SCENARIOS TO SOLUTIONS POSTER SESSION

Tuesday, October 28th, 6:00 pm
Boulders Meeting Room
Posters are listed by lead authors last name, * indicates the presenter

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Linking Local People with Nature: An Example from Amaltari Homestay in Nawalparasi District of Nepal

*Abdul S. Ansari**
Terai Arc Landscape, (TAL) Program, Sauraha, Chitwan, Nepal

Chitwan National Park is situated in south central part of Nepal, covering 932 km2 of core area in the subtropical lowlands of the inner Terai. The area was gazetted as Chitwan National Park in 1973 recognizing its unique ecosystems of international significance, which is the country's first National Park. UNESCO has declared the Chitwan National Park as a World Natural Heritage Site in 1984. In 1996 an area of 750 km2 surrounding the park was declared as a Buffer Zone, which consists of forests and private lands including cultivated lands. The park and the local people jointly initiate community development activities and manage natural resources in the buffer zone. Government of Nepal has made provision of providing an amount of 30-50 percent of the park revenue for community development and natural resource management in the Buffer Zone where 21 Buffer Zone User Committee with 1 Buffer zone user sub Committee has been mobilized. Amaltari BZUC is the one of them which is situated on Nawalparasi District. With a view to reducing people's dependence on natural resources while ensuring that its benefits can be sustainably managed, a home stay concept was introduced in 2013.

Plot-Level Forest Composition Data at Regional Scale

Matthew J. Duveneck[1], Jonathan R. Thompson[1], B. Tyler Wilson[2], Sofie McComb[1], and Luca Morreale[1]*

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As part of the Harvard Forest LTER Future Scenarios Project we are simulating species level forest dynamics throughout New England. The representation of forest composition at the start of these simulations has a strong influence on the simulation outcomes. We have modified, calibrated, and assessed a map that uses remote sensing (MODIS) and other environmental data to assign an individual field plot (USFS Forest Inventory Analysis plots (FIA)) to every 250m cell in the region using a process called gradient nearest neighbor imputation. Our method included a process of selecting the best imputation based on choosing from the closest five remotely sensed spectral neighbors (e.g. we screened imputed cells for tree species matching range distribution). We evaluated imputed tree species composition compared to aggregated FIA plots within EPA level IV ecoregions. At each ecoregion, we measured the dissimilarity (Bray-Curtis) between the FIA plots and imputed cells. We found the best imputation map resulted in an ecoregion average dissimilarity of 0.12. Although spatial variation exists, our results suggest that the imputation map largely represent the species distribution across New England.

Changes to the Land: Four Scenarios for the Future of the Massachusetts Landscape

Kathy Fallon Lambert, Jonathan Thompson, Meghan Blumstein, David Foster*
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This material is based upon work supported by the National Science Foundation under Grant No. DEB-1338809

For the first time since agricultural abandonment in the mid-1800s, Massachusetts and the five other New England state have been losing forest cover – this time to development. The purpose of the two-year Massachusetts Landscape Scenario Project was to work with practitioners to develop a set of plausible land-use scenarios for the future of the Massachusetts landscape, to compare the impacts on ecosystem services, and to use the results to inform conservation, land-use policy, and forest management decisions. A team of researchers from the Harvard Forest combined participatory scenario development, simulation, and analysis with policy outreach and communication to meet the project's dual goals of insight and impact.

A Framework for Integrating Scenario Studies Across Applications

*Holly Hartmann**
Carpe Diem West Academy
Portland, Oregon

The use of climate change scenarios to support adaptation planning can be a confusing proposition, with decision makers often seeking the 'best' approach to use. This poster clarifies that, rather than considering various approaches to compete for resources and attention, they are more appropriately seen as complementary, with each providing a unique perspective on prospective conditions. Distinction is made among methods that seek (1) to reduce uncertainty, typically through public processes such as shared vision planning that emphasize shared values and goals, (2) to characterize uncertainty, typically through use of ensembles and probabilities in integrated model assessments and sensitivity studies, and (3) to embrace uncertainty, by strategically considering divergent conditions that are simply plausible if not probable. This presentation describes a framework for connecting each of these approaches in a complementary, rather than competitive, fashion that also connects scenario activities from local to global scales.

Future Development Scenarios for Nairobi National Park, Kenya

Rob Lilieholm, Michelle Johnson, Spencer Meyer, Randall Boone, Robin Reid, Jeffrey Worden, Jared Stabach, David Nkedianye, and Mohammed Said*

Kenya's Athi-Kaputiei Plains (AKP) cover over 2,590 km2 of rolling grasslands that once supported the migration of wildlife populations second in size to only the Mara-Serengeti ecoregion. Nairobi National Park (NNP) covers a small portion in the north of the AKP system, but serves as a crucial reserve for wildlife during the dry seasons. NNP is fenced on three sides and bordered to the north by Nairobi – one of the largest and fastest-growing cities in Africa. Nairobi's population has increased from 500,000 people in 1970 to over 3 million today. This growth has been characterized by residential and commercial expansion and intensified land use. Unplanned growth combined with physical constraints and mounting environmental impacts threatens the sustainability of both human and natural systems. These threats include the viability of urban centers and traditional Maasai pastoral livelihoods, as well as broader landscape-level processes such as globally significant wildlife migration patterns. We developed a set of five future fencing and development scenarios to inform policy makers of likely future development trends. These 2030 scenarios include: (1) trend; (2) trend with smart growth development; (3) increased development; (4) increased development with smart growth; and (5) increased growth with the inclusion of a proposed major highway corridor directly south of Nairobi National Park. Once vetted, these scenarios will be linked with agent-based models of wildebeest migration to evaluation the sustainability of remaining wildlife migration corridors.

Forest Ownership in New England

*Luca L. Morreale, Brian Hall, Joshua S. Plisinski, Jonathan R. Thompson**
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Forest ownership maps are an important tool for landscape planning and ecosystem management. Even so, accurate, regional-scale ownership maps are rare. The Harvard Forest *Futures Scenarios* project is developing a forest ownership map of New England to help constrain and inform a suite of landscape models. The map is an aggregation of multiple data sources, including: the USGS National Land Cover Database, the James M. Sewall Company's database of large landowners, the Nature Conservancy's Protected Open Space layer, and several smaller datasets. Because individual private landowners are known to be the dominant owner class, we constructed the map using the assumption that all forestland is individually owned unless other information is available. We assessed the classification accuracy of the map against 5,467 U.S. Forest Service inventory plots where true ownership was known.

More than half of New England's forestland is in Maine, where forestland is 90% privately owned—about half of this is owned by corporations (mostly TIMOs and REITs). Federally owned forests are largely consigned to two large blocks: White Mountain NF in New Hampshire (318,823 ha) and Green Mountain NF in Vermont (161,748 ha). Individuals own the vast majority of forestland in southern New England. The overall map accuracy is 77%. Producer's accuracy was disappointingly low for municipal- and corporate-owned forests. We hope to improve this map as more data become available. We encourage people to contact us if they have spatial ownership data to share (email: jthomps@fas.harvard.edu).

Forest Conservation in New England

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This material is based upon work supported by the National Science Foundation under Grant No. DEB-1338809

How Well Do Climate and Ecosystem Characteristics Predict Bird Abundance at the Landscape Spatial Scale?

Nick Rodenhouse, Biological Sciences, Wellesley College, Wellesley, MA; Mary Martin, Zaixing Zhou and Scott Ollinger, Earth Systems Research Center, University of New Hampshire, Durham, NH; John Battles, Department of Environmental Science, Policy & Management, University of California, Berkeley, CA; Kevin McGuire, Department of Forest Resources and Environmental Conservation, Virginia Tech, Blacksburg, VA*.

Birds like other mobile animals choose where to live based on multiple features of the habitat and social environment. Spatial patterning in the abundance of birds and bird species is well documented (Fig. 1), but the extent to which these correspond with ecosystem processes and patterns and the drivers of those is poorly known. Yet an understanding of these relationships may be key to predicting how environmental changes in ecosystem function might affect bird species richness and abundance. We tested whether bird abundance and species richness are positively correlated with forest productivity and its drivers at the landscape spatial scale. The study was conducted at the Hubbard Brook Experimental Forest (HBEF), NH, USA. Birds abundance was quantified with 10-min, fixed radius counts at 318 points representing northern hardwood forest within the 3160-ha HBEF. Ecosystem features assessed included those that were measured, remotely sensed or modeled. Vegetation composition and structure was measured in 0.05 ha plots centered on each survey point. Elevation was measured by using GPS. Foliar nitrogen was estimated by hyperspectral remote sensing data from NASA's AVIRIS. Topographic wetness index (TWI) was generated from LIDAR data. ANPP was modeled by using PnET-II (http://www.pnet.sr.unh.edu/) and MTCLIM (http://gcmd.nasa.gov/records/MTCLIM.html). We extracted values for each predictor variable that represented the 50-m radius area used for the bird surveys. The relatively low ability of the tested variables to predict average bird abundance or species diversity within northern hardwoods forest indicated that bird abundance and species richness can be sustained over a broad range of values for ecosystem features. However, these findings also imply that changes in key ecosystem measures (TWI, ANPP, foliar nitrogen, vegetation features) can affect bird abundance and richness.

New England Environmental Finance Center Overview Poster

Martha Sheils,
New England Environmental Finance Center
Edmund S. Muskie School of Public Service
University of Southern Maine
Portland, Maine

Founded in 2001, New England Environmental Finance Center (NE/EFC) seeks to advance the shared goal of US EPA and the Edmund S. Muskie School of Public Service at the University of Southern Maine to research, publish, and extend creative approaches to environmental policy, protection and management, especially the associated questions of *how to pay* for needed environmental improvements. NE/EFC strives to build capacity of public and private clients throughout New England to pay for the growing costs of protecting the environment and to be better prepared to manage both chronic acute problems of environmental protection and finance. We are a founding member of the Environmental Finance Center Network (EFCN), a national partnership of public universities creating innovative solutions to the difficult how-to-pay issues of environmental protection and improvement. EFCN works with public and private sectors to promote sustainable environmental solutions while bolstering efforts to manage costs.

Patterns and predictors of recent forest conversion in New England

Alexandra M. Thorn, Jonathan R. Thompson, Joshua Plisinski*
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This material is based upon work supported by the National Science Foundation under Grant No. DEB-1338809

Analysis of current trends in forest change provides a key component of modeling future long term forest change in future scenarios. We used boosted regression tree (BRT) analysis to assess geographical predictors of forest conversion to development in New England. BRT combines classification and regression trees with machine learning to generate non-parametric statistical models that can capture both non-linear relationships. We assessed the change from forest cover to developed land between 2001 and 2011 using NLCD maps for 2001, 2006, and 2011, and performed BRT analysis to evaluate the role of fifteen biophysical and social variables in predicting locations of forest conversion. Predictor variables were selected based on availability of regional datasets and plausibility of contributing to land cover conversion, and the variable list was reduced to minimize collinearity. Predictor variables tested were: elevation, slope, distance to roads, density of highways, distance to built land, distance to urban areas, population density, change in population density, relative change in population density, population per housing unit, median income, land ownership categories, state, and county classification as recreation or retirement counties. The resulting model explained 7.4% of the variation in forest conversion, a fairly high value given the complexity of factors predicting land development and the high granularity of the spatial data sets (30 m pixels). The two most important variables in the BRT were "distance to urban areas" and "change in population density", which together made up 84.5% of the variation explained by the model. All other variables had less influence on the model than would be predicted by chance. A probability surface generated from the BRT illustrates spatial variation in probability of forest conversion and highlights the high rates of development observed in major urban centers. The probability surface will provide a key input for simulation models of forest and land cover change.

What Will New Hampshire's Land Cover be in 2050?

Alexandra Thorn, Cameron Wake, Curt Grim, Barbara Wauchopre, and Clay Mitchell*
University of New Hampshire,
Durham, New Hampshire

We are developing alternative scenarios for land cover change in New Hampshire (NH) for the NH EPSCoR Ecosystems and Society project. These land cover scenarios will serve as inputs to process-based terrestrial and aquatic ecosystem models to explore how ecosystem services will change in the future under changes in climate and land use. To obtain a wide range of input regarding what NH may look like in the future, facilitated discussions were organized with stakeholders from seven different sectors (environmental non-profits, business and industry, timberland owners, agriculture, recreation and tourism, government, and academics and consultants). Based on stakeholder responses, current trends, and recent planning documents, we developed four scenarios for future land cover change: Current Trends, Conventional Sprawl, Planned Future, and Planned Future with Agricultural Expansion. These land cover scenarios differ in a number of ways, but primarily by how dispersed or concentrated development is, and to what degree ecosystem services are prioritized for development.

The *Current Trends* scenario represents a linear extrapolation of the past fifteen years (1996-2011) of land cover changes, land conservation, and population growth. The *Conventional Sprawl* scenario assumes that development is dispersed and ecosystem services are not prioritized. Development is driven by rapid population growth and development within each municipality occurs with temporally variable zoning similar to current practices. In the *Planned Future* scenarios, the only development that occurs is redevelopment of previously developed land, and all lands identified as high priority for conservation by environmental non-profit stakeholders are conserved by 2060. In the *Planned Future with Agricultural Expansion* scenario, agriculture (hay fields and pasture) simultaneously expands onto prime agricultural soils (500,000 acres of farmland as envisioned by the Food Solutions New England "Omnivore's Delight" scenario). We combined these narratives with regression tree analysis and publicly available datasets (NOAA C-CAP, USGS Digital Elevation Models, SSURGO, flood insurance maps, U.S. Census data, New Hampshire Land Cover Assessment, and the NH Public Roads layer from the GRANIT database) to generate maps at decadal time steps out to 2100 of plausible land cover distribution under each of these scenarios.