural wildfire. Some studies have used fire behavior and stand growth models to examine how we might use thinning regimes to maximize C stocks in fire prone forests, but these studies only model a narrow range of fire effects. It remains unclear how variation in tree mortality during fire and tree regeneration after fire impact the timescale of post-fire carbon recovery. We use data collected from a natural mixed severity wildfire in the central Sierra Nevada, California which burned thinned and unthinned stands. We estimate the impact of thinning and wildfire upon aboveground C stocks. Secondly we use sensitivity analysis techniques to investigate how timescales of carbon recovery after fire are influenced by variable rates of tree mortality and regeneration. Rates of mortality from wildfire averaged 30% lower in treated stands, though treatments removed up to 50% of aboveground C. Regeneration rates were highly variable. Few seedlings emerged one year after fire, but two thirds of plots had regeneration in year two and three, with densities varying from 30 seedlings ha-1 to over

18,000. Results suggest that model predictions of post-fire carbon accumulation are highly influenced by mortality and regeneration rates.
Keywords: Carbon, Wildfire, Disturbance, Sensitivity

286. Variability and persistence of post-fire biological legacies in jack pine-dominated ecosystems of northern Lower Michigan
Authors: Kashian, Daniel Kashian, Wayne State University; R. Gregory Corace, US Fish & Wildlife Service; Lindsey Shartell, Michgan Technological University; Deahn Donner, US Forest Service; Philip Huber, US Forest Service
Offered Presentations: Disturbance 3 - Wednesday (2011-04-06): 13:40 - 14:00 - Broadway 4
Abstract: Stand-replacing wildfires have historically shaped the forest structure of dry, sandy jack pine-dominated ecosystems at stand and landscape scales in northern Lower Michigan. Unique fire behavior during large wildfire events often preserves long strips of unburned trees arranged perpendicular to the direction of fire spread. These biological legacies create heterogeneity across the burned and otherwise homogenous landscape, providing diversity of forest structure, stand age, and wildlife habitat. Emulating this heterogeneity is therefore an important aspect for forest managers aiming to mimic natural disturbances on these landscapes. However, little information exists on the size, shape, proportion, or other aspects of landscape structure as it pertains to biological legacies, nor on their persistence over time, in a way that managers can emulate their natural occurrence. We examined the occurrence of biological legacies following stand-replacing wildfires in jack pine-dominated ecosystems of northern Lower Michigan using a chronosequence of aerial imagery for northern Lower Michigan over the last 50 years. Fire perimeters and the biological legacies that occurred following wildfire were digitized into a geographic information system and analyzed with landscape metrics. Preliminary analysis suggests that biological legacies have considerable variability in initial shape and size, likely due to the initial stand conditions, fuel loading, and fire behavior, and the longevity of these legacies differed considerably over our sampled sites. Forest management actions (primarily artificial regeneration of jack pine) following wildfire have generally been detrimental to the long-term maintenance of biological legacies.
Keywords: Jack pine, Biological legacies, Wildfire, Michigan

287. Spatial optimization of fuel management activities for dry forest restoration
Authors: Ager, Alan Ager, US Forest Service; Nicole Vaillant, US Forest Service; Mark Finney,
Offered Presentations: Disturbance 3 - Wednesday (2011-04-06): 14:00 - 14:20 - Broadway 4
Abstract: Dry forest restoration is a management priority for the U.S. Forest Service, especially in the interior west where decades of fire suppression efforts have resulted in an increased frequency of uncharacteristic wildfires. Designing restoration projects on dry forest landscapes is a complex problem, and spatial planning models are often used to prioritize and optimize investments in management activities. For instance, treatment locations can be optimized by identifying regular patterns of treatments that result in the greatest reduction in landscape fire spread rate per area treated. Algorithms to perform this type optimization have been incorporated into wildfire behavior programs (FlamMap). In this work, we developed a spatial optimization process tailored to dry forest restoration, where the long term goal is to create large landscapes where natural and planned ignitions that can be managed to sustain fire resilient forests. Here, the optimization problem is to create large â€œfire readyâ€ patches within which fire behavior does not exceed thresholds that either result in loss of ecological value (large trees), or trigger fire suppression, while minimizing the area treated, and maximizing the value of the resources within the patch. We present the results of this optimization approach on a 245,000 ha area within the Deschutes National Forest. The work expands the application of spatial optimization in fuel treatment planning to the problem of dry forest restoration.
Keywords: Spatial optimization, Forest restoration, Wildfire risk

288. Evaluating the effects of forest restoration thinning on fire hazard and area burned in the Cedar River Municipal Watershed
Authors: Johnson, Morris Johnson, US Forest Service, Pacific Northwest Research Station, Pacific Wildland Fire Science Laboratory; David Peterson, US Forest Service, Pacific Northwest Research Station, Pacific Wildland Fire Science Laboratory; Amy LaBarge, 2Seattle Public Utilities, Cedar River Municipal Watershed
Offered Presentations: Disturbance 3 - Wednesday (2011-04-06): 14:20 - 14:40 - Broadway 4
Abstract: Forest managers at the Cedar River Municipal Watershed (CRMW) are actively thinning and leaving slash in Tsuga heterophylla and Abies amabilis ecosystems to accelerate late-successional forest habitat, to restore and sustain natural processes, and to protect and enhance water quality and quantity. CRMW is a major source of drinking water for over 1.4 million residents in the greater Seattle, Washington (USA) area. In 2006, CRMW managers contacted fire scientists at the Pacific Wildland Fire Sciences Laboratory in Seattle, WA to help evaluate the consequences of restoration treatments without slash removal. In this study, we quantified the potential consequences of restoration treatments on potential fire hazard and area burned using the Fire and Fire Extension to the Forest Vegetation Simulator (FFE-FVS) and FlamMap (fire behavior mapping and analysis program). We quantified changes in fuelbed characteristics (fuelbed loadings, fuelbed depth) over time and we measured the effects of two potential surface fuel treatments (lop and scatter and mastication). We founded that untreated slash increased fire hazard, fire behavior and area burned. FlamMap's burn probabilities were higher in treated areas. Our study results had an immediate impact on fuels management in the watershed. CRMW managers developed alternative treatment prescriptions and are removing slash to address the potential increase in fire hazard and area burned.
Keywords: Restoration, Fire hazard, Thinning, Watershed

289. Burn probability mapping in an ecologically complex and data-poor area of the Columbia Mountains
Authors: Parisien, Marc-Andr Parisien, Canadian Forest Service; Gregg Walker, Parks Canada; Brian Simpson, Canadian Forest Service; John Little, Canadian Forest Service
Offered Presentations: Disturbance 3 - Wednesday (2011-04-06): 14:40 - 15:00 - Broadway 4
Abstract: Rigorous fire and land management in fire-prone areas requires an estimate of fire likelihood at every point on the landscape. In recent years, powerful fire simulation models, in conjunction with an in-depth understanding of an area's fire regime and fire environment have enabled us to obtain estimates of spatial burn probabilities. Although generally robust, the accuracy of burn probability mapping is compromised where fires have been largely excluded for a long period of time (e.g., 100 years). Also problematic are areas with extremely complex fire environments, as current fire behavior systems have been designed to represent burning in comparatively simple vegetation-weather-topography conditions. This study describes a methodology for mapping burn probability in a difficult to model area, the greater Mount Revelstoke and Glacier National Parks (MRGNP), British Columbia, Canada. In addition to particularly rugged topography, this area of the Columbia Mountains is covered by vegetation types that are poorly-represented in fire behavior systems, even though they have experienced significant (if highly irregular) fire activity in pre-modern times (prior to 1915). Parameterization of the fire environment for simulation modeling thus constitutes a considerable challenge. This challenge was overcome by combining the various types of fire information (e.g., fire history studies, reconstructed fire climatologies), new technologies (high-resolution remotely sensed data, wind flow modeling), andâ€"a must in data-limited areasâ€"ample expert advice. The modeling made extensive use of personal accounts from experienced fire behaviour officers, both for input creation and interpretation of outputs. Although the accuracy of the output burn probability map in the MRGNP area may be impossible to assess, the multi-source model

building approach provides a conservative yet informative means of obtaining otherwise non-existent fire likelihood estimates.
Keywords: Burn probability, Fire regimes, Simulation modeling, Columbia Mountains

290. Historical structure and composition of dry forests in south central Oregon
Authors: Hagmann, R. Keala Hagmann, University of Washington; Jerry Franklin, University of Washington; K. Norman Johnson, Oregon State University
Offered Presentations: Forest Ecology - Wednesday (2011-04-06): 13:40 - 14:00 - Broadway 1
Abstract: Early 20th century Bureau of Indian Affairs timber cruises provide quantitative descriptions of dry forests of the Pacific Northwest at a spatial extent and resolution currently unavailable to stakeholders. To inform restoration guidelines, we analyzed a subset of this systematic, spatially explicit sample of >200,000 hectares of the Klamath Reservation Forest (now the Winema National Forest). Reference conditions reflecting processes that shaped forests for millennia are consistent with management objectives to reduce risk of unrecoverable loss expected from current and projected stressors. We summarized data describing structure and composition for two areas: 1) dry mixed conifer forest on residual soils and adjacent pine-bitterbrush south of the Sprague River and 2) pine-bitterbrush on deep popcorn pumice north of the Sprague River. Ponderosa pine comprised 65% (s=21) of the stand in the dry mixed conifer (ABCO) plant association group (PAG); 92% (s=12) of the south Ponderosa (PIPO) PAG; and 85% (s=27) of the north PIPO PAG. In the ABCO PAG, trees per hectare (TPH) â‰¥ 15.2cm DBH ranged from 26-185 (Î¼=78, s=26); trees â‰¥ 53.3cm (21â€³) comprised 77% (s = 7) of the basal area (BA). For south PIPO PAG, TPH â‰¥ 15.2cm DBH ranged from 13-107 (Î¼=62, s=24); trees â‰¥ 21â€³ comprised 71% (s=8) of the BA. For north PIPO PAG, TPH â‰¥ 15.2cm DBH ranged from 4-182 (Î¼=67, s=21); trees â‰¥ 21â€³ comprised 73% (s=14) of the BA. Dry mixed-conifer forests were apparently of low density and dominated by ponderosa pine. Trees >21â€ DBH dominated basal area.
Keywords: Dry mixed conifer, Ponderosa pine, Stand structure and composition, Reference conditions, South central Oregon

291. Landscape epidemiology of species diversity effects on disease risk in a multihost plant pathogen invasion
Authors: Haas, Sarah Haas, University of North Carolina at Charlotte; Mevin Hooten, Colorado State University; David Rizzo, University of California- Davis; Ross Meentemeyer, University of North Carolina at Charlotte
Offered Presentations: Forest Ecology - Wednesday (2011-04-06): 14:00 - 14:20 - Broadway 1
Abstract: Epidemiological theory suggests that the species diversity of ecological communities can influence infectious disease dynamics through mechanisms termed dilution and amplification effects. However, few studies of diversity-disease risk relationships have been conducted within natural, non-experimental communities that account for both heterogeneity in host community structure and for potentially-confounding effects of the abiotic environment. When studying emerging diseases at regional to landscape scales, geographic disequilibria in the pathogen population may necessitate statistical methods capable of handling zero-inflation and spatial autocorrelation. We use a landscape epidemiological approach with hierarchical Bayesian modeling to assess effects of the biotic and abiotic environment on diversity-disease risk in an emerging plant pathogen, Phytophthora ramorum, throughout the Big Sur, California ecoregion (n=280 sites). P. ramorum infects almost all woody plant species throughout the area, yet host species exhibit asymmetric transmission and susceptibility. We compare results of our Bayesian model to those from generalized linear models (GLMs) that do not account for hierarchical data, zero-inflation and spatial autocorrelation. Both analytical frameworks had better model fit when abiotic landscape effects were included. GLMs showed a negative diversity effect on disease risk (i.e., a dilution effect), but the Bayesian models did not show diversity-disease associations. Our results illustrate the strengths of accounting for landscape heterogeneity in

epidemiological studies and reveal potentially erroneous ecological inferences if zero-inflation and spatial autocorrelation are not accounted for when present in a dataset. Our results also contribute to the paucity of diversity-disease risk studies on generalist plant pathogens in natural communities.
Keywords: Species diversity, Disease, Bayesian hierarchical model, Spatial autocorrelation, Sudden oak death

292. Micro-spatial heterogeneity of a deciduous forest, and controlling environmental factors
Authors: Matlack, Nicole Smith, Ohio University; Jennifer Philhower, Ohio University; Glenn Matlack, Ohio University
Offered Presentations: Forest Ecology - Wednesday (2011-04-06): 14:20 - 14:40 - Broadway 1
Abstract: Seed dispersal has presumably evolved in the context of heterogeneous landscapes in which opportunities for seedling establishment are localized and relatively infrequent. To understand the evolution of dispersal in forest herb species, we examined the distribution of several plant-relevant environmental variables in long-established second-growth forests of Southeastern Ohio, USA. At a landscape scale, ridges tended to have least litter depth, low soil depth, and little soil moisture. Bottomlands were characterized by low shrub cover and great soil depth, canopy openness, and soil moisture. Slopes showed intermediate values. At the scale of individual plots, environmental variables showed positive autocorrelation at scales from 0.5 - 10 meters, corresponding to exposure of parent rock and arrangement of coarse woody debris. We conclude that opportunities for germination are structured at the scale of sites and microsites within sites, suggesting a complex hierarchical system of selection on dispersal systems.
Keywords: Forest, Herb, Dispersal, Evolution, Seed

293. Resource limitation influences on annual tree-ring growth increment in a New Mexico Pinus ponderosa forest
Authors: Marshall, Laura Marshall, University of Arizona
Offered Presentations: Forest Ecology - Wednesday (2011-04-06): 14:40 - 15:00 - Broadway 1
Abstract: Water limitation and other factors can put stress on mature overstory trees in a dynamic landscape, and forest management choices can relieve or exacerbate that stress. I examined the physiological reactions of overstory trees to changing stand density, and the factors leading to overstory tree mortality in dense forest areas. Regeneration, mortality, and growth as moderated by internal physiological and external climatic and disturbance factors are major drivers of forest changes. These factors interact to create the forest present on the landscape. In this study, I compared tree growth response and physiological measurements in dense and open stands to find how limitation-driven bottom-up growth constraints contribute to stand density and forest conditions on a broader scale. Ponderosa pine forests are typically water limited in arid forests such as the study site, and so competition-mediated water limitation was expected to be the primary driver of decreased radial growth and the higher mortality of overstory trees observed in dense stands. This was investigated using carbon isotope analysis of whole wood. However, carbon isotope discrimination was found to be higher in dense than open stands, so that trees in dense stands were acting as if they were less water stressed than trees in open conditions. In further testing, nitrogen appeared limiting in the dense stands. This could have influenced the carbon discrimination findings through decreased photosynthetic capacity. These findings have implications for forest management and restoration in arid environments where in some areas unexpected limiting factors might alter forest dynamics.
Keywords: Dendrochronology, Dendroecology, Resource limitation, Nitrogen, Stable carbon isotopes

294. Modeling species establishment under the projected warming climate in the Missouri Ozark highlands

Authors: Schneiderman, Jeffrey Schneiderman, University of Missouri-Columbia, School of Natural Resources, Department of Forestry; Hong He, University of Missouri-Columbia, School of Natural Resources, Department of Forestry; Frank Thompson III, US Forest Service; William Dijak, US Forest Service
Offered Presentations: Global Change 3 - Wednesday (2011-04-06): 15:20 - 15:40 - Broadway 1
Abstract: Understanding tree species establishment is critical to the study of the effects of climate change on forest ecosystems. We used the forest ecosystem model LINKAGES to investigate tree species establishment under alternate climate scenarios in the Missouri Ozark Highlands, the Western-most part of the Central Hardwood Forest. Tree species establishment reflects individual species interactions with the environment. LINKAGES is a model of linked nitrogen-carbon cycles in forest ecosystems. We used LINKAGES to analyze tree establishment in 10 ecological subsections, each containing 5 land type associations. We ran each simulation for 50 years under current climate conditions and projected climate warming conditions for the end of this century. Future climate conditions were derived from an ensemble average, ensemble highest, and ensemble lowest projections of 16 general circulation models. Biomass amounts for each species were quantified with an empirical equation as a species establishment coefficient. Preliminary results indicated species establishment for shortleaf pine (Pinus echinata) increased in all land types of all ecological subsections. Eastern redcedar (Juniperus virginiana) increased establishment in all land types except in the southern ecological subsections of the study area. White oak (Quercus alba) species establishment decreased , except in 2 ecological subsections in the eastern part of the study area. Northern red oak (Quercus rubra) and black oak (Quercus velutina) species establishment decreased over the entire study area. We will use species establishment coefficients to parameterize LANDIS, a spatial landscape model, to investigate landscape change under alternate climate and forest management scenarios.
Keywords: Tree species establishment, Climate warming, Missouri Ozark Highlands, Linkages

295. Simulating the effects of climate heterogeneity on complex mountain landscapes in an individual-based multi-scale approach
Authors: Seidl, Rupert Seidl, Oregon State University; Werner Rammer, University of Natural Resources and Life Sciences Vienna, Austria; Thomas Spies, US Forest Service, Pacific Northwest Research Station; Robert Pabst, Oregon State University
Offered Presentations: Global Change 3 - Wednesday (2011-04-06): 15:40 - 16:00 - Broadway 1
Abstract: The expected climatic changes are going to affect a variety of processes across a wide range of scales in forest ecosystems. Since the mechanisms governing many ecological processes are characterized by nonlinearities and feedbacks across scales, understanding how forests might respond to these changes requires an integrated, multi-scale perspective, particularly in complex mountain landscapes characterized by high spatial heterogeneity. With the aim of simulating such interactions mechanistically as emerging system properties, we have developed a model capable of scaling from individual trees to forest landscapes (iLand: the individual-based forest landscape and disturbance model). Individual tree competition for and utilization of resources are modeled explicitly in iLand, applying ecological field theory and physiological principles of tree growth and mortality. The model includes a spatially explicit, process-based regeneration module and simulates above- and belowground biogeochemical cycles. Here, we describe the simulation approach and present a successful evaluation against independent empirical data at the level of individual trees (in multi-species old-growth stands), forest stands (i.e., productivity over environmental gradients), as well as at the landscape level (i.e., vegetation composition at the HJ Andrews Experimental Forest, Oregon). Furthermore, we apply iLand to investigate the long-term effects of climate heterogeneity on vegetation composition and carbon storage in the complex mountainous terrain of the central western Cascades in Oregon. Our results highlight the influence of complex terrain on forest dynamics and suggests that effects of climate change could be distinctly modulated by landscape heterogeneity.

Keywords: Individual-based modeling, Landscape modeling, Complex systems, Mountain forests, Environmental heterogeneity

296. Using multi-criteria analysis to incorporate a fire model into long-term projections of watershed processes
Authors: Kennedy, Maureen Kennedy, University of Washington, Seattle; Donald McKenzie, Pacific Wildland Fire Sciences Lab, US Forest Service
Offered Presentations: Global Change 3 - Wednesday (2011-04-06): 16:00 - 16:20 - Broadway 1
Abstract: Disturbance, particularly fire, is an important component of watershed processes, and will continue to be an important component in a changing climate. Mechanistic landscape models of fire spread and fire effects require detailed data, are computationally intensive, and are subject to cumulative error from uncertainties in scores or even hundreds of parameters. Alternatively, simple representations of future fire events in watersheds specify attributes such as extent, frequency, and severity a priori from selected distributions that may not coincide with the results of future fire-climate interactions. We are building a raster fire-spread model of intermediate complexity that represents a middle ground between simple methods and fully mechanistic models. The model will be coupled with RHESSys, the Regional Hydro-Ecological Simulation System, for projecting the effects of climatic change on mountain watersheds. In the simulation, attributes of fires will be emergent properties of the effects of climate, hydrology, vegetation, and topography, and the simulation will be evaluated for its ability to replicate aggregate statistical properties of watershed-scale fire regimes, including patch-size distributions, age-class distributions, spatial structures, and the fire cycle. We will evaluate the model against current known fire-regime properties for watersheds in the Pacific Northwest (USA) using multi-criteria analysis and Monte Carlo inference. We draw upon our published work that illustrates the effectiveness of these analyses for identifying dominant controls on cross-scale properties of low-severity fire regimes.
Keywords: Fire, RHESSys, Climate change, Watershed processes, Multiple criteria

297. Integrating climate change into large-scale connectivity planning efforts in the Pacific Northwest
Authors: Krosby, Meade Krosby, University of Washington; Joshua Lawler, University of Washington; Brad McRae, The Nature Conservancy; Tristan Nunez, University of Washington; Peter Singleton, US Forest Service
Offered Presentations: Global Change 3 - Wednesday (2011-04-06): 16:20 - 16:40 - Broadway 1
Abstract: Large-scale landscape connectivity planning has become an important conservation strategy for counteracting the negative effects of habitat fragmentation. At the same time, increasing connectivity has become recognized as a valuable tool for biodiversity conservation in a changing climate. This raises the important question of how to prepare landscape connectivity plans that will continue to provide functional connectivity as climates change, while accommodating large-scale, climate-driven shifts in species' geographical ranges. Methods for incorporating climate change into landscape connectivity plans are still in their infancy, and feature a wide variety of possible approaches. Perhaps the most important distinction among approaches is the degree to which models of future climate change and associated species responses are included. We will discuss the approach used to incorporate climate change into the Washington Wildlife Habitat Connectivity Working Group’s connectivity needs assessment. This approach employs a diverse suite of modeling approaches, from those relying only upon current landscape features and climate, to those using models of future climate and bioclimatic envelopes. We will present results from completed analyses, including modeling of temperature gradient connectivity and climatic refugia, and discuss plans for future analyses.
Keywords:

298. Soundscape ecology: what is it?

Authors: Pijanowski, Bryan Pijanowski, Purdue University; Luis Villanueva-Rivera, Purdue University; Sarah Dumyahn, Purdue University; Almo Farina, Urbino University; Stuart Gage, Michigan State University
Offered Presentations: Global Change 3 - Wednesday (2011-04-06): 16:40 - 17:00 - Broadway 1
Abstract: We summarize the foundational elements of a new area of research called soundscape ecology. The study of acoustics in landscapes is based on an understanding of how sound, from various sources - biological, geophysical and anthropogenic - can be used to understand coupled natural-human dynamics across different spatial and temporal scales. New terms are introduced and defined. We explain through an integrative framework the underlying natural and anthropogenic processes that create the soundscape. We also summarize the intellectual foundations of soundscape ecology - spatial ecology, bioacoustics, urban environmental acoustics and acoustic ecology. The four major components of soundscapes, namely, acoustic composition, spatial variability, temporal dynamics and acoustic interactions, are summarized and related back to our integrative framework of soundscape dynamics. Soundscape ecology tools that will be needed are also discussed along with the several ways in which soundscapes need to be managed. In conclude by playing soundscape recordings made by our group and compare these against compositions made by acoustic ecology musicians who have listened to these landscapes and have composed musical pieces that integrate ecological sounds.
Keywords: Soundscapes, Landscape, Biophony, Acoustic ecology, Geophony

299. Detection of forest threats via unsupervised geospatiotemporal data mining of remotely sensed phenology data
Authors: Mills, Richard Mills, Oak Ridge National Laboratory; Forrest Hoffman, Oak Ridge National Laboratory; Jitendra Kumar, Oak Ridge National Laboratory; William Hargrove, US Forest Service
Offered Presentations: Disturbance 4 - Wednesday (2011-04-06): 15:20 - 15:40 - Broadway 3
Abstract: In support of efforts by the USDA Forest Service to develop a National Early Warning System for Forest Disturbances, we are developing and applying highly scalable parallel geospatiotemporal data mining techniques for unsupervised identification of areas where forest health is threatened. These techniques techniques employ a combination of k-means cluster analysis and singular value decomposition (SVD) to define a set of categorical, multivariate classes or states for describing and tracking the behavior of forest ecosystem properties through time within a multi-dimensional phase or state space. We have applied our approach to annual phenological patterns derived from Moderate Resolution Imaging Spectroradiometer (MODIS) Normalized Difference Vegetation Index (NDVI) for unsupervised change detection. We will present initial results from the analysis of seven years of 250-m MODIS NDVI data for the conterminous United States. While determining what constitutes a normal" phenological pattern for any given location is challenging due to interannual climate variability
Keywords: Data mining, Geospatial analysis, High-performance computing, MODIS, Disturbance

300. Investigating all-terrain vehicle (ATV) trail impacts on vegetation and habitat fragmentation
Authors: Van Vierssen Trip, Nyssa van Vierssen Trip, Department of Biology, Memorial University of Newfoundland; Yolanda Wiersma, Department of Biology, Memorial University of Newfoundland
Offered Presentations: Disturbance 4 - Wednesday (2011-04-06): 16:00 - 16:20 - Broadway 3
Abstract: All Terrain Vehicles (ATVs) have changed how we access wilderness and remote areas. Although ATV trails can greatly increase human access to previously inaccessible areas, they can also have detrimental impacts such as soil erosion, pollution, destruction of vegetation and disturbance of wildlife. Over the past two decades, the use of recreational vehicles has increased in the province of Newfoundland and Labrador, Canada. We examined the impacts of existing ATV trails within and adjacent to the Avalon Wilderness Reserve. We set up a 2X2 factional experimental design; factors were cover type and relative moisture. We assigned treatments using a random

stratified sample created with Geographic Information System (GIS) based on air photo imagery and a DEM. We measured erosion depth and average vegetation height and species composition along transects perpendicular to 28 trails. On a subset of trails we estimated intensity of use by placing magnetic traffic counters at entrances to trails. We compared multiple regression models for ecological effects of trail use and trail characteristics using Akaike Information Criterion (AICc). The most parsimonious model to explain erosion patterns was the global model (AICc Weighting wi=0.4898) which takes into account the main effects of cover type and relative moisture and the interaction between the them. Other models explain variation in plant community composition as a result of trail properties. The results of this study could help guide off-road vehicle use policy and trail management around ecologically sensitive areas; ultimately with the goal of minimizing adverse impacts on ecologically sensitive sites.
Keywords: ATV trails, Connectivity, Disturbance, Road ecology, Motorized recreation

301. Hurricane impacts to tropical montane forests in the Cordillera Central, Dominican Republic
Authors: Gannon, Benjamin Gannon, Colorado State University; Patrick Martin, Colorado State University
Offered Presentations: Disturbance 4 - Wednesday (2011-04-06): 16:20 - 16:40 - Broadway 3
Abstract: Hurricanes are common, catastrophic disturbances of many tropical montane forests (TMFs). Combined forces of hurricane winds and rain-induced landslides and flooding are important drivers of TMF dynamics. We studied the effects of Hurricane George which hit TMFs in Hispaniola in 1998 with two main objectives: 1) to quantify the degree and spatial pattern of hurricane damage via remote sensing and spatial analyses, and 2) to explore post-hurricane changes in landscape and forest ecosystem dynamics. The study area is centered in two parks in the Cordillera Central mountains of the Dominican Republic, ranging in elevation from 1000 to over 3000m ASL. The class 3 hurricane left a complex mosaic of damage across the highly dissected topography. Change detection analysis of Landsat TM imagery was used to describe the spatial pattern of the damage from Hurricane Georges, and a multiple regression model was used to analyze the relative influence of terrain and vegetation on the spatial patterning of damage. Damage and recovery was also measured in 100 forest inventory plots sampled in 2010, stratified by forest type and damage severity. Normalized Difference Infrared Index (NDII) change detection indicated that Hurricane Georges disproportionately affected pine forest: 17.5% of pine forest showed decreases in NDII versus only 7.9% for cloud forest. Pine forest with high severity damage also showed an average loss in basal area (from uprooting, tipping, or snapped stems) of 70.9% compared to 22.2% for cloud forest. Overall, hurricane impacts were mediated by topography and by the resistance-resilience of contrasting forest types.
Keywords: Hurricane disturbance, Remote sensing, Tropical montane forests, Landscape dynamics, Disturbance interactions

302. A conceptual framework for the spatial analysis of landscape genetic data
Authors: Wagner, Helene Wagner, Department of Ecology and Evolutionary Biology, University of Toronto; Marie-Josee Fortin, Department of Ecology and Evolutionary Biology, University of Toronto
Offered Presentations: Landscape Genetics - Wednesday (2011-04-06): 15:20 - 15:40 - Broadway 2
Abstract: Understanding how landscapes constrain gene flow and the spread of adaptive variation is important for biological conservation under global climate change and human landscape alteration. However, the integration of population genetics with landscape ecology and spatial statistics remains an interdisciplinary challenge at the levels of concepts and methods. We present a conceptual framework that relates the spatial distribution of alleles to the processes of gene flow and adaptation as regulated by spatial heterogeneity of the environment, while explicitly considering the spatial and temporal dynamics of landscapes and populations. When selecting appropriate methods, it is necessary to consider the effects of multiple processes, the properties of population genetic data, and

the effects of sampling. We discuss the potential and limitations of four approaches: (i) location-based methods model the spatial distribution of alleles from local site characteristics, (ii) link-based approaches model the probability of gene flow between two patches, (iii) neighborhood-based methods model the connectivity of a focal patch, and (iv) boundary-based methods model the barrier effect of landscape features. Further research is needed to (i) account for spatial patterns related to gene flow in the patch-based analysis of adaptive genetic variation, (ii) provide robust alternatives to the Mantel test for link-based analysis, (ii) integrate patch-based and link-based methods, e.g. in the context of gravity models, and (iii) develop boundary-based methods of hypothesis testing for discrete and admixed populations.
Keywords: Landscape genetics, Spatial analysis, Gene flow, Selection, Hypothesis testing

303. Thresholds, limiting factors and landscape connectivity
Authors: Cushman, Samuel Cushman, US Forest Service, Rocky Mountain Research Station; Andrew Shirk, U Washington; Erin Landguth, U Montana; Ruth Short Bull, U Montana
Offered Presentations: Landscape Genetics - Wednesday (2011-04-06): 15:40 - 16:00 - Broadway 2
Abstract: Variation in the quality of movement habitat across complex landscapes can have large impacts on rates and patterns of animal movement and resulting degree of gene flow and population connectivity. It is possible that delectability of landscape genetic relationships is related to whether or not each landscape feature limits movement and gene flow in a given landscape. It is possible for a critical dependence upon certain landscape features to be invisible to analysis depending upon whether this landscape element limits movement. We used two empirical modeling approaches to identify threshold like relationships between landscape complexity and population connectivity. First we use individual based landscape genetics to demonstrate that landscape features such as forest cover, roads and elevation were consistently important but inconsistently detected as drivers of genetic differentiation in American black bear (Ursus americanus). Second, we used spatial analysis of movement paths of American marten (Martes americana) to demonstrate that critical dependence on certain landscape elements can be cyptic when those elements do not limit choice of potential movement paths. We extend these empirical findings with simulation modeling to explore the nature of limiting landscape factors on landscape genetic processes using simulation modeling. Simulation modeling is particularly suited for this question, as it allows explicit control over pattern-process relationships which enables rigorous attribution of the causes of observed differentiation, which is not possible with correlational empirical modeling. Our hypotheses related to the effects of habitat area, fragmentation and the contrast in resistance between habitat and non habitat on the detectability of stipulated landscape genetic relationships. We found that both habitat area and habitat fragmentation affect the apparent strength of landscape genetic relationships, but that measures of habitat fragmentation appeared more important than habitat area alone. We found that landscape genetic effects are often not detectable when habitat area is very high, habitat fragmentation very low, or both. In such situations landscape structure does not limit gene flow. We found that when the contrast in resistance values between habitat and non-habitat interacts with habitat area and fragmentation in affecting detectability of landscape genetic relationships. Thus, while landscape features could be absolutely critical to providing connectivity in such landscapes these relationships are not detectable if gene flow is not limited by spatial patterns of these features.
Keywords: Fragmentation, Connectivity, Threshold, Limiting factor

304. A landscape genetics approach for science-based conservation planning along the Front Range, Colorado
Authors: Murphy, Melanie Murphy, University of Wyoming; Chris Funk, Colorado State University; Erin Muths, USGS
Offered Presentations: Landscape Genetics - Wednesday (2011-04-06): 16:00 - 16:20 - Broadway 2

Abstract: Landscape genetics is a powerful approach combining landscape ecology and population genetics that can produce robust estimates of functional connectivity on a time-scale relevant to conservation decisions. Despite the potential, genetic data have rarely been applied to evaluate potential impacts of climate change or alternative conservation plans. Fort Collins Natural Area Program (FCNAP) is a municipal organization charged with managing and expanding a reserve program within and around Fort Collins, Colorado USA. Primary goals of the management plan are to maintain amphibian populations within the FCNAP and to acquire new reserves that will be beneficial to these populations. To assist FCNAP in meeting management goals, we assess probability of occurrence and functional connectivity (estimated by genetic distance) for boreal chorus frogs (Pseudacris maculata; 15 microsatellite loci, 1200 individuals). We then use these models to predict the effect of alternative management scenarios (protection and/or restoration of explicit habitats) on boreal chorus frog occurrence and connectivity in the context of continued urbanization and climate change. Our results suggest that roads, gravel pits and hot areas impede functional connectivity while protected and cool-wet areas are associated with enhanced connectivity. Removal of invasive species (Bull frogs) increases probability of occurrence but has only minimal impact on functional connectivity. We rank the importance of spatially explicit habitats for maintaining or restoring functional connectivity, incorporate development risk and identify areas where bypass structures may be most effective. The novel analytical framework and tools developed for this study can be applied in any system for utilizing genetic data to evaluate management scenarios.
Keywords: Landscape genetics, Climate change, Landuse planning, Amphibians, Functional connectivity

305. Deductive inference in landscape genetics
Authors: Shirk, Andrew Shirk, University of Washington; Samuel Cushman, US Forest Service; Erin Landguth, University of Montana
Offered Presentations: Landscape Genetics - Wednesday (2011-04-06): 16:20 - 16:40 - Broadway 2
Abstract: Landscapes influence mating probabilities within a population by resisting the movement of breeding individuals or their propagules. Because a population's viability may be highly dependent on whether it is panmictic or structured by barriers, distance, or landscape resistance gradients, inferring population structure is a common goal in conservation analyses. Recent work has shown that by evaluating multiple alternative hypotheses within a causal modeling framework, researchers can strengthen their inferences regarding the mechanism of genetic isolation. While such an approach reduces the risk of erroneous inferences, the potential for incorrect inference remains because researchers can never feasibly test all plausible alternative hypotheses. In this paper we demonstrate the value of combining empirical induction with deductive inference from simulation modeling. Previous empirical model selection identified a model of landscape resistance that was highly related to the genetic isolation among mountain goats (Oreamnos americanus) inhabiting a fragmented landscape in the Cascade Range, Washington (USA). Here, we simulate the process of gene flow that would result if that hypothesis were true and evaluate how well the observed pattern of genetic isolation matches the simulated pattern. This dual inductive-deductive inferential loop strongly affirmed genetic isolation by landscape resistance gradients as functions of elevation, landcover, and roads, and the rejection of alternative hypotheses of isolation by distance and isolation by barriers.
Keywords: Landscape genetics, Simulation, Deduction, Induction, Mountain goat

306. Landscape genetics of rattlesnakes across two fragmented landscapes in Ontario, Canada.
Authors: DiLeo, Michelle DiLeo, Queen's University; Stephen Lougheed, Queen's University
Offered Presentations: Landscape Genetics - Wednesday (2011-04-06): 16:40 - 17:00 - Broadway 2
Abstract: The massasauga rattlesnake (Sistrurus c. catenatus), eastern Canada's only extant venomous reptile, is currently restricted to four disjunct regions in Ontario. Across its range it has suffered local extirpations, population decline, and range contraction and fragmentation.

Massasaugas have long generation times, low dispersal, and specific habitat requirements related to the availability of ideal hibernation and gestation sites. These factors combined suggest that populations may be very sensitive to habitat changes, and slow to recover from such perturbations. Here we use a landscape genetic approach to investigate the effects of fragmented landscapes on gene flow and population structure of the threatened massasauga across the two largest remaining regional Canadian populations (Bruce Peninsula and Georgian Bay). Both regions are complex habitat mosaics with large anthropogenic disturbances in the form of agriculture, urban areas, recreational development and extensive road networks. Using 14 DNA microsatellite markers we find evidence for marked hierarchical genetic population structure with significant differentiation between regional populations, but also instances of population subdivision across very small spatial scales (<5km). Ultimately, we will determine the physiognomic basis for these abrupt genetic breaks. We will test whether metrics based on landscape resistance models better predict observed patterns of genetic population structure within regional landscapes, compared to straight-line geographical distances alone. The results of this project will be used to inform conservation decisions at the landscape level by identifying aspects of the habitat mosaic that support or impede dispersal and subsequent gene flow between massasauga populations.
Keywords: Landscape genetics, Snakes, Connectivity, Genetic population structure, Landscape resistance

307. Movement patterns and habitat utilization of nonnative feral goats in Hawaiian dryland montane landscapes
Authors: Chynoweth, Mark Chynoweth, University of Hawaii at Manoa; Chris Lepczyk, University of Hawaii at Manoa; Creighton Litton, University of Hawaii at Manoa; Susan Cordell, Institute of Pacific Islands Forestry, US Forest Service; Gregory Asner, Department of Global Ecology, Carnegie Institution of Washington
Offered Presentations: Wildlife Ecology 2 - Wednesday (2011-04-06): 15:20 - 15:40 - Broadway 4
Abstract: Large populations of nonnative, feral goats (Capra hircus) are present on five of the eight main Hawaiian Islands where they have been notable components of the landscape for at least a century. However, very little information exists on their behavioral ecology (e.g., habitat use). Such an understanding is essential to manage not only the goats, but also the native plant communities that they inhabit. We deployed GPS satellite collars (n=12) to track movement patterns of feral goats every two hours over a one year period in one of the last remaining montane dry forest habitats on the Island of Hawaiâ€˜i. Movement data from the first 6 months has been retrieved from collars and combined with remotely sensed imagery (NASA's MODIS sensor; Carnegie Airborne Observatory LiDAR) to quantify how movement patterns are correlated with seasonal changes in vegetation dynamics (structure, composition, and phenology). Preliminary results of this work demonstrate that feral goats do not use habitat uniformly, but rather show preference for native-dominated shrublands during the day and barren lava at night. Displacement data demonstrate bimodal diurnal patterns of activity and habitat utilization. Ultimately, the results of this study can be used in the context of both the conservation and restoration of native Hawaiian dry forest ecosystems, arguably the most degraded ecosystem in the Hawaiian Islands.
Keywords: Feral goat, Hawaii, Movement ecology, LiDAR, MODIS

308. Incorporating behavioural processes into movement models: state-space modelling of moose telemetry data
Authors: Beyer, Hawthorne Beyer, University of Toronto; Marie-Josee Fortin, University of Toronto; Dennis Murray, Trent University
Offered Presentations: Wildlife Ecology 2 - Wednesday (2011-04-06): 15:40 - 16:00 - Broadway 4
Abstract: There are many environmental and behavioural drivers of animal space use and movement. Despite a growing abundance of animal location data, however, movement models typically fail to

incorporate all but the simplest behavioural processes. Thus, a major goal of movement ecology is to incorporate more sophisticated and realistic models of behaviour into movement models. Female moose (Ontario, Canada) show high degrees of site fidelity and patch re-use, and their movement is, therefore, often poorly approximated by simple statistical models or diffusion-based modelling approaches such as correlated random walks. We model moose movement by incorporating higher-order behavioural processes (site fidelity, memory) into mechanistic state-space models. We contrast movement behaviour among individuals in a protected area (Algonquin Provincial Park) with a population subject to hunting and anthropogenic disturbance in a nearby human-inhabited landscape. We find that the marked avoidance of human activity alters movement behaviour in several important ways. There is also wide variation in individual movement strategies, which we relate to animal age, environment, and reproductive biology. We argue this variability is a fundamental biological characteristic of movement data that should be explicitly incorporated into inferences and stochastic simulations of these models. Furthermore, state-space models provide a powerful and rigorous framework for incorporating multiple drivers of movement and that such mechanistic process models are a strong basis for evaluating the consequences of environmental change on animal ecology.
Keywords: Movement, Behavior, Disturbance, State-space models, Memory

309. Rodenticide use and non-target impacts on felids in an urban ecosystem
Authors: Steinberg, Rebecca Steinberg, Yale University; Susan Clark, Yale University; Anita Morzillo, Oregon State University; Seth Riley, US National Park Service
Offered Presentations: Wildlife Ecology 2 - Wednesday (2011-04-06): 16:00 - 16:20 - Broadway 4
Abstract: Bobcat and mountain lion populations are declining in the Santa Monica Mountain region of California. Despite a US EPA policy regulating availability of anticoagulant-based rodenticides, unintentional poisoning may be contributing to their decline. Little is known about the ecological, social, and political factors affecting anticoagulant use in this urban area. Our study used an interdisciplinary approach to examine three questions: 1) Does felid habitat use include particular urban landscape features that may serve as attractants or refugia for prey species?; 2) What can we learn about residential and commercial rodenticide use that may affect local felids?; and 3) What contextual recommendations can be made for improved pesticide regulations and carnivore conservation? A preliminary analysis of 40 urban bobcat locations shows that bobcat habitat includes landscape features likely to be used by prey species (e.g., golf courses, fruit trees, fire breaks). Of 33 residential interviews about rodenticide use, homeowners' worldviews of nature and wildlife influence rodent control practices on their properties. Interviews with pest control operators suggest that most operators are not aware of secondary poisoning of carnivores. Collectively, both commercial and residential rodenticide use practices may contribute to secondary poisoning. Our results provide knowledge for understanding how urban residents and pest control companies affect carnivores by poisoning of rodents. Results have management policy implications, including designing public outreach programs and informing adequate rodenticide regulations.
Keywords: Anticoagulant, Rodenticide poisoning, Bobcat, Mountain lion, Interdisciplinary

310. Landscape evaluation of habitat use by moose, wolves, and black bears during moose calving season
Authors: Raper, Diana Raper, Oregon State University; Kevin White, Alaska Department of Fish and Game; Anita Morzillo, Oregon State University
Offered Presentations: Wildlife Ecology 2 - Wednesday (2011-04-06): 16:20 - 16:40 - Broadway 4
Abstract: Understanding habitat use by predators and their prey is critical for elucidating predator-prey relationships. Throughout much of Alaska moose, wolves, and black bears are sympatric. However, lack of knowledge about spatial and temporal variability in habitat use continues to challenge our understanding of the relationships among these species. Our objective was to examine habitat use by wolves, black bears, and female moose during the pulsed moose calving period (May

18 - June 4) in the Gustavus-Glacier Bay ecosystem in southeast Alaska. Moose location data were obtained by radio-tracking individual cow moose throughout calving season. We employed sign surveys, a noninvasive survey method, to collect habitat use information about wolves and black bears across the study area. Surveys sites were identified using a random selection of locations from a sampling grid overlaid across the study area. Additional sign location data were collected opportunistically when traversing the landscape to and from randomly identified survey sites. Predator sign location data and moose location data were imported into a Geographic Information System. Collectively, predator-moose location data were analyzed spatially in conjunction with land cover data to examine the use of different habitat types by these species during the critical moose calving season. Preliminary analysis indicates that there is greater overlap in habitat use between wolves and black bears than between these two predators and parturient moose. These data provide insight into predator-prey relationships during a critical time when moose are most vulnerable to predation.
Keywords: Habitat use, Moose, Wolves, Black bears, Calving season

311. Comparing patterns in species occupancy in three regions experiencing different levels of development pressures
Authors: Hepinstall-Cymerman, Jeffrey Hepinstall-Cymerman, University of Georgia; Paige Barlow, University of Georgia; John Marzluff, University of Washington; Michael Parrish, University of Georgia
Offered Presentations: Wildlife Ecology 1 - Monday (2011-04-04): 11:00 - 11:20 - Parlor BC
Abstract: Increasing urbanization has substantially altered suburban and rural landscapes through intensification of existing land use and exurban development in previously rural or undeveloped areas. These changes have profound implications for avian communities present in these landscapes. We use single- and multi-species, single-season occupancy models accounting for imperfect detection to estimate site occupancy for selected forest-associated warbler species in residential areas along the developing fringe of Seattle, Washington; Athens, Georgia; and Franklin, North Carolina. We explore how variables representing human disturbance, habitat composition, and configuration at multiple spatial scales explain patterns of avian occupancy and diversity. We ranked models using AIC and developed composite models for individual species as well as communities for our three study areas using one year of field data. We then validated and updated our models for the Seattle and Athens sites using additional years of field data in a Bayesian framework. While specific species and models differed between our three study regions, some general patterns in community response to urban and residential development were observed. In addition, our results indicate that measures of human disturbance, habitat composition, and landscape configuration are important in explaining patterns of species occupancy.
Keywords: Species occupancy modeling, Avian, Community, Urbanization

312. A holistic approach to planning - green infrastructure at the campus scale
Authors: Dowdell, Jennifer Dowdell, Biohabitats, Inc.
Offered Presentations: Land Use Planning 2 - Wednesday (2011-04-06): 15:20 - 15:40 - Council Suite
Abstract: There are several widely held definitions of green infrastructure. The major difference between these is the issue of scale. This divergence is an opportunity to explore a more nuanced definition of green infrastructure. This presentation will review project examples of this regenerative design and planning approach to master planning at universities in the mid-Atlantic and southeastern United States. This campus-based green infrastructure planning work combines stormwater management and ecological enhancement and restoration through an interpretation of the inherent patterns in the landscape, in an effort to build a site's capacity for regeneration while creating an integrated teaching and learning environment responsive to development pressures and conservation needs. This approach involves a strong focus on connectivity and designing for stacked benefits at

multiple scales. It combines an appreciation for historic function with an understanding that in urbanized areas, where natural function may not return in its original form, that a new functional living system with natural characteristics can be introduced in a way that provides opportunities for appreciation and stewardship within the campus community while meeting regulatory requirements. Stacked benefits associated with this integrated approach to planning and design, include stormwater management, improvements to human health and well being, improved wildlife corridors and enhanced habitat patches, mitigation of urban heat island effects, increased opportunity for education and stewardship, and increased land value.
Keywords: University, Planning, Green infrastructure, Stormwater, Landscape

313. Development by design: Balancing wind-energy impacts with conservation
Authors: Evans, Jeffrey Evans, The Nature Conservancy; Joseph Kiesecker, The Nature Conservancy; Joe Fargione, The Nature Conservancy
Offered Presentations: Land Use Planning 2 - Wednesday (2011-04-06): 15:40 - 16:00 - Council Suite
Abstract: Renewable energy offers the potential to reduce carbon emissions while increasing energy independence. However, renewable energy has a larger land footprint than other forms of energy production, making appropriate siting, mitigation, and sustainable production practices particularly important. In the US, meeting the Department of Energy's 20% wind goal would result in approximately a 5 million hectare footprint, with an additional 17,702 kilometers of new transmission lines. We introduce a disturbance index for the continental United States that could serve as a blueprint to minimize conflicts between biodiversity conservation and future development. We present results of analysis that examines patterns of wind energy production on disturbed vs. undisturbed lands as a function of state level DOE wind energy goals. Our results illustrate that, in the majority of US states, wind energy goals can be met by placing development in areas of existing disturbance. In only a few states will wind energy production goals involve trade offs between maximizing energy production and potential biodiversity impacts.
Keywords: Biodiversity, Conservation, Wind, Development

314. Impacts of urbanization, reduced springflow, and climate change on a small karstic watershed in Central Texas
Authors: Vogl, Adrian Vogl, Texas State University-San Marcos; Vicente Lopes, Texas State University-San Marcos
Offered Presentations: Land Use Planning 2 - Wednesday (2011-04-06): 16:00 - 16:20 - Council Suite
Abstract: Analysis of alternative futures combined with spatially explicit watershed modeling provides a way to scope resource management problems and see how current practices can impact both watershed hydrology and water quality in the future. In the central Texas Hill Country, rapid urbanization is occurring around major city centers interspersed with distributed development along major roadways. These developments are highly dependent on regional aquifers for water supplies. Many stream ecosystems in the area have historically been perennial spring-run creeks, highly dependent on baseflow from aquifers to maintain flow and water quality. The Cypress Creek, in western Hays County, is presented as a case study in which we evaluate potential impacts and interactions of continuing urban development, declining aquifer levels, and climate change on water resources. This study combines scenario analysis with watershed modeling to: 1) develop conceptual scenarios of future urban development; 2) model land cover change for each scenario; 3) evaluate results of development scenarios using the SWAT hydrologic model; and 4) evaluate these results under reduced spring flow inputs and climate change. Results show that development impacts on hydrology and water quality are overwhelmed by negative impacts from reductions in spring flow. Climate change also impacts hydrology and nonpoint source pollution loading, but the

direction and magnitude of changes vary greatly depending upon the level of urbanization. This study demonstrates that the current management framework for spring-fed streams, one that relies on watershed-level solutions for regulating water quality, is inadequate where such quality is highly dependent on maintaining adequate spring flows.
Keywords: Hydrologic modeling, Urbanization, Scenario analysis, Climate change, Water quality

315. The socioeconomic value of community food production: A landscape approach
Authors: Smith, Vincent Smith, UW-Madison; Janet Silbernagel, UW-Madison
Offered Presentations: Land Use Planning 2 - Wednesday (2011-04-06): 16:20 - 16:40 - Council Suite
Abstract: Community Food Production (CFP) is emerging in the U.S. and abroad as a key feature of community food security, urban greening, economic development, and other urban re-development initiatives. CFP resources in the form of home gardens, community gardens, school gardens, urban and peri-urban farms, and edible urban forests continue to gain wide support and attention. However, the assumed socioeconomic values of CFP have not been well studied. Our research explores, defines, and maps CFP, its socioeconomic impacts, and attributed values. We capture the social and spatial complexity of CFP resources across communities through spatial analysis, semi-formal interviews, questionnaires, and horticultural data. In addition, our work at the landscape scale is used to determine how values attributed to CFP are differentially realized. We will discuss the results of a three year study to explore the socioeconomic value of CFP in urban areas in and around Madison, WI (USA). We will also explore how findings impact our understanding of CFP practices in the U.S. and abroad more generally. We will discuss how spatial composition and configuration of resources impacts the effectiveness of CFP to meet stated objectives. Finally, we will demonstrate the potential future role of CFP under explicit landscape scenarios. Reported methods and findings will demonstrate the role of natural and social sciences in landscape ecology research and practice.
Keywords: Urban and peri-urban agriculture, Community food security, Scenarios, Urban ecosystems, Civic agriculture

316. Reserve selection in dynamic landscapes
Authors: Butsic, Van Butsic, UW-Madison Forest and Wildlife Ecology; David Lewis, University of Puget Sound; Volker Radeloff, UW-Madison Forest and Wildlife Ecology
Offered Presentations: Land Use Planning 2 - Wednesday (2011-04-06): 16:40 - 17:00 - Council Suite
Abstract: Reserves are a cornerstone of conservation and how to best select reserves has been a defining question for conservation biology and landscape ecology. When landscapes are dynamic (especially when anthropogenic disturbance is in constant flux), reserve selection strategies must take into account the effect of dynamic land development, conservation costs, and ecological benefits over time. Currently, this information is rarely integrated into reserve selection models. Econometric models which predict the likelihood that a parcel will develop in the absence of conservation, the costs of conservation, and feedbacks between conservation purchases, can greatly advance reserve selection strategies to increase their effectiveness in dynamic settings. Here, I use econometric models in a coupled human natural systems framework to investigate the underlying principals of reserve selection in dynamic landscapes threatened by anthropogenic change. Using a combination of analytic results, theoretical landscape simulations, and an empirical investigation, I suggest a set of guidelines to inform conservation purchases in dynamic settings where land use change is driven by anthropogenic forces. These guidelines suggest that the optimal conservation strategy for any landscape is driven by the underlying heterogeneity in landscape development probabilities, conservation costs, and ecological benefits. When landscapes are homogeneous in terms of land development and conservation costs, selection strategies with a purely biotic focus are efficient. As

landscapes become more heterogeneous in land development and conservation costs, the inclusion of econometric models in the selection strategy becomes necessary for optimal reserve selection.
Keywords: Reserves, Biodiversity, Anthropogenic change, Landscape, Development

317. Harvesting forest residues for bioenergy influences amphibian and herbaceous plant community assemblages in northern hardwood forests
Authors: Deahn M. Donner, Institute for Applied Ecosystem Studies, Northern Research Station; Christine A. Ribic, US Geological Survey, Wisconsin Cooperative Wildlife Research Unit, University of WI–Madison, Matthew St. Pierre, Chequamegon-Nicolet National Forest, and Dan Eklund, Chequamegon-Nicolet National Forest
Poster #12 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The most readily available source of woody biomass is through whole-tree harvesting that removes what has been traditionally left as slash [i.e., fine woody debris (FWD)]. While FWD has the potential to be used as energy feedstock, a critical element of managing for biodiversity is maintaining woody debris on the forest floor. Woody biomass is important for providing seed beds, and creating habitat structure for wildlife. Loss of FWD may result in a change in species that may have cascading effects across trophic levels; and cause shifts in the size, distribution, and vertical zonation of vegetation over large areas. Land managers are concerned with removing FWD in northern hardwood systems because of the existing lack of large woody debris and understory structural diversity. We examined the impact of FWD removal on amphibian and herbaceous plants on rich soils under regenerating northern hardwood stands in Wisconsin. During winter 2010, we manipulated the amount of FWD removed after timber harvest (0, 65 and 100%) at 9 sites within the Chequamegon-Nicolet National Forest to compare the abundance and diversity of plants and amphibians across treatments. Preliminary analysis showed the abundance of Wood Frog and Red-backed salamander declined in all treatments after FWD removal compared to pre-treatment data. American Toad and Spring Peeper declined except in 100% tipwood removal where the number of individuals increased. In contrast, the community of herbaceous plant species remained consistent across years; Viola spp., Pennsylvania sedge, sweet cicely, wild lily-of-the-valley, and big-leaf aster were the most common summer plants.

318. Relief as spatial drivers for savanna distribution in the Campos Gerais region, Paran
Authors: Moro, Lia Maris Orth Ritter, ESALQ; Milton Ribeiro, UNESP; Valquiria Nanuncio, UEPG; Rosemeri Moro, UEPG
Poster #13 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The Campos Gerais region is located in the state of ParanÃ¡, Brazil, and marks the austral limit of the savanna (cerrado) biome. The regional plant cover shows similarities to pastures in western SÃ£o Paulo state and in Brazil's Central Plateau. In the Campos Gerais, savanna patches now occur as small scattered disjunct habitat islands and enclaves, mostly on private farms, where they are under strong pressure from agricultural activities. In spite of the importance of the region for savanna conservation, few studies have focused on understanding the factors that influence or maintain its distribution in the regional landscape. The objective of this study was to identify the relative contribution of climate and relief variables to explain the present savanna distribution in ParanÃ¡. Savanna habitat patches were mapped in the field, and vegetation types were characterized using the Rapid Ecological Assessment and Path methods. In analyzing climate data related to savanna occurrence in the Campos Gerais, we observed that temperature and evapotranspiration did not act as environmental filters. Relief orientation (i.e., sun exposure) was an important factor, and the fragments were preferentially oriented toward the east (azimuth between -70 and 20 degrees).

Conservation and habitat restoration actions must consider this aspect of natural relief orientation in order to improve biodiversity protection. Connectivity between the remaining savanna patches should be improved, but such efforts will only succeed if farmers become involved in biodiversity programs.
Keywords: Savannah, Campos Gerais, Climate, Landscape

319. Integrating expert knowledge into a model of land cover change: A case study from Michigan
Authors: Price, Jessica Price, University of Wisconsin at Madison; Janet Silbernagel, University of Wisconsin at Madison; Randy Swaty, The Nature Conservancy
Poster #16 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Conservation efforts are currently expanding in both scope and scale. Management strategies now apply a broader range of ownership and management techniques at the landscape-scale, such as conservation easements. However, evaluating the effectiveness of landscape-scale management strategies remains difficult. Traditional monitoring efforts span decades or longer, limiting the capacity of adaptive management to address the unprecedented and potentially rapid ecosystem changes that will result from climate change and new demands for natural resources. Therefore, we developed an approach that provides insight into potential future land cover and conservation outcomes resulting from various land management regimes and climate change. This approach combines spatially explicit landscape modeling with scenario building informed by expert knowledge. Here, we present our experiences integrating local expert knowledge into a land cover model of the Two Hearted River Watershed in Michigan's Upper Peninsula. We discuss how expert knowledge was elicited, refined, and integrated with empirical data to model land cover using the VDDT/TELSA modeling suite developed by ESSA Technologies. This iterative, cooperative process produced a model responsive to local ecological conditions and management decisions, avoiding the generalities and gaps in knowledge resulting from the use of empirical data and published scientific studies alone. We generated ten spatially explicit landscape scenarios that inform land managers and conservation practitioners about how to best utilize scarce financial resources, reduce the risks associated with innovative strategies, and determine when and where different management strategies may be most effective.
Keywords: Scenario analysis, Alternative futures, Landscape modeling, Climate change, Local knowledge

320. NLCD 2011 Tree Canopy Cover Pilot Project
Authors: Moisen, Gretchen Moisen, US Forest Service, Rocky Mountain Research Station; John Coulston, US Forest Service, Southern Research Station; Tracey Frescino, US Forest Service, Rocky Mountain Research Station; J. Toney, US Forest Service, Rocky Mountain Research Station; Mark Finco, US Forest Service, Remote Sensing Applications Center; C. Ken Brewer, US Forest Service, Washington Office; Warren Cohen, US Forest Service, Pacific Northwest Research Station; Barry Wilson, US Forest Service, Northern Research Station; John Tipton, Thomas A. Jackson
Poster #22 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: The Multi-Resolution Land Characteristics (MRLC) consortium has developed plans for the 2011 National Land Cover Dataset (NLCD) which will include an approximate Anderson Level II classification, percent impervious surface, and percent tree canopy cover. Because it is central to its inventory and monitoring needs, including carbon assessment, the Forest Service Forest Inventory and Analysis (FIA) program has assumed responsibility for the latter, and will be developing this Tree Canopy Cover (TCC) layer. A pilot project was launched early in 2010 to test alternative sampling and modeling methodologies in support of this commitment. Photo-interpreted data from NAIP imagery was collected in 5 diverse pilot areas in the US, including one each in Oregon, Utah, Kansas, Michigan and Georgia. Photo plots were collected on the FIA grid, intensified 4-fold , and consisted of 105 dots distributed in a 90 m square. This data coupled with current Landsat data, other ancillary explanatory variables, FIA plot data, and information from related projects was used to answer

numerous questions about alternative means to observe tree canopy cover, repeatability in photo-interpreted NAIP imagery, best predictor variables, efficient sampling strategies, flexible modeling alternatives, and more. In this poster, we provide results from the 2011 NLCD TCC pilot tests, and summarize recommendations made for this national product that is currently in its prototype phase.
Keywords: NAIP Imagery, Random forest models, Sampling intensity, Mapping units, Hierarchical modeling

321. Evaluation of riparian landscapes in Pitangui and Jotuva rivers (first plateau), Ponta Grossa, Paran
Authors: Moro, Tiaro Pereira, UEPG; Rosemeri Moro, UEPG
Poster #47 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Wetlands are completely protected by ParanÃ¡ State legislation although riparian zones are protected by federal law in Brazil only 30 meters in both sides no matter their declivity or flood extension. Nevertheless, researches ongoing intend to demonstrate that riparian forests could be used as reliable indicators of the conservation extension along riverine environments. We measured several spatial attributes of riparian lotic landscapes of Pitangui river and its main tributary, Jotuva river, in the south part of Brazil, encompassing 1,969.5 ha by means of a 2005 SPOT5 image. The criteria adopted for riparian zones delimitation were the visible wetlands limits and the shrub vegetation size. 16 polygons of marginal forests (hygrophilous vegetation) were delimited in both rivers, whereas wetlands (hydrophilous vegetation) performed 75 polygons in Pitangui river and 35 in Jotuva. There are different patterns in the landscape related to relief with lateral dissimilarities in Pitangui due to the predominant right side degradation bank, and a longitudinal one in Jotuva, resulted from its nested superior course. Circularity index of hygrophilous forests in Pitangui (Âµ=0.45Â±0.25) and Jotuva (Âµ=0.46Â±0.22) pointed to linear patches (corridors) while Circularity index of wetlands in Pitangui (Âµ=0.69Â±0.14) and Jotuva (Âµ=0.71Â±0.14) pointed more rounded patches. The importance of including wetlands in riparian analysis in these rivers is discussed once they have a distinctive role in the landscape.
Keywords: Riparian, Lotic, Landscape, Vegetation

322. Genetic diversity of Qualea grandiflora intra population at cerrado in S
Authors: Ritter, Lia Maris Orth Ritter, Universidade de S; Miklos Bajay, Universidade de S; Renata Gabriela V C Souza, Universidade de S; Elza M. Ferraz, Universidade de S; Paulo Yoshio Kageyama, Universidade de S
Poster #53 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: This study was conducted in a population of Qualea grandiflora Mart, in a strict sense cerrado in SÃ£o Paulo, in order to establish the genetic diversity within populations of that typical specie from Brazilian cerrado. DNA was extracted from fresh leaf material, according to the protocol Ferreira & Gratapaglia (1998) modified. Were used microsatellites loci developed by Ritter et al (unpublished data). All SSR loci studied demonstrated high levels of polymorphism. The average number of alleles per locus was 12.5. In all loci analyzed He was greater than Ho, indicating excess of homozygosis. Hardy Weinberg equilibrium deviation was found in 6 of 8 loci, suggesting that inbreeding occurs in this population. The values of Polymorphic Information Content (PIC) were high (average 0.799). Spatial genetic structure analysis of the population through the correlation graph of co ancestry demonstrates that there is family structure development opportunity to a distance of approximately 45 meters. This discovery reinforces the existence of a genetic structure, possibly related to restriction of gene flow by seed or the occurrence of vegetative propagation. The effective population size (Ne) calculated for the study population was 10 (indicating a small genetic representativeness). Based on the effective size of reference 50, 500 and 1000, the minimum viable areas for conservation of the species vary from 3.6 to 72.11 acres. Those values show that there is a

need for conservation of relatively large areas of cerrado due to the noncontiguous distribution of species and its close relation with the occurrence of the different cerrado faces.
Keywords: Cerrado, Qualea grandiflora, Genetic diversity, SSR, Conservation

323. Cumulative effects assessment in forest landscapes and expert knowledge
Authors: Perera, Ajith Perera, Ontario Forest Research Institute; Lisa Buse, Ontario Forest Research Institute
Offered Presentations: Symposium 1: Expert Knowledge and Assessing Cumulative Effects in Forest Landscapes - Monday (2011-04-04): 09:40 - 10:00 - Galleria 1
Abstract: Some jurisdictions are developing proactive policies to assess cumulative effects of anthropogenic disturbances in forest landscapes and expect researchers to provide a scientific foundation to do so. The formal body of scientific knowledge, developed by formal research methods and published after peer-reviews, is far from adequate to meet such requests. Typical urgency of demands for information does not always permit long term formal investigations to generate knowledge. Knowledge of expert professionals “ scientists as well as practitioners -- offers a ready solution to inform policies and plans of cumulative effects assessment. If used rigorously, many opportunities exist to use expert knowledge in research: reducing complexities of the view of ecological systems, scoping and scaling of forest landscape patterns and processes, formulating scientific propositions and hypotheses, identifying key ecological signals to monitor, collecting and interpreting data, and even testing hypotheses. These uses extend beyond the traditional use of expert knowledge “ the expert systems approach to decision making. We discuss these topics with examples from Ontario, Canada where a major exercise is underway to develop strategic policy and tactical guidelines to assess cumulative effects in forest landscapes.
Keywords: Expert knowledge, Cumulative effects assessment, Forest landscapes, Canada, Ontario

324. Unknown unknowns: the emergence of unexpected interactions between climate change and forest health
Authors: McNulty, Steve McNulty, US Forest Service
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 09:20 - 09:40 - Broadway 3/4
Abstract: Former Secretary of Defense Donald Rumsfeld received much criticism for his statement regarding the unknown unknowns" of the Iraq war. A similar set of unknowns are likely linking in the shadows of climate change impact science. These are combinations of stresses and ecosystem conditions that will combine in new and unique ways in the coming years and decades. Such combinations could possibly cause a fundamental rethinking of the definition for a "healthy" forest. Examples of these "ecological surprises" are already occurring
Keywords: Surprises, Health, Forest, Interactions

325. Integrating phenology into cross-scale risk assessments of climate change
Authors: Norman, Steve Norman, US Forest Service; William Hargrove, US Forest Service
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 09:40 - 10:00 - Broadway 3/4
Abstract: Climate change is an established cause of why species’ ranges shift, why vegetation fluctuates locally, and why disturbance varies over time. What we lack is a practical approach for integrating these complex effects of climate change and other issues of concern to better manage landscapes. Integrated Risk Assessment (IRA) meets that need. IRA integrates values at risk, models complex interactions and addresses uncertain outcomes. We illustrate this approach by predicting the relative effects of climate change by integrating broad-scale tree range stress, local-scale topographic refugia, and fire regimes in the eastern United States. A change in fire regimes is thought to provide a key mechanism by which vegetation change is accelerated. However, eastern fire regimes are highly

complex due to their seasonal sensitivity to climate and leaf phenology, dominance by human starts, and nuanced effects on species. Moreover, many eastern forests are changing in undesired ways due to too little fire, and fire-based restoration is advocated to enhance forest resilience to stresses associated with climate change. The long-term effectiveness of such management strategies is contingent on local and range-wide factors that can be exploited to prioritize efforts across scales.
Keywords: Climate change, Fire, Scale, Phenology

326. Catching up with the climatologists: developing ensembles of ecological impacts models to look at climate change opportunities and challenges
Authors: Bachelet, Dominique Bachelet, Conservation Biology Institute; Becky Kerns, US Forest Service PNW; Miles Hemstrom, US Forest Service PNW; David Conklin, Conservation Biology Institute; Jessica Halofsky, U. Washington
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 10:00 - 10:20 - Broadway 3/4
Abstract: Since the early days of IPCC (Intergovernmental Panel on Climate Change), the climate model community has offered a series of potential futures to be used as a range of possibilities given the number of teams involved and the available data to initialize the models. The climate impacts (terrestrial) community includes many types of established scientists who simulate species niches, global vegetation dynamics, crop yields, population dynamics, fire effects, streamflows, pest and disease outbreaks, etc but rarely interact between themselves to put together a cohesive picture of how terrestrial landscapes may change as a whole. It is high time collaborations develop to provide impacts model ensembles that give a range of potential futures to land managers and policy makers eager for quantitative and tangible results from research teams. In this project, we attempt to bring together results from three approaches (a state and transition model VDDT, a dynamic global vegetation model MC1, and a suite of species envelope models) to provide usable information to land managers tasked with reducing fire risk in Western states. Calculating disturbance (fire, insect outbreak) probabilities, estimating species vulnerability to changes in climate variables by defining thresholds, defining the effect of CO2 on growth and decomposition rates, all require modelers to make decisions based on data availability and current state of knowledge. We review each approaches strengths and weaknesses, discuss the modeling approaches inherent assumptions, and comment on the need to visualize the uncertainty associated with model outcomes.
Keywords: Climate change, Models, VDDT, MC1, Niche models

327. Interactions between climate, insect outbreaks, and forests
Authors: Hicke, Jeffrey Hicke, University of Idaho/US Forest Service; Eric Pfeifer, US Forest Service; Steve Edburg, University of Idaho; Arjan Meddens, University of Idaho
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 10:20 - 10:40 - Broadway 3/4
Abstract: Bark beetle outbreaks are major disturbances of forests in western North America, affecting more area per year than forest fires. Bark beetle epidemics are strongly influenced by climate and climate change through winter mortality of larvae, year-round temperature effects on life stage development rates, and drought stress on trees hosts. In turn, beetle outbreaks affect future climate through the carbon cycle. Forests that experience bark beetle epidemics have reduced productivity and increased decomposition. Both responses act to reduce carbon sequestration, and may lead to a net carbon source. Forests recover in decades to centuries, implying no net loss of carbon to the atmosphere. However, projected climate change will likely lead to increased bark beetle disturbances compared with the past and resulting in an increase of atmospheric CO2. Furthermore, beetle outbreaks will accelerate species composition responses of forests to climate change, potentially leading to reductions in carbon sequestration. These feedbacks among bark beetle outbreaks and climate through the carbon cycle will be discussed.

Keywords:

328. Potential of MODIS satellite data for assessing forests vulnerable to climate change impacts, based on a Northern Front Range case study
Authors: Spruce, Joseph Spruce, Computer Sciences Corporation; W Hargrove, Eastern Forest Environmental Threat Assessment Center, US Forest Service; J Gasser, Lockheed Martin Civil Programs, Stennis Space Center; J Smoot, Computer Science Corporation, Contractor to NASA Applied Science and Technology Project Office; P Kuper, Computer Science Corporation, Contractor to NASA Applied Science and Technology Project Office
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 10:40 - 11:00 - Broadway 3/4
Abstract: Considerable forest acreages across the United States are currently identified as being vulnerable to climate change impacts. The forests in the Colorado Front Range are one example, which has recently experienced a multiyear drought, along with extensive forest mortality from insect attacks and wildfires. This presentation discusses an effort to use MODIS satellite data for regional forest monitoring in the northern portion of Colorado Front Range, where mountain pine beetle (MPB) has recently caused extensive lodgepole pine mortality. We acquired and temporally processed MODIS MOD13 16 day Aqua and Terra NDVI time series data into % NDVI change products. The products were re-aggregated into 24 day composites that were organized into annual data stacks. For a given compositing period, we computed % NDVI change products that compared the â€œcurrentâ€ NDVI to the observed historical maximum NDVI. A forest mask was applied to isolate % change in forest NDVI. We found that the more extensive, severe forest disturbances tended to have higher MODIS NDVI drops of 15% or more. MODIS-based detections of forest disturbance patches were assessed through comparison with higher resolution satellite and aerial imagery, aerial sketch maps, and field data. MODIS NDVI in this study showed potential for aiding regional assessments of forests vulnerable to climate change. Such products enabled the detection and monitoring of multiple large lodgepole pine overstory mortality areas across the region. Use of the entire time series of MODIS % NDVI change products allowed MPB forest mortality progressions to be more fully viewed and assessed.
Keywords: remote sensing, MODIS NDVI, Forest landscapes, Disturbance, Land cover change

329. Providing forest managers predictions of vegetation dynamics that account for climate change
Authors: Crookston, Nicholas Crookston, US Forest Service; Gerald Rehfeldt, US Forest Service; Gary Dixon, US Forest Service; Aaron Weiskittel, University of Maine
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 11:00 - 11:20 - Broadway 3/4
Abstract: Forest managers have long used predictions of growth and yield, including several measures for forest species composition and size structure, when developing management plans. There is a long history of models that provide the necessary information to forest managers at spatial and temporal scopes and resolutions required to support this work. Most of these models assume that site conditions will remain constant and that species composition will follow succession trends that typify the site. Historic range of variability is often cited as a foundation for determining target forests. Here we present evidence that species composition will not remain constant within the time-scope of typical forest plans. Maximum stand density, site index, and genetic adaptation will also change. We modified the Forest Vegetation Simulator to take these factors into account in model outputs. Predictions made using the modified model illustrate that climate change-induced mortality is the biggest factor affecting model outputs as the loss of trees of a dominant species heavily influenced stand dynamics. Running the model once for each of several General Circulation Model outputs, using different green house gas scenarios revels that in some cases there is little variation

between predictions and in other cases the results vary widely. Simulations made for three climatically diverse landscapes are used to illustrate model performance.
Keywords: Climate change, Forest management

330. A multi-phase approach to assessing potential changes in Eastern US tree distributions
Authors: Iverson, Louis Iverson, US Forest Service; Anantha Prasad, US Forest Service; Stephen Matthews, Ohio State University; Matthew Peters, US Forest Service
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 11:20 - 11:40 - Broadway 3/4
Abstract: Climate change will likely cause impacts that are species specific and significant; a comprehensive modeling scheme is critical to better understand potential changes in suitable habitat. We use empirical, abundance-based habitat models utilizing decision tree-based ensemble methods (DISTRIB) to explore potential changes of 134 tree species habitats in the eastern United States (http://www.nrs.fs.fed.us/atlas).To help interpret and add value to these outputs, we assigned and calculated Modification Factors for disturbance and biological factors that cannot be specifically assessed with the empirical-statistical approach. We also use a spatially explicit cellular model, SHIFT, to calculate colonization potentials, based on the abundance of the species, the distances between occupied and unoccupied cells and the fragmented nature of the landscape. These tools are demonstrated for a few species from Wisconsin. The combination of these three approaches to assessing the likely impacts of climate change provide a more thorough analysis and, we hope, a tool set that managers can begin to use in the course of their adaptive management decisions in the face of climate change. With DISTRIB, we provide potential changes in individual species' suitable habitat under various climate models and scenarios of human responses to carbon emissions. With the modifying factors, we assess each species' capacities and vulnerabilities to adapt to various changing conditions. And with SHIFT, we provide an indication of the rate of natural migration through the current fragmented habitats. We intend to use SHIFT to assess simulated outcomes of landscape manipulation to enhance dispersal and assisted migration options under climate change.
Keywords: Climate change, Eastern US, Distribution, Suitable habitat, Trees

331. Contemporary forest Inventories as an indicator of future tree range shifts
Authors: Woodall, Christopher Woodall, US Forest Service
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 11:40 - 12:00 - Broadway 3/4
Abstract: Changes in tree species distributions are a potential impact of climate change on forest ecosystems, the examination of which has been limited to simulation activities due to a lack of consistent, long-term forest inventory datasets. The goal of this study was to compare current geographic distributions of tree seedlings with biomass (trees with a diameter at breast height â‰¥ 2.54 cm) for species in the eastern United States using a contemporary forest inventory. Compared to mean latitude of tree biomass, mean latitude of seedlings was found to be significantly farther north (> 20 km) for many northern study species. Density of seedlings relative to tree biomass of northern tree species was nearly 10 times higher in northern latitudes compared to southern. It is hypothesized that as northern and southern tree species together move northward due to greater regeneration success at higher latitudes, generalized species may fill their vacated niches in southern locations. The results of this study suggest that the process of northward tree migration in the eastern United States is currently underway for numerous species with rates approaching 100 km/century.
Keywords: Tree migration, Climate change, Forest inventory

332. Using whole plot imputation to forecast forest inventories in response to climate and socioeconomic changes
Authors: Wear, David Wear, US Forest Service; Robert Huggett, North Carolina State University
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 13:00 - 13:20 - Broadway 3/4
Abstract: Multiple forces will jointly determine the trajectories of forest type and age distributions over the next several decades. Natural disturbances, climate change, human uses, and successional change interact to define broad patterns of change in the region. This paper examines forecasts of change in forest conditions over the next fifty years in response to these forces based on empirical forest forecasting models developed for the 2010 RPA Assessment. Patterns of change vary over time and space and are especially sensitive to forecast changes in precipitation and population growth and development within regions of the United States. As a result of these multiple drivers, forest area declines, and total standing biomass is expected to peak and begin to decline early in the projection period. Several shifts among forest types are evident and declines in early successional habitats are forecasted.
Keywords: Scenarios, Forecasting, Climate change, Land use change

333. Determining shifts in climate regimes using earth system model projections
Authors: Hoffman, Forrest Hoffman, Oak Ridge National Laboratory; William Hargrove, US Forest Service; Richard Mills, Oak Ridge National Laboratory; Jitendra Kumar, Oak Ridge National Laboratory; Salil Mahajan, Oak Ridge National Laboratory
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 13:20 - 13:40 - Broadway 3/4
Abstract: Changes in Earth's climate in response to increasing concentrations of greenhouse gases are expected to alter terrestrial ecosystems and the hydrological cycle. Combinations of environmental conditions that influence ranges and distributions of plant and animal life are often mapped geographically as ecoregions. A multivariate clustering technique, developed by Hargrove and Hoffman, has been applied to ecological regionalization of various environmental factors for the conterminous United States and globally. Here we apply a similar geospatiotemporal data mining method to quantitatively track the evolution of ecological regions through time using monthly time series output from fully coupled Earth system models (ESMs) under different climate change scenarios. Our approach establishes an exhaustive set of recurring bioclimatic regimes that form a skeleton through the cloud of model output in the bioclimatic phase space formed by the characteristics being considered. Instances of these regimes migrate across the globe seasonally and grow and shrink due to interannual variability and long term trends. When considered as a consistent set of climate states defined across all model results, these regimes provide a multivariate basis for comparison of projections across models and scenarios. Moreover, by mapping all land cells to discrete climate states, the dynamic behavior of any part of the system can be studied by its time-varying sequence of climate state occupancy. Results from the analysis of global ESM output and their implications for future biome distributions will be presented.
Keywords: Earth system model, Ecoregions, Cluster analysis, Data mining, Ecosystems

334. Global tree range shifts under forecasts from two alternative GCMs using two future scenarios
Authors: Hargrove, William Hargrove, US Forest Service; Kevin Potter, NC State University Dept of Forest Resources; Frank Koch, NC State University Dept of Forest Resources; Forrest Hoffman, Oak Ridge National Laboratory
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 13:40 - 14:00 - Broadway 3/4
Abstract: Global shifts in the environmentally suitable ranges of 215 tree species were predicted under forecasts from two GCMs (the Parallel Climate Model (PCM), and the Hadley Model), each

under two IPCC future climatic scenarios (A1 and B1), each at two future dates (2050 and 2100). The analysis considers the globe at a resolution of 4 km2. A statistical multivariate clustering procedure was used to quantitatively delineate 30 thousand environmentally homogeneous ecoregions across present and 8 potential future global locations at once, using global maps of 17 environmental characteristics describing temperature, precipitation, soils, topography and solar insolation. Presence of each tree species on Forest Inventory Analysis (FIA) plots and in Global Biodiversity Information Facility (GBIF) samples was used to select a subset of suitable ecoregions from the full set of 30 thousand. Once identified, this suitable subset of ecoregions was compared to the known current range of the tree species under present conditions. The subset of suitable ecoregions for each tree species can then be tracked into the future to determine whether the suitable home range for this species remains the same, moves, grows, shrinks, or disappears under each model/scenario combination. Maps were generated for each tree species showing the Minimum Required Movement (MRM) straight-line distance from each currently suitable location to the geographically nearest lifeboat" location having suitable conditions in the future. Locations that are the closest "lifeboats" for many MRM propagules originating from wide surrounding areas may constitute high-priority preservation targets as a refugium against climatic change."
Keywords: Climate change, Ecoregion, Assisted migration, PCM, Hadley

335. Anticipating climate-change induced biome shifts for military installations
Authors: Westervelt, James Westervelt, Construction Engineering Research Laboratory; William Hargrove, Forest Service
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 14:00 - 14:20 - Broadway 3/4
Abstract: Natural resource managers on military installations are responsible for maintaining the health of ecosystems and abundance of listed species - in support of the training and testing missions. Many management decisions, like planting trees and establishing/maintaining species management areas, have long-term implications and must account for long-term natural and man-made changes. To begin the process of planning for climate change, managers will want to ask if and when the conditions will change sufficiently to favor local biome shifts. We report here on a process that turns current ecosystem maps (GAP program, covering the US; and the TNC international ecosystem map) into potential future maps based on forecasts generated by general circulation models. The results will help installation natural resource managers frame local analyses and help headquarter-level offices prioritize installations by level of anticipated threat of change.
Keywords: Climate change, Biome shift, Military, Ecosystem change

336. Adapt, move or die: spatially explicit assessment of climate change genetic degradation risk in forest trees
Authors: Potter, Kevin Potter, North Carolina State University; William Hargrove, US Forest Service, Eastern Forest Environmental Threat Assessment Center; Barbara Crane, US Forest Service, Region 8; Frank Koch, North Carolina State University
Offered Presentations: Symposium 2: Climate Change – Impacts and Effects on Vegetation - Monday (2011-04-04): 14:20 - 14:40 - Broadway 3/4
Abstract: Changing climatic conditions may pose a severe threat to forest tree species, forcing three potential population-level responses: on-site toleration/adaptation, range-shift or extirpation. All could have negative genetic consequences. Conserving the genetic diversity of these species will be important, as genetic variation may allow species and populations to adapt to changing conditions. To efficiently conserve genetic variation of species, however, it will be necessary to understand (1) where the climate change pressure will be greatest for each species and (2) what species and populations are more highly predisposed to genetic degradation. We are synthesizing two very different types of data to conduct a spatially explicit assessment of the risk posed by climate change

to the genetic integrity of North American forest tree populations: (1) 4-km2 resolution maps predicting the genetic pressure that could be imposed by climate change on forest tree species and (2) information about the biological attributes and genetic diversity of individual species. The maps, generated through the Multivariate Spatio-Temporal Clustering (MSTC) approach, quantify potential climate change genetic pressure, as defined by the straight-line Minimum Required Movement (MRM) distance from the existing locations of each species to the nearest favorable future habitat in 2050. Species attribute information includes population structure, rarity, regeneration capacity, dispersal ability, habitat affinities, genetic variation, and pest and pathogen susceptibility. This work should be valuable for scientists and managers attempting to determine which species and populations to target for monitoring efforts and for pro-active gene conservation and management activities.
Keywords: Climate change, Landscape genetics, Biological diversity, Assessment, Monitoring

337. Impacts of dendritic network structure on population biology and evolutionary ecology: a review of theoretical approaches for assessing human-mediated changes in connectivity
Authors: Labonne, Labonne Jacques, INRA
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 10:00 - 10:20 - Broadway 1
Abstract: The particular spatial shape of river networks has long been recognized by hydrobiologists, mainly because of its cumulative hydrological aspects. The river continuum concept proposed a robust framework to understand some of the patterns observed in riverine aquatic species. Because populations and species were often physically isolated in river networks, the metapopulation concept first arose like a natural choice to understand dynamic processes within a watershed. The dendritic nature of rivers, in constrast, evaded most of the theoretical approaches until recently. The last years have seen a handful of dedicated theoretical proposals to explicitly account for dendritic structures on population dynamics and genetics. These numerical and analytical models have shown significant departures from the classical metapopulation expectations. For instance, dendritic structures can sometimes conserve higher genetic variation than other spatial arrangements, all else being equal. Similarly, connectivity, seen as local density of available habitat, can sometimes prevent the conservation of genetic variation and increase extinction risks. Finally, accounting for dendritic spatial structures of rivers improved the understanding of biodiversity patterns at local and basin scale. Both water flow and dendritic structures appear to condition asymmetrical relationships for dispersal, gene flow or chemical cues. Habitat availability is also often distributed as a function of an upstream-dowstream gradient. The multiple combinations of these factors and the life histories of species inhabiting dendritic networks have yet to be explored to provide more general patterns, in order to be able to uncover both fine scale and basin-wide evolutionary mechanisms. Such knowledge would be required to fully understand the short and long term, as well as small and large scale consequences of connectivity manipulation in river systems.
Keywords: Dendritic network, Connectivity, Metapopulation, Gene flow, Dispersal

338. Network thinking in riverscape conservation
Authors: Eros, Tibor Eros, Balaton Limnological Research Institute, Hungarian Academy of Sciences
Offered Presentations: Symposium 3: Human Influence on Connectivity and Population Structure in Rivers - Monday (2011-04-04): 13:00 - 13:20 - Broadway 1
Abstract: Graph-theoretic approaches have received increased interest recently in landscape planning and conservation in the terrestrial realm, because these approaches facilitate the effective modelling of connectivity among habitats. We examined whether basic principles of graph-theory can be extended to other ecosystems. Specifically, we demonstrate how a network-based context can be used for enhancing the more effective conservation of riverine systems. We first show how to use graph-theoretic techniques to model riverscapes at the segment level. Then we use a real stream network (Zagyva river basin, Hungary) to examine the topological importance of segments in

maintaining riverscape connectivity, using betweenness centrality, a commonly used network measure. Using the undirected graph model of this riverscape, we then prioritize segments for conservation purpose. We examine the value of each of the 93 segments present in the Zagyva river basin by considering the conservation value of local fish assemblages, connectivity and the size of the habitat patches. For this purpose we use the “integral index of connectivity”, a recently advocated habitat availability index. Based on the results the selection of the most valuable habitat segments can be optimized depending on conservation resources. Because of their inherent advantage in the consideration of connectivity relationships, we suggest that network analyses offer a simple, yet effective tool for searching for key segments (or junctions) in riverscapes for conservation and environmental management. Further, although the joint consideration of aquatic and terrestrial networks is challenging, the extension of network analyses to freshwater systems may facilitate the more effective selection of priority areas for conservation in continental areas.
Keywords: Graph theory, Stream network, Fragmentation, Network topology, Fish

339. Discussion (led by Dean Urban)
Authors: Urban, Dean
Offered Presentations: Symposium 4: Urban Long-term Research Areas (ULTRA): Opportunities for Comparison and Synthesis - Monday (2011-04-04): 16:00 - 1700 - Broadway 2

342. Boring to the Core: Using dendrochonology and archival research to define disturbance events that have impacted a 1920s era railroad logging camp
Authors: Paullin, Pamela Paullin, USDA-NRCS
Offered Presentations: Symposium 6: Landscape and Disturbance Legacies of Railroad Logging: 50 to 130 Years of Post Disturbance Recovery - Tuesday (2011-04-05): 10:40 - 11:00 - Broadway 1
Abstract: Dozens of railroad logging camps once existed throughout the forests of the Pacific Northwest. The location of many of these camps has been lost with time, hidden by dense second growth stands of timber, or destroyed by forest fires, logging, road building, and general vandalism. Through the use of historical records including oral histories, maps, old timber cruises, and photos, the approximate location of one of these forgotten camps was rediscovered in the Cascade Mountains of Clackamas County, Oregon. The archival research revealed that two forest fires and the construction of a landing strip had occurred on or near Camp 1, but the location, extent, and impact of the disturbances on the as yet undefined archaeological site were unknown. It will be demonstrated that a combination of dendrochronology, field survey, archival research, and GPS mapping capabilities is an effective strategy to determine archaeological site boundaries in a forested environment, as well as define the location and timing of disturbance events that have impacted the archaeological record.
Keywords: Railroad logging, Dendrochronology, Archaeology, Disturbance, Logging camps

343. Ecological patterns and stories of landscape transformation in 19th century San Jos
Authors: Beller, Erin Beller, San Francisco Estuary Institute; Micha Salomon, San Francisco Estuary Institute; Robin Grossinger, San Francisco Estuary Institute
Offered Presentations: Symposium 8: Historical Ecology of Highly Modified Landscapes: Using History to Re-imagine Future Landscape Potential - Wednesday (2011-04-06): 10:20 - 10:40 - Broadway 1
Abstract: A dense urban corridor stretches continuously from Palo Alto to San JosÃ©, creating a heavily settled region that lies at the heart of the Santa Clara Valley (also known as Silicon Valley). The area includes San JosÃ©, the largest city in the Bay Area and tenth largest in the United States. We synthesized hundreds of early cartographic, textual, and visual accounts to produce a map reconstruction of historical conditions in the valley, including stream form and habitat distribution and abundance, circa 1800 (prior to significant Euro-American modification). Our findings reveal a

heterogeneous ecology, providing rich details of the landscape patterns and individual ecological features that formerly characterized the region. Despite an intensive history of modifications to the natural landscape, an examination of these historical documents reveals an abundance of ecological information relevant to our understanding of the modern landscape and with practical application to contemporary management questions. For example, changes in hydrology have impacted urban stormwater, bank erosion, and groundwater recharge, all of which are significant challenges in the valley today. This information has the potential to inform future planning efforts from the project to the regional scale, identifying underlying patterns and processes and shifting perceptions of what once existed and what may be possible to restore.
Keywords: Historical ecology, Landscape history, Urban ecology, Restoration planning, Santa Clara valley

344. Stand-replacing patches within a
Authors: Collins, Brandon Collins, US Forest Service, Pacific Southwest Research Station; Scott Stephens, UC Berkeley
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 09:40 - 10:00 - Broadway 4
Abstract: The complexity inherent in variable, or mixed-severity fire regimes makes quantitative characterization of important fire regime attributes (e.g., proportion of landscape burned at different severity levels, size and distribution of stand-replacing patches) difficult. As a result, there is ambiguity associated with the term “mixed-severity”. We address this ambiguity through spatial analysis of two recent wildland fires in upper elevation mixed-conifer forests that occurred in an area with over 30 years of relatively freely-burning natural fires. We take advantage of robust estimates of fire severity and detailed spatial datasets to investigate patterns and controls on stand-replacing patches within these fires. Stand-replacing patches made up 15 % of the total burned area between the two fires, which consisted of many small patches (< 4 ha) and few large patches (> 60 ha). Smaller stand-replacing patches were generally associated with shrub-dominated (Arctostaphylos spp. and Ceanothus spp.) and pine-dominated vegetation types, while larger stand-replacing patches tended to occur in more shade-tolerant, fir-dominated types. Additionally, in shrub-dominated types stand-replacing patches were often constrained to the underlying patch of vegetation, which for the shrub type were smaller across the two fire areas than vegetation patches for all other dominant vegetation types. For white and red fir forest types we found little evidence of vegetation patch constraint on the extent of stand-replacing patches. The patch dynamics we identified can be used to inform management strategies for landscapes in similar forest types.
Keywords: Fire ecology, Fire severity, RdNBR, Wildland fire use, Fire management

345. Mixed-severity fire dynamics of Douglas-fir/western hemlock forests in the central western Cascades of Oregon in relation to topography and past climate
Authors: Swanson, Alan Tepley, Department of Geography, University of Colorado, Boulder, CO; Frederick Swanson, US Forest Service, Pacific Northwest Research Station, Corvallis, OR; Tom Spies, US Forest Service, Pacific Northwest Research Station, Corvallis, OR
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 10:20 - 10:40 - Broadway 4
Abstract: Understanding historical expressions of mixed-severity systems is essential for determining the degree that 20th-century management has altered their dynamics and for developing forest management strategies under a warming climate. To characterize the mixed-severity fire regime in Douglas-fir/western hemlock forests in the central western Cascades of Oregon, we collected stand- and age-structure data from 124 stands throughout two large watersheds. Most stands (75%) had two or more post-fire cohorts. Cohorts were dominated by shade-tolerant species following low-severity fire that killed few canopy trees. Douglas-fir abundance in the post-fire cohort increased following

higher-severity fire. A trend of decreasing fire frequency and severity toward lower slopes was suggested by increasing abundance of older trees, especially older fire-sensitive, shade-tolerant species, from upper to lower slope positions. This trend becomes more pronounced with increasing topographic relief. For example, only 15% of stands lack evidence of fire for > 400 years, and these stands are limited to concave landforms beneath the highest ridgetops (> 1,200 m), where cold-air pooling and topographic shading contribute to cool microclimate and high fuel moisture. Warm phases of the Pacific Decadal Oscillation have synchronized extensive burning across the Pacific Northwest in the 20th century. Similarly, post-fire establishment of Douglas-fir was widespread across both watersheds during warm phases in the 16th and 19th centuries. Little establishment was found during cool phases of the 17th and 18th centuries. Thus, variable fire frequency and severity, driven by complex topography and climatic variation, were essential to the development of diverse forest stand and landscape structures.
Keywords: Fire, Mixed-severity, Douglas-fir, Topography, Climate

346. Conserving Northern Spotted Owl habitat and populations while mitigating wildfire risk and increasing resiliency of forest structure and function: balancing among conflicting ecosystem services in landscapes characterized by disturbance
Authors: Kennedy, Rebecca Kennedy, US Forest Service, Pacific Northwest Research Station; Paul Hessburg, US Forest Service, Pacific Northwest Research Station; Bruce Marcot, US Forest Service, Pacific Northwest Research Station; Peter Singleton, US Forest Service, Pacific Northwest Research Station; Martin Raphael, US Forest Service, Pacific Northwest Research Station; John Lehmkuhl, US Forest Service, Pacific Northwest Research Station; Alan Ager, Western Wildland Environmental Threat Assessment Center; Thomas Spies, US Forest Service, Pacific Northwest Research Station
Offered Presentations: Symposium 10: Landscape Ecology of Mixed-severity Fire Regimes in the Pacific Northwest and Northern California - Wednesday (2011-04-06): 11:00 - 11:20 - Broadway 4
Abstract: Policymakers and land managers are faced with a conundrum: to maintain or increase populations of the threatened Northern Spotted Owl (NSO; Strix occidentalis caurina), while reducing wildfire risk in dry, fire-prone Pacific Northwest forests of the Pacific Northwest. The US Fish and Wildlife Service's Final NSO Recovery Plan augments the US Forest Service Northwest Forest Plan's late-successional reserve design, to address the need for dynamic, shifting habitat mosaics in portions of the eastern Cascades of Oregon and Washington, and northern California. Our research, the VFO Project, informs NSO Recovery Plan development and implementation by testing several hypotheses about how realistic forest management, natural fire regimes and forest dynamics may interact at multiple spatial and temporal scales, to influence short- and long-term habitat and population dynamics of the threatened Northern Spotted Owl. Our study is unique because of its coordinated focus on fire and fuels management effects on NSO habitat and populations, and incorporation of the invasive Barred Owl influences on the NSO. Our objectives: 1) quantify and map current large wildfire risk to NSO habitat and existing older forest structure; 2) determine short-term effects of vegetation and fuels management on fire risk and NSO habitat; and 3) characterize long-term potential spatio-temporal dynamics of NSO habitat and populations. This research provides innovative modeling procedures and results, maps depicting locations most prone to large wildfires, examples of prescriptions promoting habitat development while minimizing likelihood of large high severity fires, and maps and modeling predictions of habitat dynamics and NSO persistence under diverse scenarios.
Keywords: Conservation, Northern spotted owl, Habitat dynamics, Spatial modeling, Fire

347. Post-fire successional patterns and dynamics across the grassland-woodland ecotone in a Great Basin shrub-steppe landscape mosaic
Authors: Roberson, Justin Roberson, Department of Geography - University of South Carolina; John Kupfer, Department of Geography - University of South Carolina; Calvin Farris, National Park Service
Offered Presentations: Fire 1 - Monday (2011-04-04): 09:20 - 09:40 - Galleria 3
Abstract: Fire managers in Great Basin shrub-steppe rangelands face difficult decisions about where, when and whether to conduct prescribed burns. In some areas, fire exclusion has resulted in a dramatic increase in woody vegetation cover, a loss of native herbaceous cover and diversity, and increased fuel loads and fire hazards. In other areas, prescribed burning and/or wildfires have contributed to potentially irreversible conversions from native perennial grasses to exotic annuals that are favored by burning, initiating a possible feedback loop between fire frequency and exotic cover. These contrasting disturbance-succession trajectories are often juxtaposed within the same landscape. To elucidate post-fire successional patterns and dynamics at Lava Beds National Monument in northern California, we sampled vegetation and soils across gradients in elevation, fire history and geology. Lowest elevations were dominated by herbaceous species regardless of fire history, with compositional differences linked to variations in soil characteristics and fire frequency. Dominant life form and community composition at mid- and high-elevation sites were dictated primarily by time since fire, within constraints of soils and geology. Shrub cover increased with time since fire but began to decline after more than 40-80 years due to shrub senescence. In general, sandier soils and those with higher sodium concentrations supported greater shrub and tree cover, while finer-textured soils and those with higher nitrogen concentrations were associated with herbaceous species. Response curves for a number of indicator species, including Artemisia tridentata, Chrysothamnus spp., Purshia tridentata, and Juniperus occidentalis, clarified the effects of environmental conditions, fire history, and management strategy on community patterns and dynamics.
Keywords: Fire ecology, Great Basin, Shrub-steppe ecosystem, Succession

348. Quantifying fire hazard and fire behavior following a windstorm in southwest Oregon (U.S.A.) using the FCCS
Authors: Johnson, Morris Johnson, US Forest Service, Pacific Northwest Research Station, Pacific Wildland Fire Science Laboratory; Jessica Halosky, University of Washington, College of the Environment; David Peterson, US Forest Service, Pacific Northwest Research Station, Pacific Wildland Fire Science Laboratory
Offered Presentations: Fire 1 - Monday (2011-04-04): 09:40 - 10:00 - Galleria 3
Abstract: Post-disturbance logging on federal lands is a controversy topic in natural resource management. In early January 2008, a major windstorm with wind gusts up to 145 km/h blew down 2,800 ha of forests in the Butte Falls Resource Area (Medford Bureau of Land Management) in southwestern Oregon. The post disturbance fuelbed profiles could predispose these areas to subsequent large-scale disturbances (e.g., stand replacing fire, insect and disease epidemics). We used the Fuel Characteristics Classification System (FCCS) and Fire and Fire Extension to the Forest Vegetation Simulator (FFE-FVS) to quantify fuelbed characteristics (e.g., fuelbed loadings, fuelbed depth) and fire behavior potentials (e.g., rate of spread, flame length) before timber removal, after timber removal, and after surface fuel treatment. We used repeated measures ANOVA to compare mean levels of fuelbed depth, fuel loading (1-hr, 10-hr, 100-hr, 1000-hr, and larger fuel categories), and simulated fire behavior variables. Post-disturbance logging did not increase small surface fuels (1-hr). There was a significant reduction in 1-hr fuels after salvage logging and after surface fuel treatments (and treatment combination). Post disturbance logging, pile and burn, and treatment combination significantly reduced fuelbed depths. There was not a significant reduction in FCCS fire rate of spread after post disturbance logging, but there was a significant reduction after surface fuel treatment (and after the treatment combination). FCCS flame length and reaction intensity was not

significantly altered by treatments. FCCS crown fire potential was not reduced after salvage logging but was significantly reduced after surface fuel treatment (and the treatment combination).
Keywords: Blowdown, Fire hazard, Fuel treatment, FCCS

349. Spatial scaling of surface and canopy fuels in the Northern Rocky Mountains, USA
Authors: Keane, Robert Keane, Forest Service; Kathy Gray, UC Chico; Valentina Bacciu, Univ. Sassari, Italy
Offered Presentations: Fire 1 - Monday (2011-04-04): 10:00 - 10:20 - Galleria 3
Abstract: Surface and canopy fuels information form the foundation of many applications in fire management and planning, but most fire behavior prediction systems are point models that assume homogeneous fuels across space. Current wildland fuel research, however, has found that the variability of fuel across space is much more important to fire behavior than average fuel conditions. This presentation describes a study that investigated the spatial distribution of a number of fuel characteristics in northern Rocky Mountain forested stands to model and map fuels for fire behavior and effects prediction. In this study we attempted to quantify the spatial variation of forest fuels, and then attempt to derive some scaling factors that would integrate this spatial variability into the mapping process. Moreover, we attempted to explore some scaling factors for the distribution of fuel biomass over fuel size and component. We measured fuel loadings (biomass sq meter) for ten fuel components within nested plot sizes on a large sampling grid using a combination of planar intercept, photoload, and direct collection methods at 1, 5, 10, 15, 25, 50, 75, 100, 200, and 1,000 m intervals on a 1 km2 plot. We implemented this grid on six common northern Rocky Mountain fuel types- sagebursh, ponderosa pine, Douglas-fir, western larch, pinyon-juniper, and lodgepole pine. We describe the spatial distribution of fuel loading for these components using a number of spatial statistical techniques such as spatial autocorrelation, connectivity, Moran's I, and variograms. Fuel size class biomass distributions showed that these results can be scaled to make sampling and measuring of fuels easier in the future. Results from this study will be used to develop the next generation of fuel models to be used as input to future fire effects and behavior models to more accurately simulate fires across a spatial domain.
Keywords: Wildland fuels, Spatial scaling, Spatial variability, Fuel loading

350. Top-down and bottom-up control of fire regimes in montane grasslands of the Valles Caldera, New Mexico, USA
Authors: Dewar, Jacqueline Dewar, University of Arizona; Donald Falk, University of Arizona; Craig Allen, US Geological Survey, Jemez Mountains Field Station, Los Alamos, NM; Robert Parmenter, Valles Caldera National Preserve, Jemez Springs, NM; Thomas Swetnam, University of Arizona; Christopher Baisan, University of Arizona
Offered Presentations: Fire 1 - Monday (2011-04-04): 10:20 - 10:40 - Galleria 3
Abstract: Montane grasslands are distributed across the western United States, including the southern and central Rocky Mountains, but little is understood about their historic fire regimes. We reconstructed historic fire regimes at multiple spatial scales in ponderosa pine and mixed-conifer forests surrounding the â€œvalleâ€ grasslands in the Valles Caldera National Preserve of the Jemez Mountains in northern New Mexico. We reconstructed temporal and spatial patterns and compared variations of historic fire occurrence within and among valles as recorded in fire-scarred trees. Using a spatially-explicit sampling design, we collected 610 fire-scarred samples surrounding eight valles. We identified 181 fire years from AD 1479 to 1900, with adequate sample size after AD 1700. Preliminary results confirm pre-1900 historic occurrence of high frequency, low-severity surface fires over multiple centuries (mean fire interval = 2.33 yr). In some fire years, synchronous fires burned across the grasslands and into the surrounding forests over much of the ~40,000 ha Caldera (greater than 35% of total sites burning), indicating dominant top-down climate control of fire occurrence. These widespread fires typically occurred at ~10.5 year intervals. In other years, fires

burned relatively small portions throughout the Caldera (between 10 and 35% of total sites at ~6 year intervals), creating asynchronous burn patterns. Asynchronous fires suggest stronger bottom-up controls driven by fuels, fuel moisture, weather conditions, topography, and human ignitions. Results of this study will be used in planning forest and grassland restoration actions, and reinstituting pre-fire-suppression fire regimes for prescribed and natural fire management.
Keywords: Fire regimes, Montane grasslands, Ponderosa pine, Fire synchrony, Spatial analysis

351. Stochastic modeling of fire regimes in montane grasslands and forest ecotones of the Valles Caldera National Preserve, New Mexico
Authors: Conver, Joshua Conver, University of Arizona; Donald Falk, University of Arizona; Stephen Yool, University of Arizona; Robert Parmenter, Valles Caldera National Preserve
Offered Presentations: Fire 1 - Monday (2011-04-04): 10:40 - 11:00 - Galleria 3
Abstract: Montane ecosystems of the western United States have experienced dramatic changes in their fire regimes over the last 150 years. Fire behavior modeling enables a better understanding of how ecosystem changes have altered past fire regimes. The Valles Caldera National Preserve in the Jemez Mountains, northern New Mexico, contains one of the largest montane grasslands in North America, complemented by a century of weather records and multiple land uses ranging from logging to grazing and recreation. However, little is known about the fire regimes of these important ecosystems, which have experienced increased fuel loads and stem densities resulting from a century of fire exclusion and tree encroachment. In particular, we ask whether fire pathways in the natural regime tended to spread across the valle grasslands or along the grassland-forest ecotone. We used the program FlamMap to model fire behavior under a variety of weather and fuel conditions. FlamMap abstracts landscapes into eight factors with the greatest influence on fire behavior and utilizes wind and weather data to study the drivers of grassland fire behavior on a landscape scale. Wind and weather patterns are varied for multiple simulations, and fire spread pathways are computed. The results are compiled into a probability surface that represents the most parsimonious pathways of fire spread in this landscape. The results of the model, complemented with fire history studies in dendrochronology, further the understanding of fire's historical function in a montane-grassland conifer ecotone and assist in restoring a landscape suffering from the effects of fire exclusion.
Keywords: Fire regime, Fire modeling, Fire behavior, Restoration ecology

352. Spatial variability of a pine forest fire regime in a fragmented landscape
Authors: Ireland, Kathryn Ireland, School of Forestry, Northern Arizona University; Peter Ful, School of Forestry, Northern Arizona University; Amanda Stan, School of Forestry, Northern Arizona University
Offered Presentations: Fire 1 - Monday (2011-04-04): 11:00 - 11:20 - Galleria 3
Abstract: Fire regimes often vary at finer spatial scales in response to factors such as topography or fuels while climate usually synchronizes fires across larger scales. We investigated the spatial variation from local to landscape scales in ponderosa pine (Pinus ponderosa) fire regimes in a highly fragmented landscape in northwestern Arizona. Our study area of 4,000 ha was characterized by patches of ponderosa pine forest in drainages that were separated by a matrix of piÃ±on-juniper woodlands. We reconstructed fire histories in sixteen 25-ha grids (total 400 ha sampled) placed in patches of ponderosa forest. Fire frequency varied substantially at finer spatial scales. For fires that scarred at least 25% of the samples within each 25-ha grid, mean fire return intervals ranged from 5 to 23 years. However, synchrony at larger spatial scales was apparent from fifteen widespread fires that scarred at least 25% of the samples within the study area. These widespread fires were correlated with drought conditions during the year of the fire and above-average wet conditions in the 2 years before the fire, as measured by Palmer Drought Severity Index reconstructions. Widespread fire years were correlated with La NiÃ±a conditions (NINO3 index) in the year of the fire and strong El

NiÃ±o conditions in the 3 years prior to the fire. Fine-scale variability in fire regimes in this landscape may be governed by vegetation structure and the patchy distribution of ponderosa forests while climate conditions appear to synchronize fires across the larger landscape.
Keywords: Fire history, Climate, Ponderosa, PDSI, ENSO

353. The influence of wilderness fire management policies on fire regime characteristics in the Northern Rockies, USA
Authors: Haire, Sandra Haire, University of Massachusetts; Kevin McGarigal, University of Massachusetts; Carol Miller, Aldo Leopold Institute
Offered Presentations: Fire 1 - Monday (2011-04-04): 11:20 - 11:40 - Galleria 3
Abstract: Fires play an important role in many wilderness areas, and management policies encourage the use of naturally ignited fires to achieve sustainable ecosystem structure and function. Recent studies suggest that under these policies, the size of recent fires is limited where fires have burned in the past. Thus, we hypothesized that the distribution of fire sizes has shifted toward smaller fires under wilderness management. Using federal fire records (1984-2007), we modeled fire size distributions across a wilderness management gradient which reflected wilderness location and context. We tested the relationship of the distribution scaling parameter, alpha, to wilderness management and seasonal climate gradients in three study regions. Contrary to expectations, size distributions in Northern Rockies and the Southwest were more influenced by large fires as landscapes became more dominated by wilderness. However, several locations deviated from this trend in the Sierra Nevada, obscuring relationships between alpha and the wilderness management gradient. In the Northern Rockies, locations with warmer spring temperatures were more likely to have fewer large fires, but the Southwest and Sierra Nevada fire size distributions had no obvious relationships to spatial climate gradients. Although large fires would be expected in more northerly, high elevation ecosystems where burning is limited by moisture, short term effects of fire suppression at the edges and outside wilderness areas could explain similar wilderness-fire size trends in the Southwest. Incorporating a weight for management intensity in developing the wilderness management gradient will likely be worthwhile in interpreting our findings.
Keywords: Climate-management interactions, Wilderness management, Disturbance, Fire size distributions, Pareto distribution

354. Influences of fuel treatment type and age on fire severity in the Western United States
Authors: Wimberly, Michael Wimberly, South Dakota State University; Mark Cochrane, South Dakota State University; Jeremy Werner, South Dakota State University
Offered Presentations: Fire 1 - Monday (2011-04-04): 11:40 - 12:00 - Galleria 3
Abstract: Information on fuel treatment effectiveness is critical for development and implementing forest management strategies in fire-prone forests of the western United States. Previous studies of fuel treatments have typically focused on one or a few wildfires within a limited geographic area. These studies have used different data sources and methods, and have generated a variety of results that are often contradictory. The availability of burn severity maps and fuels maps at a national level, combined with the increasing accessibility of GIS data on forest management history, offers an opportunity for comprehensive assessment of fuel treatment effectiveness at regional to national extents. Our study examined fuel treatment effectiveness for more than 200 fires that occurred between 2001 and 2007 in the western United States. For each fire, we used spatial autoregression to compute treatment effects on remotely sensed burn severity metrics (dNBR and RdNBR) controlling for vegetation, topography, and other spatially autocorrelated confounding variables. We then used meta-analysis to compare treatment effects by treatment type, treatment age, and geographic region. Treatments involving fire (historical wildfires, prescribed burning, and prescribed burning combined with thinning) reduced fire severity more than mechanical treatments such as mastication and thinning. Treatment effectiveness decreased with age for all treatment types. These

effects were generally consistent across geographic areas. These results highlight the importance of incorporating fire into fuel treatments to reduce the loadings of fine surface fuels, and emphasize that wildfires as well as prescribed fires can be effective at reducing the severity of subsequent burns.
Keywords: Wildfire, Fuel treatment, Spatial statistics, Remote sensing

355. Application of wildfire simulation modeling to analyze spatial patterns of wildfire risk on a national forest in central Oregon
Authors: Ager, Alan Ager, US Forest Service Pacific Northwest Research Station; Nicole Vaillant, US Forest Service, Pacific Northwest Research Station; Mark Finney, US Forest Service,RMRS Research Station
Offered Presentations: Fire 2 - Monday (2011-04-04): 14:00 - 14:20 - Broadway 1
Abstract: Mechanistic wildfire simulation modeling is widely used in the U.S. Forest Service to analyze wildfire risk and design fuel management projects. The work is facilitated by a minimum travel time algorithm (M. Finney) that makes it computationally feasible to estimate fine scale burn probabilities on large landscapes. We used wildfire simulation modeling to analyze risk and transmission among key human and ecological values on the 0.6 million ha Deschutes National Forest in central Oregon. The Forest contains numerous urban interfaces, old growth forests, habitat for rare species, and recreational sites. We simulated 50,000 wildfires with random ignition locations and generated maps of burn probability, flame length, and size of fire generated by an ignition. We also calculated the ratio of fire size to burn probability to examine wildfire transmission among land designation. The results showed complex spatial patterns in fire behavior that could largely be related to ecological conditions and corresponding fire regimes. However, patch level variation in fire behavior within land designations was pronounced, owing to local variation in fuels and topography. For instance, average burn probability northern spotted owl nest sites ranged from 0.0002 to 0.040. Areas of high fire transmission were found where long fetches of fuels were located downwind of the ignition point. The study revealed spatial variation in wildfire risk factors that can be used to prioritize fuel management and restoration programs.
Keywords: Wildfire simulation, Wildfire risk, National forest, Risk assessment

356. Factors affecting prescribed burning of longleaf pine in a mixed-use landscape
Authors: Costanza, Jennifer Costanza, NC State University
Offered Presentations: Fire 2 - Monday (2011-04-04): 14:20 - 14:40 - Broadway 1
Abstract: The success of conservation and restoration efforts in mixed-use landscapes depends on a consideration of individual sites and their broader spatial context. This may be particularly true for restoration of fire-dependent ecosystems using prescribed burning. In a landscape that includes human land uses, risk of fire becoming out-of-control may affect decisions about the use of prescribed burning. It is important to understand how prescribed burning decisions are affected by both the potential ecological benefits of burning as well as risk, and which factors contribute to perceptions of risk. I investigated the factors that influenced prescribed burning of the longleaf pine ecosystem by six land-management agencies in the Onslow Bight, a mixed-use landscape in North Carolina. Using GIS and logistic regression, I related historic prescribed burn records to criteria that stakeholders in the region had previously said were important for determining their priorities for burning. My analysis shows that sites in good ecological condition, containing conservation targets such as threatened and endangered species, were more likely to be burned than degraded sites, indicating a focus away from restoration in the landscape. Furthermore, whether a site was burned was influenced by its proximity to urban and residential developed land. These results suggest that the condition of the landscape may increase perceptions of risk, and facilitate prescribed burning decisions that result in little restoration accomplished. Restoration of this ecosystem may be even more difficult in the future, given projections of increased urban development in the Southeast US.
Keywords: Restoration, Fire, Risk, Mixed-use landscape, Land management

357. Eastern U.S. Wildfire risk mapping: Utilizing MaxEnt and site conditions
Authors: Peters, Matthew Peters, Northern Research Station, US Forest Service; Louis Iverson, Northern Research Station, US Forest Service; Stephen Matthews, Northern Research Station, US Forest Service / School of Environment and Natural Resources, The Ohio State University
Offered Presentations: Fire 2 - Monday (2011-04-04): 14:40 - 15:00 - Broadway 1
Abstract: As the wildland/urban interface increases and climate change alters fire regimes, the potential risk of fire damage to property and resources poses a major threat in the eastern United States. Knowledge of site-specific conditions that increase the risk of wildland fires can be vital to managers. Through risk mapping, we hope to identify areas that local agencies can focus efforts to reduce the risk of intense fires. Available soil moisture has been shown to provide a wealth of information about ecosystems. In this risk-mapping effort, an Integrated Moisture Index (IMI), calculated from digital elevation models and soil survey data, combined with a long-term drought indicator (Palmer Drought Severity Index, PDSI) were used to investigate risk conditions of wildland fires in New Jersey, Ohio, and Pennsylvania. PDSI data indicate that droughts have historically been more frequent in New Jersey and Pennsylvania than in Ohio. Despite the occurrence of wetter or near normal conditions during the recent decade for all three states, more droughts and wildfires were recorded in New Jersey and Pennsylvania (2000-2009). To test which variables are associated with fire occurrence, fine-scale environmental data, along with records of droughts and reported wildfires, were used to inform a statistical model (MaxEnt) about conditions that potentially promote fires. Monthly probability distributions for wildland fire risk were generated from 4847 records. These risk maps had a higher accuracy over annual risk, suggesting that the higher temporal data are best to capture the risk of wildfires in this highly fragmented and heterogeneous landscape.
Keywords: Risk mapping, Wildfires, Wildland-urban Interface, MaxEnt, Eastern U.S.

358. Challenges of forest landscape modeling
Authors: He, Jian Yang, Institute of Applied Ecology, Chinese Academy of Sciences; Stephen Shifley, US Forest Service, Northern Research Station; Frank Thompson, US Forest Service, Northern Research Station; David Larsen, University of Missouri
Offered Presentations: Forest Landscape Modeling - Monday (2011-04-04): 14:40 - 15:00 - Council Suite
Abstract: Over the last 15 years, we have seen a rapid development in the field of forest landscape modeling, fueled by both technological and theoretical advances. Forest landscape models (FLM) have become an important tool for understanding large-scale and long-term landscape (spatial) processes such as fire, windthrow, seed dispersal, insect outbreaks, disease propagation, forest harvest, and fuel treatment, because controlled field experiments designed to study the effects of these processes often are not possible. Although FLMs have benefited greatly from advances in computer technology and modeling theories, computing capacity and model validation are still two bottlenecks in the applications of FLMs. The simulation capacities of most FLMs such as various versions of LANDIS models are at the level of 2000 by 2000 pixels. Spatial resolutions have to be sacrificed (e.g. from 30 m to 200 m) when they are applied to regional scales. Recently, FLMs have taken advantages of the emergence of 64-bit operating system computers and greatly expanded simulation capacity. The recent progress as represented by the LANDIS PRO model employed new data structures that combined sorted linked lists and hash tables to record tree species and age cohorts. This innovative design along with 64-bit operating system make it possible to simulate very large (e.g., 108 pixels or larger) landscapes. With such a technology breakthrough, forest dynamics of an entire ecological section (e.g., 90,000 km2) can be simulated at 30 m resolution. From a theoretical perspective, to take advantage of the new design of USDA Forest Inventory and Analysis (FIA), key inventory attributes such as trees per acre and DBHq were added at each pixel. Tree growth, mortality, seed dispersal and regeneration are simulated in conjunction with stand

development, competition, and succession. The simulated stand attributes such as species composition, tree per acre, basal area, and importance value can be calibrated and validated by FIA data at pixel, land type, and landscape level. With the quantitative stand attributes, aboveground forest biomass and carbon can be computed more realistically incorporating forest succession, natural disturbances, and management.
Keywords: Forest landscape modeling, Quantitative stand attributes, Model calibration, Result validation, LANDIS Pro

359. Variability in climate change-induced vulnerability to fire across conservation landscapes in the People
Authors: Krawchuk, Meg Krawchuk, University of California, Berkeley; Max Moritz, University of California, Berkeley; Marc Parisien, University of California, Berkeley
Offered Presentations: Global Change 1 - Monday (2011-04-04): 15:20 - 15:40 - Council Suite
Abstract: At a general level, fire activity is constrained by availability of resources to burn, fire-conducive atmospheric conditions, and an ignition source. Existing studies show that the relative strength of these components in regulating fire activity varies spatially. Accordingly, changes in climate should alter future fire in different ways depending on the magnitude of the change and which constraints are alleviated. We can think of these ideas in a framework where vulnerability to change is a function of exposure (magnitude of climate change) and sensitivity (shape of a response function, or constraint). Here, we take advantage of modeled future fire activity produced from a statistically based, global fire-climate model and focus on understanding the vulnerability of landscapes to potential changes in wildfire via near-future climate change. Using this model and outcomes, we quantify spatial variability in exposure and sensitivity across 32 landscapes identified as conservation priorities by The Nature Conservancy China Program in the People's Republic of China. These landscapes cover a span of environmental heterogeneity and gradients in controls over fire activity. Not surprisingly, results show that these landscapes vary in future vulnerability to altered fire activity. Of more interest are the ties to existing understanding of spatially varying constraints on fire and how exposure to climate change interacts with constraints to alter projected future fire activity. Results from this research contribute to sustainable conservation management by flagging landscapes vulnerable to altered disturbance regimes in the future.
Keywords: Fire, Conservation, Climate change, Vulnerability

360. Exploring people
Authors: Pocewicz, Amy Pocewicz, The Nature Conservancy; Max Nielsen-Pincus, University of Oregon; Russell Schnitzer, The Nature Conservancy
Offered Presentations: Land Use Planning 1 - Monday (2011-04-04): 15:40 - 16:00 - Forum Suite
Abstract: Many communities in the western US are challenged with balancing growing demands for energy and residential development with the protection of wildlife habitat, water, open spaces, agriculture and other diverse ecological and social values. These complex decisions about land use may be improved through community engagement and spatially-explicit social preferences and values. We completed a social mapping survey across three counties of Wyoming, in which participants were asked to identify on maps places important to them for reasons such as recreation, wildlife, and agriculture, places that would be suitable for energy or residential development, and to share their knowledge about wildlife abundance and land conditions. Places important for recreation, water, habitat protection were mapped most frequently. Using the points mapped by participants, we created a density or "hotspot" map of each attribute to collectively represent participants' values. We measured spatial associations among hotspot maps for groupings of values - development, social, and ecological - and found that places valued for social and ecological values had significant spatial overlap, while there was little overlap or conflict among these values and development preferences. To better understand social perceptions and mapping behavior, we compared the social maps to

other datasets representing biological values, current and anticipated development patterns, land tenure, and other landscape features. Our results highlight the strengths and limitations of social maps and demonstrate the utility of such maps to inform land use decisions, such as siting of new development and protection of wildlife habitat or open space.
Keywords: Conservation planning, Development, Landscape values, Land use, Social science

361. Wolves, elk, and willows: landscape configurations on Yellowstone
Authors: Marshall, Kristin Marshall, Colorado State University; David Cooper, Colorado State University; N Hobbs, Colorado State University
Offered Presentations: Riparian Landscapes - Tuesday (2011-04-05): 11:00 - 11:20 - Galleria 1
Abstract: A fundamental challenge in contemporary ecology is to understand how disturbance influences interactions within food webs and how spatial variability in these interactions shapes landscape structure and function. In Yellowstone National Park the absence of an apex predator during most of the 20th century allowed elk populations to increase dramatically in abundance. As a result, willows (Salix. sp) experienced heavy browsing by elk and were essentially eliminated from the landscape. After wolves were reintroduced to Yellowstone in 1995, many suggested that elk browsing pressure declined and willows recovered on the Northern Range. Our findings have shown that recovery has been less widespread than originally believed and that some areas are fully recovered while others are still suppressed. In this study, we examine the causes of spatial variation in willow growing conditions across 27 Northern Range study sites. At each site, we measured willow height, annual production, and over-winter offtake during 2007-2010. Landscape covariates were developed using a GIS as potential predictors of spatial variation in all three responses. Specifically, we investigated metrics that described elevation, aspect, and soil moisture. We used Bayesian hierarchical models to investigate the effects of landscape covariates on individual willows and site-level responses. Competing models were evaluated and model averaging employed to obtain the best-fit model. Overall, model results suggest that watershed context and soil moisture metrics describe meaningful variation in willow height and growth patterns. Additionally, climate variability, landscape variation, and ecological interactions interact to shape growing conditions on the Northern Range. Keywords: Trophic cascade, Yellowstone National Park, Willow, Bayesian hierarchical model

362. Hopkins' bioclimatic law revisited: Toward transfer functions for land surface phenologies
Authors: Henebry, Geoffrey Henebry, South Dakota State University
Offered Presentations: Remote Sensing - Tuesday (2011-04-05): 09:20 - 09:40 - Galleria 3
Abstract: In 1918 Hopkins presented his "Bioclimatic Law" describing plant phenologies as linear functions of latitude, longitude, and elevation. A recent survey of land surface models concluded that the models' crop phenologies diverged sufficiently to impede an intercomparison of simulations from associated climate models. A key step in projecting future landscapes is simulating the associated land surface phenologies (or LSPs). Can Hopkins help? Grassland phenologies are more complicated than cropland phenologies due to multiple forcing factors and spatial heterogeneities in resource availabilities and land management. Many tallgrass species are distributed across temperature, not moisture, gradients, resulting in significant ecotypic variation across the species' geographic range. Is it feasible to "transplant" tallgrass LSPs across isotherms, but along isohyets, to simulate shifts in cultivation from maize-soy to switchgrass? Prior work has shown quadratic models can link Normalized Difference Vegetation Index (NDVI) time series and thermal time, measured in terms of accumulated growing degree-days (AGDD). I fitted quadratic models to MODIS NDVI and weather station data at multiple sites across the Northern Great Plains over ten growing seasons, 2000-2009. There is a strong latitudinal gradient in thermal time to peak NDVI (TTP) that results in part from a quasi-linear gradient in accumulated daylight hours. Quadratic parameter coefficients show a geographic pattern as a function of TTP, although it is more variable at shorter TTPs. The

approach works well for years with normal to high precipitation, but falters during droughty years. I show where Hopkins' Law helps and where and when it misleads.
Keywords: Phenology, Crops, Switchgrass, Biofuels, Remote sensing

363. It's a small world: a network analysis of the culture of conservation in Calumet
Authors: Dribin, Andrew Dribin, University of Illinois at Chicago; Amy Belaire, University of Illinois at Chicago; Doug Johnston, University of Illinois at Chicago; Doug Lynch, University of Illinois at Chicago; Emily Minor, University of Illinois at Chicago
Offered Presentations: Urban Landscapes 2 - Wednesday (2011-04-06): 13:40 - 14:00 - Council Suite
Abstract: Today, we are entangled in so many networks. Social networks, ecological networks, urban networks, television networks and the list could go on. Yet, how do these networks relate? What is the relationship between an ecological and an urban network? A social network and an ecological one? This study aims to make sense of this web of webs by applying social network analysis to describe the emerging culture of conservation in the Calumet region - a highly industrialized and unique ecosystem on the south shore of Lake Michigan. Working with the 2010 Calumet Summit - an environmental conference held to encourage cross-regional collaboration between Northwest Indiana, Chicago and Chicago's south suburbs - our primary hope of this study is to make the interactions between the social, urban and ecological networks more detectable and graphically explicit. As a relational study, our analysis focused on two broad questions. First, how can network analysis help us understand the human-natural interactions in the Calumet region? Second, are there communication gaps that could be strengthened to promote ecological and conservation goals in the region? Through a survey of the Summit attendees, the results demonstrate that the culture of conservancy in the region is a remarkably well-connected network, a small-world even. Geographically, socially, and ecologically, Calumet is an incredibly heterogenous landscape, but the relations between the organizations involved in conservation efforts (especially with industry) are not evenly distributed. This approach offers a platform to identify potential avenues for improving collaboration and communication among the diverse stakeholders.
Keywords: Urban ecology, Conservation, Network analysis

364. Landscape patterns related to historical land use on Pitangui river basin, Paran
Authors: Moro, Rosemeri Moro, UEPG
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 13:40 - 14:00 - Forum Suite
Abstract: The Pitangui basin has been colonized since the 18th century, thus presenting an ancient history of disturbance. To explain the spatial configuration of this landscape (98,695.64 ha) and to link use throughout historical time to geological and pedogeomorphological features, we related economical cycles to present-day landscape fragmentation in four natural compartments: First Plateau, Devonian Scarp (I and II), and Second Plateau. Anthropogenic areas were defined as matrix besides three natural vegetation categories: wetlands, grasslands and mixed subtropical forest. We calculated landscape metrics related to area, shape and size, circularity index (CI) and fractal dimension, as well elements such as patches, corridors and stepping stones. Average size for grasslands patches ranged from 6.11 to 51.9 ha; shape index, from 1.87 to 10.46; while average CI for all compartments was 0.55 and average fractal dimension, 1.44. Average size for forest patches ranged from 8.49 to 32.66 ha; shape index, from 1.97 to 6.48; average CI for all compartments was 0.49 and average fractal dimension, 1.45. Wetland patches were present only in the First Plateau, with an average size of 4.89 ha, shape index of 1.74; average CI of 0.63 and average fractal dimension, 1.40. The contemporary agri-silvicultural use determines similar fractal patterns and CI/shape index no matter what the relief, but grasslands showed a larger size range than forests and wetlands, both of which were small (less than 10 ha on average). In areas that supported past timber exploitation grasslands patches act as stepping stones; and in areas formerly used for cattle farming, forests subsists mainly as corridors.

Keywords: South Brazil, Grasslands, Mixed forests, Fragmentation, Wetlands

365. Dynamics of CForCS
Authors: Dymond, Dymond Caren, BC Ministry of Forests
Offered Presentations: Carbon - Wednesday (2011-04-06): 14:20 - 14:40 - Studio Suite
Abstract: The Canadian Forest Carbon Succession v0.1 (CForCs) extension for the LANDIS-II model includes growth, mortality and decay. The growth and reproduction generally follow the Biomass Succession (v2) extension and the methods outlined in Scheller and Mladenoff (2004). In addition, changes in cohort biomass C, dead organic matter (DOM) and soil carbon are tracked over time. The modelling of decay generally follows the methods outlined in Kurz et al. (2009) for the Carbon Budget Model of the Canadian Forest Sector v3 (CBM-CFS3). The carbon pools tracked in CForCs and available as outputs (g C /m2) are: woody biomass, non-woody biomass, fine roots, coarse roots, very fast aboveground DOM (foliar litter plus dead fine roots), fast aboveground DOM (fine and small woody debris plus dead coarse roots in the forest floor), medium DOM (coarse woody debris), slow aboveground DOM (F, H and O horizons), very fast belowground DOM (dead fine roots in the mineral soil), fast belowground soil (dead coarse roots in the mineral soil) slow belowground soil (Humified organic matter in the mineral soil), snag stem wood, snag other wood and an extra pool for user customization. This presentation will introduce the CForCS to the LANDIS-II user community, illustrate the carbon dynamics and compare the outputs with CBM-CFS3.
Keywords: Forest, Carbon, LANDIS-II

366. Photosynthesis at saltmarshes impacted by Deepwater Horizon oil spill
Authors: Wu, Wei Wu, University of Southern Mississippi
Offered Presentations: Disturbance 4 - Wednesday (2011-04-06): 15:40 - 16:00 - Broadway 3
Abstract: We have assessed the acute and chronic impact of crude oil on photosynthesis of salt-marsh dominated species Spartina alterniflora (Smooth cordgrass) in Davis Bayou (30.37Â°N, 88.39Â°W) on Mississippi Gulf Coast. We measured the light response curves on 30-33 individual leaves at one heavily oil-contaminated sub-patch (heavy sub-patch), one lightly oil-contaminated sub-patch (light sub-patch) and one control sub-patch using LI-6400 approximately 14 (July 22-23), 54 (August 30 -September 2), 70 days (September 14-16) and 130 days (November 17-24) after the oil contamination which we speculated was coincident with Hurricane Alex June 25-July 2 and Tropical Depression Two July 7-8. The field data showed photosynthesis rates varied at the individual and sub-patch scales, over time, and in response to oil contamination levels defined by the concentration of oil range organics (C19-36) in plant biomass and photosynthesis active radiation (PAR). We applied a generalized linear model to study the impact of oil contamination levels and PAR on photosynthesis rates for each time of sampling. The results showed that both oil levels and light levels significantly affected carbon assimilation rates. We then applied a more comprehensive hierarchical Bayesian model to assimilate the random effects of individuals and space which is at both individual scale and sub-patch scale, and the fix effects of time, contamination levels, PAR, an indicator of the ratio of sub-patch area to the length in touch with water, season and their interactions. The posteriors from the hierarchical model showed that the individual covariates' effect on photosynthesis rates are not significant but the interaction between the oil concentration and the lag time showed pronounced effect. In addition, seasonality made the resiliency assessment more complicated. Based on the data and model simulation so far, the slowest recovery of salt marsh may occur at the lightly contaminated areas where the reduced photosynthesis rates but not the death of the plants were observed, instead of at the area which initially had the most impact from oil contamination.
Keywords: Hierarchical Bayes, Photosynthesis, Deepwater Horizon oil spill, Resilience, Salt marsh

367.
Authors: Wandersee, Sarah Wandersee, San Diego State University; Yeqin Yang, Fanjingshan National Nature Reserve; Li An, San Diego State University
Offered Presentations: Sustainable Management - Tuesday (2011-04-05): 11:00 - 11:20 - Parlor BC
Abstract: As the only habitat for the Guizhou golden monkey and a biodiversity hotspot, conservation within Fanjingshan National Nature Reserve (FNNR) is important globally and locally. Delineated in 1978 to protect the Guizhou golden monkey, FNNR contains historic villages, religious sites, and households that engage in a broad range of livelihood activities, including extraction of forest resources. Achieving sustainable conservation may be challenging not only due to difficulties inherent in locally implementing national regulations but also due to the complexity of human-nature systems with feedbacks and indirect effects. Broad-scale protection measures have the potential to preserve non-target species that may compete with or take resources from local residents. Furthermore, the damage of livelihood resources from these non-target species, while impacting local economic endeavors, may reduce essential conservation support from people interacting daily with an ecologically sensitive area. Pilot interviews in 2009 indicated crop damage from boars as a limiting factor in overall local conservation support in FNNR. Further investigation was conducted in spring 2010 through household surveys, gathering data on livelihoods, resource use, demographics, land use, crop damage extent and severity, and environmental perceptions of 268 households in 8 villages. Analysis of the data uses multivariate regression and multi-level modeling to increase understanding of the role “pest” species play in affecting local environmental perceptions and the indirect effects that conservation has on local livelihoods. Results from the analysis lead to management recommendations for mixed use reserves as well as incorporation into an agent-based model for further investigation of human-nature dynamics.
Keywords: Pest species, Sustainability, Guizhou golden monkey, Conservation, Reserves

368. Microclimate driven by complex terrain predicts within-season movement by a migrant songbird
Authors: Frey, Sarah Frey, Oregon State University, Department of Forest Ecosystems and Society; Matthew Betts, Oregon State University, Department of Forest Ecosystems and Society
Poster #64 - Monday (2011-04-04): 17:30 - 19:00 - Plaza Foyer
Abstract: Current predictions about species sensitivity to climate change are primarily based on “bioclimatic envelope models.” These models assume that species either shift their geographic ranges to match underlying macroclimate, or they go locally extinct where macroclimate is no longer suitable. The degree to which species' behavior can mediate these possibilities is not well known. For instance, microclimate variability in complex terrain could buffer against climate changes by providing local options for short, adaptive movements and resource tracking. We assessed the potential for Hermit Warblers (Dendroica occidentalis) to behaviorally adapt to microclimatic changes; we examined their within-season movements at the H.J. Andrews Forest in the Oregon Cascades. Avian point counts were conducted at 184 sites during six distinct sampling periods from May-July 2010. Local temperature was monitored at 56 sites. We used dynamic occupancy models to estimate probability of detection, site occupancy, settlement, and vacancy. We investigated the effect of elevation (a proxy for temperature) on within-season movement. The effect of elevation on settlement and vacancy varied by sampling period, most notably flipping from positive to negative between mid- and late-May, corresponding with a drop in mean weekly temperature. We also found that sites that were more buffered from temperature changes throughout the season had a lower vacancy probability, whereas sites with larger changes in temperature were more likely to be vacated. These preliminary results indicate that birds may be capable of responding to changes in macroclimate within a breeding season by shifting territories to capitalize on buffered microclimates in complex terrain.
Keywords: climate change, complex terrain, microclimate, within-season movement, Dendroica occidentalis

369. Effects of land use change for biofuel production on wildlife in agroecosystems
Authors: Nogeire, Theresa Nogeire, University of California Santa Barbara; David Stoms, University of California Santa Barbara; Frank Davis, University of California Santa Barbara
Offered Presentations: Symposium 5: Modeling Landscape Functions under Scenarios of Global Change - Monday (2011-04-04): 16:20 - 16:40 - Broadway 4
Abstract: Growing sufficient biofuel feedstock to meet politically-mandated targets will occupy a large amount of land, and therefore will have a large impact on wildlife. Learning how to protect the needs of wildlife while growing biofuel crops will require a better understanding of wildlife use of agricultural habitats. Using a habitat-relation database, expert opinion, and literature review, we examine use of agroecosystems by wildlife in California, with particular focus on the possible effects of realistic biofuel production scenarios. In California, nearly a third of terrestrial vertebrate species use agroecosystems, most commonly for foraging. Our models used the suitability of one mile sections as landscape mosaics, incorporating suitability of both agricultural and natural land uses, and validating these suitabilities using field observations from the Breeding Bird Survey and a local field survey. We find that most changes between crop categories will have mixed effects depending on the species and on management practices. Irrigated grain crops and high-density grasses generally have higher suitability for the majority of agroecosystem wildlife species. Although crop type matters, management practices are potentially more important. Biofuel crops will be most wildlife-friendly when they leave field margins vegetated and undisturbed, are not tilled or are tilled with careful attention to timing, are not harvested during breeding seasons, minimize use of pesticides, and are grown at low densities. Further efforts to examine impacts of biofuel production on wildlife will benefit from more field studies comparing wildlife use of different agricultural habitats and different types of management.
Keywords: biofuel, wildlife, agro-ecosystems, habitat suitability

370. All ponds are not created equal: incorporating metapopulation dynamics of pond-breeding amphibians into land planning
Authors: Felson, Alexander Felson, Yale University
Offered Presentations: Urban Landscapes 2 - Wednesday (2011-04-06): 14:20 - 14:40 - Council Suite
Abstract: Developers traditionally hire consultants to evaluate land, including assessing and often ranking isolated wetlands based on habitat quality. Consultants apply a rapid assessment approach to individual ponds focusing on presence of larvae, vegetation, hydrology, and disturbance levels. Focusing on individual ponds is also common for ecologists. Studies have exposed larval densities as the main determinant of amphibian population survival and fecundity. Based on this evidence, it would make sense to assess individual ponds to test for habitat value versus expanding to analyze pond clusters even though amphibians likely function as metapopulations. We set up larval density research to test these assumptions by comparing the impact of manipulated intrapond predator densities on survival and growth rate versus habitats across eight ponds. The research on larval densities produced results indicating that habitat varies significantly between ponds and impacts the survival and growth rate of larvae more than intrapond predator density, and irrespective of the presence of egg masses and larval concentrations. Ponds that appear to be productive based on the rapid assessment approach may actually be habitat sinks with low survival. In our project the consultant diluted the high value ponds with false positives including several low survival ponds. The developer only preserved a 30-40% of the high value ponds and selected several of the false positives while leaving true high value ponds to receive heavy development impacts. Assessment and mitigation practices should refocus from ponds with highest population density to ponds with the highest survival rates based on in depth analysis.
Keywords: urban, suburban, amphibian

371. The effect of upstream lakes and wetlands in modeling phosphorus concentrations in lakes
Authors: Zhang, Tao Zhang, Michigan State University; Patricia Soranno, Michigan State University
Offered Presentations: Spatial Analysis - Wednesday (2011-04-06): 16:20 - 16:40 - Forum Suite
Abstract: Both lakes and wetlands are believed to be capable of removing phosphorus from waters flowing through them. However, in a heterogeneous landscape, modeling the effect of upstream lakes and wetlands on downstream lake phosphorus concentrations can be complex and data-intensive. In this study, we developed a spatially-explicit model to estimate phosphorus concentrations in lakes. This model simulates phosphorus and water flux from lake catchments to lakes. Using this model, we examined the effects of upstream lakes and wetlands on downstream lake phosphorus concentration. We found that the presence of upstream lakes results in less phosphorus transported to downstream lakes. In models that do not account for the effect of upstream lakes, the predicted phosphorus is overestimated. We found that wetlands also reduce phosphorus fluxes into downstream lakes and increase lake retention time by reducing water inflow to lakes. In a scenario where current wetlands in lake catchments were converted to forested land, phosphorus concentration in most downstream lakes was higher. Our results show the importance of considering the spatial configuration of freshwater ecosystems in models of land-water interactions.

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