SAMAB 20th Annual Conference

Southern Appalachian Man and the Biosphere

Climate Change: Science to Action

Gatlinburg, Tennessee

November 16-18th, 2010

Program and Abstracts

Climate Change: Science to Action

20th Annual SAMAB Conference
November 16-18, 2010 ~ Gatlinburg, Tennessee

Agenda Overview

Tuesday, November 16th, 2010		
10:00 a.m.	Registration Opens	
12:30 p.m.	**Welcome and Introductions,** Gary Peeples, *U.S. Fish & Wildlife Service* (Dogwood I & II)	
1:00 p.m.	**Keynote Address,** Dr. Heidi Cullen, *Director of Science Communications, Climate Central* (Dogwood I & II)	
2:00 p.m.	*Break*	
2:30 p.m.	**Climate Change Research** (Dogwood I)	**Panel: Integrative Tools** (Dogwood II)
6:00 p.m.	**Poster Session and Reception** (Azalea Room)	
Wednesday, November 17th, 2010		
7:30 a.m.	Registration	
8:30 a.m.	**Ecological Restoration** (Dogwood I)	**Communicating Climate Change** (Dogwood II)
10:00 a.m.	*Break*	
10:30 a.m.	**Ecological Restoration** (cont'd) (Dogwood I)	**Communicating Climate Change** (cont'd) (Dogwood II)
Noon	*Lunch*	
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2:30 p.m.	*Break*	
3:00 p.m.	**Panel: Ecological Restoration** (cont'd) (Dogwood I)	**Agency and NGO Initiatives** (cont'd) (Dogwood II)
5:30 p.m.	*Break and Cash Bar social*	
6:30 p.m.	**Evening Social** – Buffet Dinner, Appalachian Storyteller and Live Music (Dogwood I & II)	
Thursday, November 18th, 2010		
7:30 a.m.	Registration	
8:30 a.m.	**Panel: Communicating Climate Change** (Dogwood I & II)	
10:00 a.m.	*Break*	
10:15 a.m.	**Science to Action: Your Input, Continuing the Discussion,** Alice Cohen, *U.S. Forest Service National Forests in North Carolina* (Dogwood I & II)	
11:15 a.m.	**Collaborating On the Next Steps** Alice Cohen, *U.S. Forest Service National Forests in North Carolina* (Dogwood I & II)	
11:45 a.m.	**Conference Wrap –Up;** Judy Francis, *North Carolina Department of Environment and Natural Resources* (Dogwood I & II) **Formal Session Adjourns**	
Noon	*Lunch on own (for Field Trip attendees)*	
1:00 p.m.	**FIELD TRIP : Great Smoky Mountains National Park** Susan Sachs, *Appalachian Highlands Science Learning Center, GSMNP* (Meet in Hotel lobby; Transportation on own, carpooling encouraged, limit 40 people)	
5:00 p.m.	Field trip returns to hotel	

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Climate Change: Science to Action

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1:00 p.m.	**Keynote Address:** **Dr. Heidi Cullen** Director of Science Communications, Climate Central *Seeing Climate, Seeing Change: Communicating Climate Science in a Changing Media Landscape* (Dogwood I & II)	
2:00 p.m.	*Break*	
2:30 p.m.	**Climate Change Research** (Dogwood I) Moderator – Sue Cameron, *U.S. Fish & Wildlife Service* 2:30 Becky Nichols, *Aquatic Macroinvertebrate Monitoring in the Smokies* 3:00 Lloyd Edwards, et al., *Effects of Urban Climate on Land Surface Phenology* 3:30 Christopher Oswalt and Sonja Oswalt, *Distribution and Recent Expansion of Select Nonnative Invasive Plants in the Southern Appalachians*	**Integrative Tools** (Dogwood II) Moderator – Steve Norman, *U.S. Forest Service Eastern Forest Environmental Threat Assessment Center* 2:30 PANEL – Integrative Approaches for Addressing Climate Change and Associated Threats to Forests Panelists: ▪ Steve Norman, *U.S. Forest Service Eastern Forest Environmental Threat Assessment Center*

	4:00 Cathryn Greenberg, et al., *Temporal Patterns of Oak Mortality in a Southern Appalachian Forest (1991-2006)* 4:30 Sharon Bewick, *A Mechanistic Approach to Modeling Ant Communities Under Warming Regimes* 5:00 Albert Bates, *Biochar and the Southern Forests*	▪ Kevin Potter, *Department of Forestry and Environmental Resources, North Carolina State University* ▪ William Hargrove, *U.S. Forest Service Eastern Forest Environmental Threat Assessment Center* Session ends at 5:00 p.m.
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6:00 – 8:00 p.m.	**Poster Session** With light hors d'oeuvres and cash bar (Azalea Room) Vicki Bott, et al., *Changing Mountain Landscape: Applied Research and Regional Engagement* Evan J. Burks, *Barton Bench Ecological Restoration* Barton Clinton, et al., *Remote Assessment of Forest Ecosystem Stress (RAFES): Development of Real Time Decision Support System for the Eastern U.S.* Miriam Davis, et al., *Biodiversity Information Needs in the Southern Appalachians: Preliminary Results of an Internet Survey* Greg Dobson, et al., *The Use of GIS-Based Maps for Facilitating Stakeholder Engagement in Conducting Regional Climate Assessments* Mark Endries, *Using GIS to Develop a Priority Work Area Map in Western North Carolina* Jeff Hicks and Todd Pierce, *The Western North Carolina Report Card on Sustainability: Web and Print Tools for Helping Decision Makers Put Climate Change in a Regional Context* Tamara Houston, *NOAA Climate Services: Sectoral Engagement Activities at NOAA's National Climatic Data Center* Hugh Irwin, et al., *The Identification of Priority Forest Sites for the Chestnut Relocation in the Southern Appalachians*	

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Wednesday, November 17, 2010		
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<tr><td>1:30 p.m.</td><td>Ecological Restoration
(Dogwood I)

Moderator – Carolyn Wells, U.S. Fish & Wildlife Service

1:30 PANEL - The Role of Ecological Restoration in Addressing Forest Structural Issues in Southern Appalachian Forests

(Panelists listed below)</td><td>Agency and NGO Initiatives
(Dogwood II)

Moderator – Rick Durbrow, U.S. Environmental Protection Agency

1:30 Tom Remaley, GSMNP Wetland Inventory, 2010

2:00 Matt Hutchins, et al., Stakeholder Engagement and Conducting Climate Assessments in Western North Carolina</td></tr>
<tr><td>2:30 p.m.</td><td colspan="2">Break</td></tr>
<tr><td>3:00 p.m.</td><td>Ecological Restoration (cont’d)
(Dogwood I)

Panel and Discussion continue…

Panelists:

▪ Hugh Irwin, Southern Appalachian Forest Coalition, Asheville, North Carolina

▪ Beverly Collins, Western Carolina University, Department of Biology, Cullowee, North Carolina

▪ Cathryn Greenberg, U.S. Forest Service Southern Research Station, Bent Creek Experimental Forest

▪ Kendrick Weeks, North Carolina Wildlife Resources Commission, Mills River, North Carolina

▪ Marek Smith, Director, Allegheny Highlands Program, The Nature Conservancy, Virginia</td><td>Agency and NGO Initiatives (cont’d)
(Dogwood II)

3:00 Laura Gadd, North Carolina Ecosystem Response to Climate Change: DENR Assessment of Effects and Adaptation Measures

3:30 Cindy Carr, Integrating Climate Change into the North Carolina Wildlife Action Plan

4:00 Jean Brennan, Appalachian Landscape Conservation Cooperative – a Science Management Partnership to Address Landscape Scale Conservation

4:30 Kenneth Stolte, Monitoring Cimate Change Effects on Ridge Ecotones of the Appalachian Trail</td></tr>
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	▪ Steve Lohr, *U.S. Forest Service, National Forests in North Carolina, Murphy, NC*	5:00 – John Peine, *How Organizations Posted on the NBII-SAIN Best Sustainability Practices Website are Addressing Climate Change*
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Thursday, November 18, 2010	
7:30 a.m.	*Registration Opens*
8:30 a.m.	**Communicating Climate Change** (Dogwood I & II) Moderator – Judy Francis, *North Carolina Department of Environment & Natural Resources* 10:30 PANEL – Communicating Climate Change in an Uncertain and Pre-Occupied World Panelists: ▪ Judy Francis, *ACIP, North Carolina Department of Environment & Natural Resources* ▪ Scott Shuford, *ACIP, Onslow County Planning & Development* ▪ Tim Owen*, NOAA's National Climatic Data Center* ▪ Jim Fox, *National Environmental Modeling & Analysis Center, UNC Asheville* ▪ Linda Giltz, *ACIP, Land-of-Sky Regional Council*
10:00 a.m.	*Break*
10:15 a.m.	**Science to Action: Your Input, Continuing the Discussion** Alice Cohen, *U.S. Forest Service, National Forests in North Carolina* (Dogwood I & II)
11:15 a.m.	**Collaborating On the Next Steps** Alice Cohen, *U.S. Forest Service, National Forests in North Carolina* (Dogwood I & II)
11:45 a.m.	**Conference Wrap-up** Judy Francis, *North Carolina Department of Environment and Natural Resources* (Dogwood I & II)
Noon	*Lunch on own*
1:00 p.m.	**FIELD TRIP: Great Smoky Mountains National Park** Susan Sachs, *Education Coordinator, Appalachian Highlands Science Learning Center* Please dress in comfortable clothing appropriate for the weather as we will be outside half of the time. Meet in the hotel lobby to carpool to the center at 1:00. Transportation on own; carpooling encouraged. Limit 40 people.
5:00 p.m.	*Field Trips return to hotel*

Acknowledgements

SAMAB greatly appreciates the outstanding assistance and cooperation of the following individuals and organizations that have worked to make this conference a success:

Conference Co-Sponsors

U.S. Forest Service
U.S. Fish & Wildlife Service
North Carolina Department of Environment and National Resources
Friends of Great Smoky Mountains National Park
SAMAB Foundation and SAMAB Cooperative

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Judy Francis, North Carolina Department of Environment and Natural Resources
Carolyn Wells, U.S. Fish & Wildlife Service, Asheville Field Office

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Judy Francis, North Carolina Department of Environment and Natural Resources; SAMAB Executive committee vice-chair
Charles VanSickle, SAMAB Foundation President

20th Annual SAMAB Conference

Climate Change: Science to Action

ABSTRACTS

Keynote Address

Tuesday, November 16, 2010; 1:00 – 2:00 p.m.
(Dogwood I & II)

Seeing Climate, Seeing Change: Communicating Climate Science in a Changing Media Landscape

Dr. Heidi Cullen

Director of Science Communication, Climate Central

The past year brought with it major changes in the economic, political, as well as media landscape. This talk will explore how recent events impacted the public's perception of climate science as well as discuss the challenges and opportunities facing scientists and journalists as the media undergoes a large-scale transformation. Topics for discussion will include new tools for science communication. Examples will be provided.

Heidi Cullen, Ph.D.
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Session: Climate Change Research

November 16, 2010; 2:30-5:30 p.m.
(Dogwood I)

Session Moderator:
Sue Cameron, U.S. Fish & Wildlife Service

Aquatic Macroinvertebrate Monitoring in the Smokies
Becky Nichols, Entomologist, Great Smoky Mountains National Park, 1316 Cherokee Orchard Road, Gatlinburg, TN 37738; (865)-436-1702; *becky_nichols@nps.gov*

The aquatic macroinvertebrate component of the Inventory and Monitoring program in Great Smoky Mountains National Park was operational from 1992-2003. This component was designed to provide data on the health of streams, aquatic biodiversity, and to determine relationships among macroinvertebrates and water quality. Many of the threats that may potentially affect stream health in the Park likely will be reflected in the aquatic macroinvertebrate community. Representative sites were sampled annually to allow for comparisons among sites from year to year, and to be able to detect any long-term trends. Biotic indices for the 27 long-term monitoring sites over a 10-year span generally indicate excellent water quality with regard to the aquatic community. Continuing analyses of these data will be conducted in the future, especially with regard to other Inventory and Monitoring components in the Park, such as air and water quality monitoring, and fish community monitoring. Analyzing all components together may reveal trends not detectable through single-component analyses.

Effects of Urban Climate on Land Surface Phenology
Lloyd A. Edwards[1], William W. Hargrove, and Steve P. Norman, U.S. Forest Service Eastern Forest Environmental Threat and Assessment Center, Southern Research Station, 200 W.T. Weaver Blvd., Asheville, NC 28804; (828)-257-4832
[1]laedwards@fs.fed.us

Phenology metrics, for example: start of season and normalized difference vegetation index maximum values are sensitive to change, thus are excellent pheno-ecoregion level change detection indicators of regional climate change and forest health. Vegetation phenology metrics are generally understood within urban core and rural climate regimes, but not the in between area, the urban climate regime. There is a great need to better understand the interrelationships between urban climate drivers, specifically anthropogenic based drivers, and their

effects on land surface phenology (LSP). This project attempts to answer a cascade of questions, such as is there an urban effect on phenology metrics, how much, and what are the primary drivers? This project uses a geographical information system (GIS) to integrate 240 meter imagery and digital data to create an urban index model (levels of urbanness) and a LSP model for the continental United States. This project uses LSP parameter products derived from moderate resolution imaging spectroradiometer (MODIS) remote sensed imagery. MODIS products are used over an average of six years (2003-08). This study uses a stepwise multi-regression analysis best fit modeling approach to explain and predict LSP without cities. LSP without cities model results are subtracted from LSP with cities MODIS products creating a delta LSP. Analysis of variance is run between delta LSP metrics and levels of urbanness. Research results may lead to and or support future research topics in regional climate change, forest health, invasive species, risk assessment, pheno-ecoregion shifts, wild land urban interface, land use, and environmental planning.

Distribution and Recent Expansion of Select Nonnative Invasive Plants in the Southern Appalachians

Christopher M. Oswalt[1] and Sonja N. Oswalt, U.S. Forest Service Southern Research Station, Forest Inventory and Analysis, 4700 Old Kingston Pike, Knoxville, TN 3792; (865)-862-2068
[1]coswalt@fs.fed.us

Studies suggest that the southern United States, specifically the Southern Appalachians, is an area of primary concern with regards to the spread of nonnative invasive plant species. Recent data show that species such as Japanese honeysuckle (*Lonicera japonica*) and Nepalese browntop (*Microstegium vimineum*) are invading forests and displacing native species throughout the southern United States. Moreover, the epicenter of the *M. vimineum* distribution appears to be in the S. Appalachians. Continual monitoring on large spatial scales is among the most important mechanisms for the detection and prevention of the spread of nonnative species, particularly with the threat of a changing climate. Better assessments of on-going biological invasions are a primary research priority in the region. As one method for addressing this need, the U.S. Forest Service Southern Research Station (SRS), in partnership with State forestry agencies across the South, initiated a southern region survey of 33 invasive plant taxa in 2001 on all forest ownerships as part of the SRS Forest Inventory and Analysis (FIA) program. The survey of invasive plant species was added to the traditional timber resource surveys that have been underway since the 1930's. The Nonnative Invasive Plant Species (NNIPS) selected for survey are regionally recognized exotic pest plants known to invade interior forest stands, forest edges, canopy gaps, and stream-sides. FIA collects information to estimate cover of invasive trees, shrubs, vines, grasses, canes, ferns and forbs. The Southern Invasive Plant Indicator Program is tasked with monitoring and reporting on plant invasions within southern forests, along with developing tools to detect emerging invasions and potentially problematic invasive plant populations. This presentation describes current results from data collected through the FIA program in the southern U.S. from 2001 to 2008. Current distribution

maps for selected nonnative invasive plants are presented along with a discussion of the potential impacts of these species on native forests of the southern U.S.

Temporal Patterns of Oak Mortality in a Southern Appalachian Forest (1991-2006)

Cathryn H. Greenberg[1], Tara L. Keysel, and James H. Speer[2]
[1] U.S. Forest Service, Southern Research Station, 1577 Brevard Road, Asheville, NC, USA 28806; (828)-667-5271 ext. 118; kgreenberg@fs.fed.us
[2] Department of Geography, Geology, and Anthropology, Indiana State University, 200 North Seventh St. Terre Haute, IN, 4780; (812)-237-3011; jim.speer@indstate.edu; http://dendrolab.indstate.edu

We tracked the rate and cause of mortality of 287 mature oak trees of five species for 15 years to determine the temporal patterns and sources of mortality. We observed a 14.9% total mortality rate during the study period. Mortality was due to oak decline (7.3% of trees) and high-intensity wind events (6.6% of trees). Decline-related mortality was gradual, averaging 0.5% annually. Windthrow was episodic, occurring during hurricane-related weather events in 1995 and 2004.

Twice as many oaks in the red oak group died of decline-related causes than in the white oak group (67% versus 33% of decline-related mortality, respectively) over the 15-year study period. Within the red oak group, total decline-related mortality was highest for scarlet oak, followed by northern red oak and black oak (57%, 29%, and 14% of decline-related mortality, respectively). Within the white oak group, decline-related mortality was much higher for white oak than for chestnut oak (71% versus 29% of decline-related mortality, respectively). White oaks dying of decline-related causes were older than surviving white oak but did not differ in size. Wind-related mortality (6.6% of study trees; *n*=19) was also higher in the red oak group (79% of total wind-related mortality) than in the white oak group (21% of total wind-related mortality). Within the red oak group, scarlet oak incurred the highest wind-related mortality, followed by northern red oak and black oak (73%, 20%, and 7% of wind-related mortality, respectively). Oak mortality rates observed in this study, coupled with oak regeneration failure, could result in a substantial reduction in the proportion of mature canopy oaks. Changes in climatic patterns such as prolonged drought or more frequent extreme weather events could further exacerbate high rates of oak mortality.

A Mechanistic Approach to Modeling Ant Communities Under Warming Regimes

Sharon Bewick, NIMBioS, University of Tennessee; sharon_bewick@hotmail.com; http://www.nimbios.org/
Collaborators: Nate Sanders, Department of Ecology and Evolution, University of Tennessee, Rob Dunn, Department of Biology, North Carolina State University, Katie Stuble, Department of Ecology and Evolution, University of Tennessee, Aaron Ellison, Harvard Forest , Nick Gotelli, Department of Biology, University of Vermont

When predicting the sensitivity of ant assemblages to climatic change, it may be important to consider trade-offs that both currently allow coexistence between ant species in a community and also are likely to change as a result of global warming. In particular, differences in thermal tolerance will likely play a key

role in determining ant community composition under climatic warming, and a dominance thermal-tolerance relationship has been proposed in several systems. In order to mathematically interpret and predict shifts in ant species abundance that occur as a result of climatic warming, we take the basic assumption of linear transitive dominance hierarchies from a mathematical dominance-discovery model proposed by Adler et. al. (2007), and then extend the model by including terms to describe species specific seasonal foraging patterns, which we use as a proxy for species specific thermal tolerances.

We apply our 'dominance-thermal tolerance model' to a system of three sympatric ant species (*Paratrechina terricola*, *Aphaenogaster rudis* and *Prenolepis imparis*) in an eastern hardwood forest. Our model predicts coexistence assuming parameter estimates made from data collected under current climatic conditions. We then consider potential changes in these parameters that might occur as a result of climatic warming. In particular, we focus on altered ant behavior, food availability and competitor abundance, and use our model to predict the effects that these changes will have on ant community composition.

Biochar and the Southern Forests

Albert Bates, Director, Global Village Institute for Appropriate Technology, PO Box 90, Summertown TN 38483-0090; (931)-964-4324; albert@thefarm.org

The Southeastern U.S. is now warming at an unprecedented rate. One consequence is the loss of forest diversity and other damage to forests from heat-related stress and in-migration of invasive pests. Studies in Japan and elsewhere have shown good results in restoring drought-damaged forests by grid-trench methods of biochar application. This is being experimented with on the Western Highland Rim of Middle Tennessee, as the author will illustrate with slides.

Spanish explorers first observed the rich dark earths or *terra preta do indio* in Amazonia in the middle of the 16th Century. Closer investigation with the tools of modern soil science now reveals that the real El Dorado was the black gold beneath the Conquistadors' feet. Recent studies suggest that when European germs decimated the native peoples of the Americas, the trees and vines that enveloped their cities took so much carbon from the atmosphere it contributed to the Little Ice Age. *Biochar* is an extremely effective climate mitigation tool.

The fertility of biochar comes from carbon formed by pyrolysis, or controlled combustion in the absence of oxygen. Biochar produced in this way, it turns out, it not only more stable than any other amendment to soil, but increases nutrient availability beyond a fertilizer effect. This ability is in part from the high charge density (cation and anion exchange potential) that results in much greater nutrient retention, and in part it is from biochar's micropore physical structure that endows it with greater resistance to microbial decay and weathering.

With carbon farming in combination with an emission reduction regime, we can reverse catastrophic climate change and restore the atmosphere to safe greenhouse gas levels on decadal time scales.

Albert Bates' books include *Climate in Crisis* (1990), *The Post-Petroleum Survival Guide* (2006), and *The Biochar Solution* (2010, in press)

Session: Integrative Tools

November 16, 2010; 2:30 – 5:00 p.m.
(Dogwood II)

Session Moderator:
Steve Norman, U.S. Forest Service Eastern Forest Environmental Threat Assessment Center

PANEL:
Integrative Approaches for Addressing Climate Change and Associated Threats to Forests

Moderator and Panelist: **Steve Norman**
Research Ecologist, U.S. Forest Service Eastern Forest Environmental Threat Assessment Center, 200 WT Weaver Blvd., Asheville, NC 28804; (828)-259-0535; stevenorman@fs.fed.us

Steve Norman is a research ecologist with the Forest Service's Eastern Forest Environmental Threat Assessment Center (EFETAC) in Asheville, NC. Native to the northern hardwoods, he has conducted research in the oak forests of the Midwest, rain forests of Central America, coniferous forests of California and hardwoods of the Southeast. His current work integrates fire, invasives and climate variability with forest planning and management. He helped develop a comparative risk assessment approach called CRAFT that is designed to help managers explore tradeoffs and uncertainties using a probability-based approach. He received his Ph.D. in geography from Penn State in 2002.

Panelist: **Kevin Potter**
Research Assistant Professor, Department of Forestry and Environmental Resources, North Carolina State University, 3041 Cornwallis Road, Research Triangle Park, NC 27709; (919)-549-4071; kpotter@ncsu.edu

Kevin Potter applies landscape ecology, evolutionary biology and population genetics tools and concepts to better understand the response of tree species and communities to forest health threats. His work includes a genetic risk assessment of Southern Appalachian tree species; projects using evolutionary diversity to measure forest community biodiversity; and genetic diversity studies of eastern hemlock, Fraser fir, and a complex of Central American pine species. He is a research assistant professor at North Carolina State University, and cooperates extensively with scientists at the Eastern Forest Environmental Threat Assessment Center. He earned his PhD in forestry from NC State in 2006.

Panelist: **William Hargrove**

U.S. Forest Service Eastern Forest Environmental Threat Assessment Center, 200 WT Weaver Blvd., Asheville, NC 28804; (828)-257-4846; hnw@geobabble.org

William Hargrove joined EFETAC in October 2006 as a research ecologist. His current research focuses on designing a national early warning system using satellite imagery that examines the lower 48 United States at 231m resolution every 8 days to locate potential forest disturbances. Hargrove helped design the National Ecological Observatory Network, mapped the risk of Sudden Oak Death spread, developed the first quantitative global ecoregion maps, and developed EMBYR, a probabilistic wildfire model. Hargrove received a Ph.D. in ecology from the University of Georgia in 1988.

Introduction: The Challenge of Forest Threat Integration

Steve Norman

The biologically diverse Appalachian forest is stressed by development, invasive plants and insects, altered disturbance regimes and climate change. These stressors are not impacting forests uniformly because of the inherent complexity of the landscape and species-specific responses to threats. To put threats in context, we need to monitor and understand them by taking a broad-scale and integrated perspective. This panel presents different approaches to understand forest threats when multiple stressors are involved. The panel will address the range-wide genetic risks to a species from multiple threats, a near real-time approach for monitoring multiple disturbances and climatic stress from space, and modeling regional changes in fire regimes from climate and seasonal vegetation change. While it is challenging to integrate multiple threats and an array of forest values, this panel will highlight how basic broad-scale science intersects the applied need for integration.

Of Microsatellites, HWA and Climate Change: Assessing Eastern Hemlock Genetic Diversity, and Threats to It, in the Southern Appalachians.

Kevin Potter

Changing climate conditions and increasing pest and pathogen infestations will increase the likelihood that forest trees in the Southern Appalachians could experience population-level extirpation or species-level extinction in the coming decades. Conserving the genetic diversity of many of these species will be important, as genetic variation correlates with the evolutionary potential of species to adapt to changing conditions. To efficiently conserve genetic variation of species, however, it will be necessary to understand (1) patterns of diversity across the landscape and (2) where the risk of interacting threats is the greatest to a given species. Eastern hemlock (Tsuga canadensis) is an ecologically important southern Appalachian forest tree species threatened both by an invasive insect decimating its natural stands, and from changing climatic conditions that could render its current habitat unsuitable. We have integrated (1) a rangewide molecular marker genetic variation study of eastern hemlock and (2) climate change prediction maps for both hemlock and hemlock woolly adelgid, to identify areas most at risk and in need of pro-active gene conservation and management activities.

Land Surface Phenology as an Early Warning Indicator of Forest Change from a Range of Causes

William Hargrove, Joe Spruce, Forrest Hoffman[2], and Steve Norman
[2]Oak Ridge National Laboratory, Computer Science and Mathematics Division; (865)-576-7680; forrest@climatemodeling.org

Land-surface phenology is the amount and timing of "greenness," as measured by satellite. By comparing a spatially and temporally specific historical value of expected normal greenness to actual greenness from a current set of satellite images, we have created a national vegetation disturbance Early-Warning System (EWS). Areas showing less greenness than expected are identified as potential vegetation disturbances. Potential disturbance maps are produced at 231m resolution every 8 days for the conterminous United States, based on images obtained during the preceding 24-day period. A series of three baseline period lengths are used to obtain the normal or expected greenness value, highlighting potential disturbances of different ages. The EWS detected a surprising spatial pattern of phenology in the Southern Appalachians in spring 2010. Low elevation areas were considerably ahead of normal expected phenological development, while high-elevation areas near Mt. Mitchell showed retarded phenological development, probably due to cold early spring temperatures. These extreme phenological differences occurred in close spatial proximity.

Modeling the Timing and Duration of the Appalachian Spring: Implications for Biodiversity and Wildfire

Steve Norman, William Hargrove, Stephen Creed[1], U.S. Forest Service Eastern Forest Environmental Threat Assessment Center, Asheville, NC
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The Southern Appalachian spring provides an important temporal niche for biological diversity and wildfire. It has long been thought that variation in climate drives year-to-year change in the onset and duration of spring, but systemically integrating broad-scale climate, disturbance and ecological responses has been difficult. Documenting such linkages is vital for understanding how the existing forest came to be and for accurately predicting how ecosystems are likely to respond to climate change. We analyze a 16-day time series of land surface phenology using 240-meter resolution satellite-based measurements of greenness (NDVI) from 2003 to 2009 for the Southern Appalachians. We compare differences in the timing and intensity of spring greenup to local, regional and global weather patterns and to wildfire. Results indicate that variation in spring greenup has been considerable in time and space, with broad implications for how and where forests and wildfire may change in coming years under different climate and management scenarios.

Discussion period

This is a question-answer period with members of the panel and/or other experts to address the intersection of climate change with other stressors.

Poster Session

November 16, 2010; 6:00-8:00 p.m.
(Azalea Room)

Session Moderator:
Barry Clinton, U.S. Forest Service, Southern Research Station, Coweeta Hydrologic Laboratory

A Changing Mountain Landscape: Applied Research and Regional Engagement

Vicki Bott[1], Jim Fox[2], and John Vogler[3]
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How has rapid urban growth and land development changed western North Carolina's natural landscape since the mid-70's? What challenges will the region face over the next 20 years in accommodating continued population growth and protecting its abundant natural resources and great biodiversity? How will growth pressures and climate change interact to create new policy challenges? These are some of the issues that researchers at North Carolina's Renaissance Computing Institute (RENCI) and UNC Asheville's National Environmental Modeling and Analysis Center (NEMAC) are examining in collaboration with local governments, Land of Sky Regional Council, and the U.S. Forest Service's Southern Research Station.

The just-completed first phase of the collaboration involves using the innovative Urban Growth Model approach developed by UNC Charlotte's Center for Applied Geographic Information Science (CAGIS, a partner in RENCI at UNC Charlotte) to map historical patterns of development and generate forecasts of urban growth for 19 counties in western North Carolina. Those results quantify and spatially locate future land development in the region. The next phase will integrate those results into ongoing regional initiatives addressing growth management, land conservation, and climate change. It will engage regional policy makers, planners, land conservationists, and other stakeholders in exploring options for a more sustainable future as they strive to simultaneously manage the demands of economic growth, mitigate and adapt to climate change

impacts, and maintain the region's unique natural amenities. The poster will illustrate the modeled results with a time series of maps showing the spread of development from 1976 through 2030 and annotated with changes in "development footprint" (acres per capita) and land conversion rates (acres per day.) It will place this analysis in the context of a regional engagement process, describing the process and demonstrating the value of the inter-disciplinary and collaborative nature of this effort.

Barton Bench Ecological Restoration

Evan J. Burks, CASRI Coordinator, The Nature Conservancy, West Virginia Field Office, P.O. Box 250, Elkins, WV, 26241; (304)-637-0160 Ext. 101; eburks@tnc.org

The Barton Bench Ecological Restoration project seeks to turn a 90 acre strip bench back into a productive forest land. The bench has been stuck in arrested succession for over 40 years due to heavily compacted soils. The Monongahela National Forest with multiple partners seeks to decompact the soils, plant native early successional species and red spruce, and redesign wetlands on sight for wildlife habitat.

Remote Assessment of Forest Ecosystem Stress (RAFES): Development of a Real Time Decision Support System for the Eastern U.S.

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Drier and warmer conditions predicted with climate change models are likely to significantly impact forest ecosystems over the next several decades. The southern U.S. has experienced significant droughts over the past several years that have increased the susceptibility of southern forests to insect outbreaks, disease, and wildfire. Weather data collected with traditional approaches provide an indirect measure of drought or temperature stress; however, the significance of short-term or prolonged climate-related stress varies considerably across the landscape as topography, elevations, edaphic condition and antecedent conditions vary. This limits the capacity of land managers to anticipate and initiate management activities that could offset the impacts of climate-related forest stress. Decision support tools are needed that allow fine scale monitoring of stress conditions in forest ecosystems in real time and help land managers evaluate response strategies. To assist land managers in managing the impacts of climate change, we are developing a stress monitoring and decision support system across multiple sites in the eastern U.S. that (1) provides remote data capture of environmental parameters that quantify climate-related forest stress across the network of sites, (2) links remotely captured data with physiologically-based indices of tree water stress, and (3) provides a PC-based analytical tool that allows land managers to monitor and assess the severity of climate-related stress.

The sensor arrays at each site detect water and temperature stress variables and transmit those data to a field office. Sensors include air and soil temperature, relative humidity, fuel moisture and temperature, xylem sap flux

density, soil moisture and matric potential, precipitation, and photosynthetically active radiation. Data are transmitted in real-time to the NOAA **G**eostationary **O**perational **E**nvironmental **S**atellite (GOES). Stem and root xylem vulnerability curves provide species-specific thresholds for water stress impacts on tree mortality. A PC-based software program that downloads monitoring data from the GOES satellite, analyzes the data, and provides the land manager with an assessment of climate-related stress conditions and potential forest health threat levels in real time is under development.

Biodiversity Information Needs in the Southern Appalachians: Preliminary Results of an Internet Survey

Miriam L.E. Steiner Davis[1], Suzie Allard, Carol Tenopir, Christopher E. Caldwell, University of Tennessee College of Communication and Information Center for Information and Communication Studies Increasing Biological Information Sources: Technical Assistance and Support for Delivery and Technology Transfer, 345 Circle Park Drive, Suite 420, Knoxville, TN 37996-0341
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Support provided by Jean Freeney and the USGS National Biological Information Infrastructure, Southern Appalachian Information Node

In the Southeastern U.S., the Southern Appalachian Information Node (SAIN) of the National Biological Information Infrastructure (NBII) aims to make the "region's biodiversity information available for decision making." The University of Tennessee's Center for Information and Communication Studies (UT CICS) assists SAIN by identifying relevant content pertaining to climate change, renewable energy resources and aquatic resource management and restoration. They are also conducting research to create enhanced information taxonomies, tools, and products for finding, using and managing biodiversity information. Currently, the priority audiences for these efforts are researchers, scientists, including citizen scientists, and decision makers. Resources for educators, students and the public are also considered. To identify the specific biodiversity information and information tool needs, uses and practices of SAIN's priority audiences, UT CICS conducted an online user needs assessment survey. The survey was sent to key SAIN partners and stakeholders as well as all science and arts faculty at research intensive universities in the Southeast. Plans are underway for expanding the survey to herbaria and collections and biodiversity related non-profits in the region. Preliminary results, in terms of the implications for facilitating biodiversity research and decision making, will be presented.

The Use of GIS-Based Maps for Facilitating Stakeholder Engagement in Conducting Regional Climate Assessments

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As our society plans for and adapts to impacts from climate variability and climate change it is critical that decision makers are able to assess risk and understand vulnerability at scales in which

local decisions are made. Access to key datasets, in the appropriate format and scale, is vital for allowing stakeholders to better communicate climate information to decision makers. The use of geographic information systems (GIS) can play an important role in this process, and in creating regional climate assessments. The University of North Carolina at Asheville's National Environmental Modeling and Analysis Center, with support from the National Climatic Data Center and the North Carolina State Climate Office, created a series of GIS-based maps for a Workshop titled "Ask the Climate Question" to serve as an engagement and facilitation tool for Workshop participants. The Workshop, held in March 2010, brought together experts, decision makers, planners, and stakeholders from varied agencies across the state of North Carolina to identify climate-related issues important to different sectors, regions, and communities of the state. The maps highlight the state's great diversity, including the Appalachian section of Western North Carolina, and emphasize such issues as weather and climate, population and public health, energy, transportation, and environmental and natural resources. They also combine climate data with stakeholder values to facilitate the application of climate information at local levels, while communicating and engaging directly with end-users and decision makers for creating regional climate assessments. These assessments not only emphasize the current state of the climate along with associated impacts and vulnerabilities, but take into account other key cross-sector concerns.

This poster will highlight the use of GIS in communicating climate variability and change information, and show how this developed framework could be useful in other areas of the Southern Appalachians for conducting regional climate assessments.

Using GIS to Develop a Priority Work Area Map in Western North Carolina

Mark Endries, U.S. Fish & Wildlife Service Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; (828)-258-3939 ext. 221; mark_endries@fws.gov

The U.S. Fish & Wildlife Service's Asheville Field Office (AFO) is responsible for reviewing for endangered species compliance all federally authorized, funded, and permitted projects, and implementing listing and recovery activities for federally listed endangered and threatened species and candidate species of concern in Western North Carolina. These activities include conserving the habitats upon which the ecosystems these species depend, reducing impacts to these rare species and their habitats, and conducting education and outreach activities which support federal trust resource conservation. In an effort to prioritize the work area of the AFO and share this information with AFO constituents, we used geographic information systems to develop a work area habitat prioritization map. This map ranks the AFO office work area landscape on a 1-10 scale based upon federal trust resource priorities of the AFO staff. To construct this map we collected the best available datasets on fish and wildlife locations and habitats, ranked each dataset based upon office priorities, and combined the ranked datasets to produce a final habitat prioritization map. This map has assisted the AFO in spatially identifying priority Federal trust species

and their habitats. This, in turn, will assist AFO in focusing their conservation efforts on areas receiving the highest scores in the model, aid in ranking projects receiving discretionary funding, increase intra-office collaboration between programs to achieve the greatest conservation benefits on the ground, and serve as a base map for future GIS-based analyses. To address the issue of climate change, we feel this map provides an excellent current-state map of important wildlife areas that can be used in conjunction with climate change conclusions to assess, plan for, and respond to the impacts expected from climate change. Furthermore, we hope to incorporate climate change conclusions into future iterations of the map as they become available.

The Western North Carolina Report Card on Sustainability: Web and Print Tools for Helping Decision Makers Put Climate Change in a Regional Context

Jeff Hicks[1] and Todd Pierce[2], UNC Asheville's National Environmental Modeling and Analysis Center (NEMAC), One University Heights, Asheville NC 28804; (828)-250-3879; http://www1.nemac.unca.edu/SARCS/ReportCard/main.html

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Collaborators: Jim Fox, Matt Hutchins, Karin Lichtenstein, Nina Hall, Bridget O'Hara, Susan Weatherford, UNC Asheville's NEMAC; Susan Fox, Mary Carol Koester, U.S. Forest Service

Communities in Western North Carolina are very concerned with climate change, but do not have the proper tools to address the effects or impacts expected from our changing climate. This shortcoming is due largely to uncertainties in climate models and the lack of properly scaled data. In addition, policy makers do not make decisions regarding future resource planning based on climate change issues alone. Instead, they would prefer to make these decisions by linking climate change information to other value drivers in their communities, such as quality of life indicators, sustainable economic growth, open space preservation, and biodiversity protection.

The Western North Carolina Report Card on Sustainability helps address these challenges. This Report Card, a collaboration between the U.S. Forest Service's Southern Research Station (SRS) and UNC Asheville's National Environmental Modeling and Analysis Center (NEMAC), provides a trusted source of data covering economic, ecological, biological, and social factors relevant to forest sustainability in an eighteen-county region in Western North Carolina. The Report Card also includes historical climate information, explains climate change predictions, and shows how climate change affects sustainability indicators.

The Report Card was completed in September 2010 and is available in both PDF and hard-copy formats. Topics covered include biodiversity, forest health, production, climate change, carbon cycle, socioeconomic benefits, and water, soil, and air resources. The Report Card also has a companion web site that lets users browse the Report Card contents and view an interactive map showing spatial data used in the Report Card. Future plans for the Report Card include outreach and education activities to bring the Report Card to decision-makers and explain its use and applicability to local and regional sustainability.

NOAA Climate Services: Sectoral Engagement Activities at NOAA's National Climatic Data Center

Tamara G. Houston, Physical Scientist, NOAA's National Climatic Data Center, Veach-Baley Federal Building, 151 Patton Avenue, Asheville, NC 28801; (828)-271-4266; Tamara.Houston@noaa.gov

NOAA's National Climatic Data Center (NCDC) has recently expanded its customer service activities to include engagement with several climate sensitive sectors. As a starting point, NCDC has identified 12 sectors which represent a majority of the customers requesting climate data and information from NCDC. These sectors include: Agriculture, Civil Infrastructure, Coastal Hazards, Energy, Health, Insurance, Litigation, Marine and Coastal Ecosystems, National Security, Tourism, Transportation, and Water Resources. Each sector has a team dedicated to learning more about and serving the needs of the sector. Activities within each sector include the development of sectoral fact sheets, hosting or co-hosting sectoral workshops, attending and/or participating at sectoral conferences, partnering on research activities, and representing NCDC at sectoral trade shows.

The Importance of Old Growth and Reestablishing Natural Forest Structure in Ecological Restoration Efforts

Hugh Irwin, Sara Fitzsimmons, and Leila Pinchot

SEE ABSTRACT IN ECOLOGICAL RESTORATION SESSION

The Implications for Ecological Restoration of Forest Structural Issues in Southern Appalachian Forests

Hugh Irwin

SEE ABSTRACT IN ECOLOGICAL RESTORATION PANEL

Understanding Climate Change Impacts: Partnerships and Technology Transfer

Karin Lichtenstein[1] and Bridget O'Hara[2], Asheville's National Environmental Modeling and Analysis Center, RENCI at UNC Asheville, One University Heights, Asheville 28804; (828)-250-3882
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The collaboration between Eastern Forest Environmental Threat Assessment Center (EFETAC) and UNC Asheville's National Environmental Modeling and Analysis Center (NEMAC) was formed to develop advanced tools and technologies to support the technology transfer needs of decision makers, land owners, and extension agents. The collaboration focuses on (a) understanding the problems involved in data collection, management and analysis of data for technology transfer, (b) creating tools that meet the high-speed access and sharing needs of the environmental threat community, and (c) developing selected tools for deployment within the Forest Service (FS). EFETAC and NEMAC work together to develop methodologies and technologies that can address climate change impacts. This poster outlines the tools and technologies that are used with 3 EFETAC projects and how NEMAC supports these products and the

technology transfer needs of the environmental threat community.

- **CRAFT** (Comparative Risk Assessment Framework and Tools) is an advanced web and GIS-based toolset for decision makers, used in a team facilitated environment. CRAFT, based on the NEPA Decision Protocol 2.0, utilizes database driven websites, GIS services, conceptual models and probability-based thinking to help teams identify and clarify objectives, design alternatives, assess probable effects, and compare and communicate risks.
- The **Early Warning System** is a suite of tools designed for research scientists, USFS Sketch Mappers, forest and natural resources managers, decision makers and the public to use phenology data to understand unexpected change within our nation's forests. Project efforts include the development of an Early Warning System website, animations and learning modules, online GIS services, database-driven web tools to document observed changes within phenological data, and automated processes to analyze and produce threat alerts. Training and workshop opportunities will be available as well.
- **Template for Assessing Climate Change Impacts and Management Options** (TACCIMO) is a Web-based tool that provides land owners, managers, and planners with the most current climate change science available. The tool compiles climate change projections, impacts and management options, and Forest Service land and resource management plans in an online database. The tool then synthesizes these inputs based on user-defined criteria and creates an optional customized report to aid forest planning and management. UNC Asheville's NEMAC will assist with enhancing geospatial web applications, automating geospatial report generation, integrating science and planning content and technical support.

Interactions between Climate and Residential Development for Breeding Bird Communities in the Southern Blue Ridge Province.

Heather A. Lumpkin[1] and Scott M. Pearson[2]
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Wildlife populations in Southern Appalachia face landscape-level habitat changes from exurban development and climate change. To what extent will these two forces act independently or synergistically? In 2009 and 2010, we censused breeding bird communities along gradients of elevation and housing density in four North Carolina counties adjacent to the Tennessee state border. Temperature was recorded at each sampling location. Housing density was measured from aerial photography. Occupancy models were developed for selected species to assess the influence of climate, exurban development, and the interaction of these two variables. While the independent effects of temperature or housing density predominated for most species, the synergistic effects of climate and residential development were observed for 10% of species modeled. These species were typically forest-

interior Neotropical migrants with centers of distribution located in the northern US. These results suggest that these northern bird species found at high elevations may be more sensitive to habitat losses due to residential development than low-elevation species. Climatic warming may intensify the effects of residential development in the future. Occupancy models also indicate species that responded positively or were indifferent to housing density. Further analysis will determine how vegetative structure may mitigate or intensify the effects of development.

Southern Research Station Forest Inventory and Analysis (SRS-FIA) Nonnative Invasive Species Program Highlights the Expansion of Problematic Species

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Nonnative invasive plant species are problematic in southern forests because of extended growing seasons and high site quality. The U.S. Forest Service Southern Research Station (SRS), in partnership with State forestry agencies across the South, initiated a survey of 33 invasive plant taxa in 2001 on all forest ownerships as part of the SRS Forest Inventory and Analysis (FIA) program. The survey of invasive plant species was added to the traditional timber resource surveys that have been underway since the 1930's. The nonnative invasive plant species (NNIPS) selected for survey are regionally recognized exotic pest plants known to invade interior forest stands and forest edges, canopy gaps, and stream-sides. FIA collects information to estimate cover of invasive trees, shrubs, vines, grasses, canes, ferns, and forbs. Recent results from the NNIPS data show dramatic expansions in the population of Chinese tallowtree, a deciduous tree species that invades coastal prairies, converting herbaceous habitat into monospecific woody habitat. We discuss the expansion of this problematic species and present new, publicly accessible invasive species maps produced by SRS-FIA.

Population-Level Assessment of Climate Change Genetic Risk in North American Forest Trees

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Changing climatic conditions could pose a severe threat to forest tree species, which may be forced to adapt to new conditions or shift their ranges to more favorable environments. On-site adaptation, range-shift and population extirpation all could have negative genetic consequences. To determine the potential impacts of these processes, we are assessing the risk posed by climate change to the genetic integrity of North American forest tree populations. Our work has three central objectives: **1)** Forecasting future suitable locations for approximately

200 North American tree species under two climate change models; **2)** quantifying the expected climate change pressure across the range of each species; and **3)** assessing the overall susceptibility of species and their populations to genetic degradation and extirpation. To meet our first objective, we are using the Multivariate Spatio-Temporal Clustering (MSTC) technique to predict the future location and quality of habitat for forest tree species under the Hadley model and Parallel Climate Model (PCM) in 2050 and 2100, looking at high-emissions and low-emissions scenarios for each. For the second objective, we are measuring the straight-line Minimum Required Movement (MRM) distance from the existing locations of each species to the nearest favorable future habitat in 2100. For the third objective, we are synthesizing existing knowledge about the biology and genetic diversity of individual species with the MSTC and MRM maps to conduct spatially explicit assessments of genetic degradation risk. We will illustrate the project with results from southern Appalachian forest tree species. This work should be valuable for scientists and policymakers attempting to determine which species and populations should be targeted for monitoring efforts, conservation actions, and genetic diversity studies.

Ecosystem Restoration on the Bankhead National Forest in Alabama

Ben Prater, Wild South

SEE ABSTRACT IN ECOLOGICAL RESTORATION SESSION

Yellow Birch and Acidic Deposition in the Southern Appalachians

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Yellow birch (*Betula alleghaniensis* Britt.) is a common tree species found from Maine to Georgia, including higher elevations on cool, moist slopes in the Southern Appalachians. It has been reported to be negatively affected (e.g., degraded crowns, reduced growth, increased mortality rates) by low soil pH, nutrient cations, and high available aluminum (Al) as a result of long-term acidic deposition in the northeast. Acidic deposition and subsequent soil acidification have greatly reduced available soil calcium (Ca) in the cation exchange system of the forest floor and upper mineral soils of mountain forests from Maine to Georgia. Aluminum is very phytotoxic—it becomes available at low pH levels and results in the loss of nutrient cations like K^{+}, Ca^{++}, and Mg^{++}. Yellow birch retains Ca in older tissues and is not able to move it to newer growing tissues, thus is negatively affected at low soil calcium concentrations, which are most detrimental to larger YB trees. Calcium-intolerant species in low soil calcium soils have a high demand for Ca for growth, maintenance, and in the defense of existing wood from infection because the protective *codit* system in roots, stems, and branches has a high Ca demand. This

greatly increases stress and vulnerability to damage from drought, cold, insect defoliation (e.g., gypsy moth), winter storm injury, root-rots, etc. We examined existing data from the Forest Inventory and Analysis program (FIA) to locate areas where large yellow birch were found, and developed a sampling protocol to evaluate 3 size classes (5-12; 12-15, and > 15 inch dbh) of yellow birch trees, and obtain soil samples for chemical analyses. To date 31 survey points have been evaluated in eastern North Carolina mountains. Preliminary results indicate that the largest size class (>15 inches dbh) of yellow birch have substantially more serious tree damages (conks, wounds, etc.) than smaller size classes.

"Ramps" Population Trends in the Southern Appalachians: 1999-2010

Joan L. Walker, U.S. Forest Service Southern Research Station, SRS-4158, Clemson, SC; (864)-656-4822; joanwalker@fs.fed.us

Collaborators: Benjamin Knapp, Bryan Mudder, Shawna Reid, Andrea Silletti, David White

Allium tricoccum, known as wild leek or ramps, is a culturally important herb harvested by digging in the early spring. Population declines attributed to over-harvesting in its northern range led to concerns about the status of *A. tricoccum* in the southeast. In 1999, we randomly selected relatively high-density plots, presumably attractive to harvesters, in the Upper Nantahala River watershed. Annually we quantified leek density and cover, and soil disturbance along permanent transects. We described plot environmental variables and examined local temperature and precipitation data. We addressed the following questions: Does abundance differ among plots and through time? How does abundance vary with site quality? Does disturbance affect mean density and temporal variability? We used analysis of variance methods with repeated measures to detect differences among plots and through time, and regression analyses to examine relationships among abundance and environmental variables. Abundance was significantly predicted by aspect ($p=.004$; $r^2 = 0.366$), increasing from west through north and east. All populations varied from year to year, but only six (23%) showed significant trends, five decreasing and one increasing. Negative trending plots all showed high soil disturbance, and the single increasing populations was a high elevation undisturbed plot. Main effects of disturbance class ($p=.0018$) and time ($p<.001$) were significant. Compared to undisturbed plots, the disturbed group always had significantly lower densities. Correlations of abundance with precipitation and temperature data were weak, as might be expected in a topographically complex landscape where local factors such as slope and aspect may moderate synoptic weather patterns. We suggest that the protected locations of ramps populations may buffer climate related changes in the future.

Session: Ecological Restoration

November 17, 2010; 8:30 a.m. – 12:00 p.m.
(Dogwood I)

Session Moderator:
Alice Cohen, U.S. Forest Service, National Forests in North Carolina

Ecosystem Restoration on the Bankhead National Forest in Alabama
Ben Prater, Wild South, Associate Director, 16 Eagle St. Suite 200, Asheville, NC 28801; (828)-258-2667; ben@wildsouth.org

The original forests of Northern Alabama consisted of chestnut, oak, hickory, and pine communities. These forestlands shifted dramatically due to changing land use and the practice of industrial forestry. In recent history, the Bankhead National Forest was unsustainably managed for timber production causing fragmentation and diminished forest health. Past management involved rapid conversion of native hardwood communities to loblolly pine plantations using large scale clearcutting and herbicides. As a result, historical and archaeological sites were destroyed while biodiversity, soils, and aquatic systems suffered.

This management approach on the Bankhead was widely unpopular with the public. Public sentiment and action surrounding these controversial and devastating activities led to the development of a revised Forest Management Plan. The Plan now manages for the many unique attributes and significant resources found in Alabama's National Forests. It focuses on the restoration of native forest communities, the improvement of wildlife habitats, and providing recreational opportunities for the public. The public input process, instituted with the Plan, along with the focus on landscape-scale ecological restoration makes the Plan unique in the region.

Furthermore, this Plan produced a scientific model of forest management and restoration for other National Forests and private lands. Active restoration in the Bankhead is currently restoring native hardwoods, shortleaf and longleaf pine ecosystems, glade communities, and historic fire regimes. The implementation of ecological restoration in the Bankhead has supported local economies and

fostered responsible harvest techniques while restoring the health and ecological stability of the land.

Cherokee National Forest Landscape Restoration Initiative

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A collective group of stakeholders have come together to reach agreement on a science-based process for supporting the ecological restoration and adaptive management of the native vegetation, rare communities, watersheds, and aquatic systems of the Cherokee National Forest. We will work collaboratively with the Forest Service to identify and prioritize the needs for restoration and design and initiate a robust public participation component to this process utilizing a variety of sources, including national, regional, and local/community expertise. Results will be compiled and presented as a set of recommendations to the Cherokee National Forest which can be considered for future management decisions. Our approach will emphasize public participation and information sharing in order to reach community-supported and science-based methods for forest management and implementing ecological restoration on the ground.

Ecological Restoration in the Face of Climate Change: Utilizing Collaborative Stewardship Contracts and Agreements

Alice Cohen, U.S. Forest Service, National Forests in North Carolina, 160 Zillicoa St, Asheville, NC 28806; (828)-257-4258; acohen@fs.fed.us

The U.S. Forest Service interprets the effects of climate change as exacerbating existing stressors, causing more severe and less predictable impacts on resources. The scope of climate change requires its consideration on a landscape level. Our general premise for resource management is maintaining healthy landscapes. Doing this in the context of climate change requires we focus on promoting the most resilient ecosystems possible, so they are less susceptible to the impacts of climate change. Adapting management practices to the unpredictability of climate change is necessary and acknowledged within the Forest Service. One recent philosophical change in management is the shift from goals of restoring a landscape to a point in history to the goal of generally promoting the healthiest current conditions to fortify ecosystems against the impacts of climate change.

One shift in management tools is the use of stewardship contracts and agreements. These tools allow for a landscape-scale approach to management by allowing funds from timber and other forest product sales to be utilized for resource projects beyond the boundaries of the sale unit, as was previously the case. Managers collaborate with interested partners in conceiving and planning projects, including analyzing resource needs and considering management priorities across the forest.

Projects may be multi-year. 100% of funds received are kept on the forest to further restoration goals and resource management needs.

This session will introduce stewardship contracts and agreements. Recent meetings in the mountains and near the coast brought together new partners and increased capacity for the use of stewardship contracts and agreements. Learn about recent National Forests in North Carolina collaborative stewardship initiatives and the big-picture direction the Forest Service and partners may take in the future.

Buck Creek Serpentine Barren Restoration Burns

Duke Rankin, U.S. Forest Service, National Forests in North Carolina, Nantahala Ranger District; (828)-524-6441; drankin@fs.fed.us

The largest and floristically most distinctive of the Southern Appalachian serpentine barrens occurs in the southern Nantahala Mountains along Buck Creek in Clay County, NC. Two G1-ranked communities have developed over the ultramafic rock (dunite). In 1995 these fire-dependent communities had not burned for more than 50 years. During the past 15 years restoration burns have been implemented across three separate burn blocks, totaling over 300 acres, to alternate the frequency of fire and allow temporal refugia for butterflies and moths species. The resulting structural changes have perpetuated a diverse assemblage of species including twenty-six state-listed (disjunct or peripheral) plants and animals. These taxa include 2 state records and a new species to science, only first described in 2004. Duke Rankin, Botanist for the Nantahala National Forest, will profile the ecological significance of this site and the restoration efforts underway here.

The Identification of Priority Forest Sites for Chestnut Restoration in the Southern Appalachians

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Efforts to breed blight-resistance into American chestnut appear to be successful and attempts to study reintroduction of the species to its original range have now started with a small series of preliminary plantings. But the Appalachian forest ecosystem that made up the majority of this species' original range is much different now than it was over 100 years ago when American chestnut was often the dominant species of a stand. One of the major and most obvious changes is that former chestnut stands are now dominated by different forest types. However, an important indicator of where chestnut can be successfully reestablished as a dominant species would be areas where there is

good evidence that they were a dominant species before the blight.

As American Chestnut restoration efforts continue, there is interest in the best forest conditions to focus restoration efforts. One aspect of this question is the most appropriate forest types and ecological conditions for restoration. In tandem with the field studies being conducted on chestnut reestablishment, this question can be addressed by information that has been collected on chestnut habitat over the last century. Before chestnut blight decimated the American chestnut, considerable information was collected on the forest conditions where chestnut were dominant. As chestnut were dying and being replaced by other tree species, this transition was documented by field studies. Today FIA plots document the ecological conditions where chestnut sprouts survive, another indicator of former dominance by American chestnut.

This historical and current information, in conjunction with GIS models of potential natural vegetation and data on existing vegetation, can be used to help predict the most suitable forests for chestnut restoration.

Template for Assessing Climate Change Impacts and Management Options (TACCIMO)*

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Forest planning will play an integral role in the effective management of forest resources under a changing climate. Connecting planning with emerging climate change science will enable planners and managers to effectively assess current management capabilities and to ensure sustainable forest resources meeting multiple demands. The Template for Assessing Climate Change Impacts and Management Options (TACCIMO) is a web-based tool that substantively connects planning and science through a report generation service. TACCIMO provides land owners, managers, and planners with access to the best and most current climate change science available.

The TACCIMO inputs are projected climate change, literature review derived impacts and management options, and USFS land and resource management plans. The web-based interface uses a relational database environment to synthesize inputs based on user selections to generate a report. From the *Planning Template Report,* USFS forest planners will be able to readily construct the documentation needed to support forest planning, while state and private users will be provided with localized forecasts and impacts. Feedback tracking ensures completeness of information and usefulness of functionalities.

** Developed by: Eastern Forest Environmental Threat Assessment Center, Southern Research Station, U.S. Forest Service, Raleigh, NC; Southern Region Planning, U.S. Forest Service, Atlanta, GA; Steve McNulty and Chris Liggett, co-Principal Investigators*

Session: Communicating Climate Change

November 17, 2010; 8:30 a.m. – 12:00 p.m.
(Dogwood II)

Session Moderator:
Gary Peeples, U.S. Fish & Wildlife Service

Climate Change Education: Resources and Challenges

Mary Ball, Department of Biology, Carson-Newman College, Jefferson City, TN 37760; (865)-471-3254; mball@cn.edu

Although there are many good climate-change teaching resources being developed, there are many challenges to implementing climate-change education, including teachers' lack of concept knowledge, lack of teacher awareness of high-quality available resources, and efforts by some people to promote so-called "balanced" teaching materials and information sources that are in fact biased. This session will introduce participants to some high-quality teaching resources on climate change and will provide them with an annotated bibliography of free climate change teaching resources. We will also engage participants in discussion of challenges related to climate change education.

Communicating About Climate Change in Great Smoky Mountains National Park

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It is always a challenge to communicate about controversial issues. In Great Smoky Mountains we are tackling climate change using a variety of different techniques, including video podcasts focusing on specific resource impacts, a citizen science phenology study, a curriculum-based field trip program and programs for the public. This presentation will focus on the key initiatives in the National Park Service as well in the Smokies.

Distributing Phenology Data: The National Phenology Dataset Explorer

Todd Pierce[1], Matthew Hutchins[2], Jeffrey Hicks[3], Karin Lichtenstein[4], and Mark Phillips[5], UNC Asheville's National Environmental Modeling and Analysis Center, One University Heights, Asheville, NC 28804; (828)-250-3879
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Vegetative phenology is the study of plant development and changes with the seasons, such as the greening-up and browning-down of forests, and how these events are influenced by variations in climate. A National Phenology Data Set, based on Moderate Resolution Imaging Spectroradiometer satellite images covering 2002 through 2009, is now available from work by NASA, the U.S. Forest Service, and Oak Ridge National Laboratory. This new data set provides an easily interpretable product useful for detecting changes to the landscape due to long-term factors such as climate change, as well as finding areas affected by short-term forest threats such as insects or disease.

The University of North Carolina-Asheville's National Environmental Modeling and Analysis Center has been working with the US Forest Service's Eastern Forest Environmental Threat Assessment Center to support the distribution and use of the National Phenology Data Set for scientists, forest managers, and the public. The National Phenology Dataset Explorer is an online GIS tool that combines the phenology dataset with contextual data layers including street maps, land use patterns, ecoregions, aerial threat surveys, and climate data.

The Explorer lets users "mix and match" data products to look at time periods of interest for any area in the coterminous United States, and thus to search for disturbances or anomalies that might represent current or past threats to the nation's forests. The Explorer includes basic NDVI (Normalized Difference Vegetation Index) data as well as derived products such as length of growing season or onset of spring. In addition, a graphing tool lets users click a map location and generate an interactive time series graph for the NDVI or any derived product.

This presentation demonstrates the Explorer and explains its relevance to the forest threat detection, forest monitoring, and scientific research community, as well as the general public. The Explorer helps in collaboration among these groups and aids in better assessment of the threats and uncertainties facing our nation. The Explorer is just one part of a much larger Early Warning System toolset, which will provide a seamless integration between monitoring, detection, early warning and prediction of forest disturbances as observed through phenological data.

Rhetorical Strategies of Environmental Cyberactivists

Elizabeth C. Fine, Professor, Appalachian Studies Program, Virginia Tech; (540)-231-9593; bfine@vt.edu

The environmental struggles against the interrelated issues of climate change, mountaintop removal mining, and deforestation use similar rhetorical strategies based on sophisticated use of the Internet. As 350.org says in its New Media Kit, "the technology that will stop the climate crisis isn't solar panels, it's the Internet." This presentation examines the rhetoric of cyberactivism used by such

sites as 1.) ilovemountains.org, 2.) 350.org, 3.) Rainforest Action Network, and 4.) Hactivist or parody sites such americascoalpower.org and coal-is-clean.com to advance their environmental agendas. The presentation critically examines the different rhetorical strategies used by these sites, their techniques for expanding their audiences, and their different use of image-events. New rhetorical tools help create a worldwide knowledge commons that both stimulates and interconnects grassroots organizations, leading to a revolution in grassroots organizing that advances social change.

1988: The Heat Is On

Fred Waage, Department of English, East Tennessee State University, P.O. Box 70267, Johnson City, TN 37614; (423)-439-5998; waage@etsu.edu

This presentation will be a précis of a planned environmental history book. In the SAMAB context it will concern the (often unintentional) ways in which the summer of 1988 was the first "teachable moment" in U.S. global warming awareness. The point of the spear was James Hansen's famous testimony to Congress. The other general, powerful, forces for awareness were the extreme heat of that summer and the media attention placed on it, and the highest "nuclear fear" since the 1950's, just before the Soviet Union's collapse (it should be noted the IPCC was also established during that year). I will use primary media sources from 1988 to chronicle these phenomena and discuss their effects. The whole will be placed against a counter-movement based on my own experience of mental breakdown that summer, ostensibly due to fear of global warming and nuclear destruction. Thus will be posed a counterclaim, in effect: to what extent does disseminating information become psychologically toxic to individuals, and work against its own aims?

Integrating the Social and Biological Sciences in Conservation Planning

John D. Peine[1] and Kathleen E. Franzreb[2]
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The accelerating adverse influence of perturbations on ecosystems likely to be exacerbated by the influence of climate change, has lead to a sense of urgency by the USFWS to develop a better ecological understanding of these implications and to integrate this knowledge into a socioeconomic context in order not only to develop the best management tools for conserving biodiversity, but also to improve the process of creating Conservation Plans at the species or ecosystem levels. This presentation concerns a strategy to facilitate the integration of social and economic dimensions into the ecosystem analysis in the context of supporting an effective decision making process leading to sustainable conservation practices. The framework component facilitated from a macro-scale perspective is the first step in incorporating socio-economic components to an ecosystem assessment. This big picture perspective provides a foundation for beginning the focusing process. Today, many conservation efforts are focused on ecosystem-based approaches in which the management objective is to conserve adequate biological and physical refuges in which species can live and

evolve. Incorporating social dynamics in the habitat restoration and conservation planning process is imperative to securing understanding and acceptance of the preferred conservation strategy. Identifying relevant social values, how deeply they are held, by whom, and in what context is a social process. As a subset of the social component, the economic implications, both market and *non-market*, of alternative strategies for habitat restoration and conservation strategies need to be accurately measured. The goal is to gauge the economic consequences and efficacy of alternative conservation strategies for different stakeholders so as to choose policies that reflect economic dimensions of social values/needs while achieving conservation goals/mandates. Too often, scientifically valid habitat conservation plans have been sidetracked by the way stakeholders were approached and utilized in the assessment and decision-making process. The challenge is how to minimize the potential for such a derailment during the planning process. The decision-making component focuses on how to incorporate all of those concepts into an integrated decision-making process designed to increase the likelihood of achieving consensus and long term commitment to species/ecosystem sustainability.

Session: Ecological Restoration

November 17, 2010; 1:30-5:30 p.m.
(Dogwood I)

Session Moderator:
Carolyn Wells, U.S. Fish & Wildlife Service

PANEL:
The Role of Ecological Restoration in Addressing Forest Structural Issues in Southern Appalachian Forests

Panelist: **Hugh Irwin**
Conservation Planner/Program Director, Southern Appalachian Forest Coalition; P.O. Box 817, Black Mountain, NC 28711; (828)-252-9223; hugh@safc.org

Panelist: **Beverly Collins**
Department of Biology, Western North Carolina University, Natural Science Building 132, Cullowhee, NC 28723; (828)-227-3663; collinsb@email.wcu.edu

Panelist: **Cathryn H. Greenberg**
Project Leader and Research Ecologist, Upland Hardwood Ecology and Management, U.S. Forest Service, Bent Creek Experimental Forest, 1557 Brevard Rd., Asheville, NC 28806; (828)-667-5261; kgreenberg@fs.fed.us

Panelist: **Kendrick Weeks**
Mountain Wildlife Diversity, N.C. Wildlife Resources Commission, Mills River, NC; (919)-609-7605; Kendrick.weeks@ncwildlife.org

Panelist: **Marek Smith**
Director, Allegheny Highlands Program, The Nature Conservancy, 12181-A Courthouse Hill Road, Warm Springs, VA 24484; (540)-839-3599; *marek_smith@tnc.org*

Panelist: **Steve Lohr**
District Ranger, U.S. Forest Service, National Forests in North Carolina, Tusquitee and Cheoah Ranger Districts, Murphy, NC; (828)-837-5152; slohr@fs.fed.us

Introduction
Hugh Irwin

Several aspects of structural diversity are the focus of different wildlife and conservation groups. Early succession habitat is considered important for a number of species, and this habitat is considered to be in short supply. Old growth habitat is in very short supply due to massive logging at the turn of the twentieth century. This same massive logging and a legacy of ongoing clearcuts during the twentieth century left most forests in an even-aged condition. Much of this forest lacks the structural diversity that would be found in uneven-aged and all-aged natural forests.

There are advocates for wildlife habitat associated with early succession forest. There are advocates as well for protection of old growth forests and forest that is approaching old growth conditions. Traditional timber programs target maturing forest stands for logging as part of a timber rotation that creates early succession as a byproduct. But efforts to increase rotational timber programs on public lands are vigorously opposed by groups that see these efforts as a threat to remaining old growth forest and forests that are just now recovering from the devastating logging of the past. Instead, these groups advocate that ecological restoration efforts focus on the creation of early succession habitat in areas where ecological conditions are the worst and where vegetation management can address the legacies of past management.

Between these two opposing views and competing needs there should be room for restoration projects that create early succession while also restoring the species and structural diversity of our native forests. But the intersection of agendas has seldom been investigated in a productive way. Presentations from the panel will discuss current information and approaches to structural diversity issues. The panel discussion and questions from the audience will allow the exploration of where these differing agendas may have common solutions.

Natural Disturbance and Forest Structure
Beverly Collins, Peter White[1]
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Today's Southern Appalachian forests, largely a legacy of chestnut blight and early 20th century logging, exhibit a narrower range of stand ages and structures than those in the presettlement landscape. Many stands are dominated by early to mid-successional species in the overstory and late successional species in the understory. Natural disturbances often serve to increase dominance of the understory late successional species, unless they are severe enough to disturb the canopy, forest floor, and soil. Large, stand-replacing natural disturbances are infrequent, with typical return intervals longer than current stands have existed. Nevertheless, Southern Appalachian forests are subject to cumulative effects of a suite of natural disturbances: the frequency of tropical storms decreases from the Piedmont and adjacent Blue Ridge westward; ridges and slopes experience ice storms and landslides; but relatively high rainfall increases the fire return interval. Only the most severe natural disturbances or combinations of disturbances (including human disturbance) initiate large

patches of early successional vegetation and young forest structure; however, gaps and edges created by disturbances and forest fragmentation provide smaller patches of early successional habitat and support establishment of shade intolerant species. Management actions can allow forests to age or enhance natural disturbance to restore heterogeneous forest structure over the landscape.

Forest Disturbance and Habitat Conditions in the Southern Appalachians
Cathryn H. Greenberg

Different disturbance types and intensities create a gradient of patch sizes and structural features in southern Appalachian forests. This mosaic of structural conditions affects movement patterns and relative abundance of many wildlife species by creating habitat heterogeneity, and by affecting the spatial and temporal availability of food resources in a forest matrix. In the southern Appalachians, fleshy fruit production is 5-20 times greater in young, recently harvested forest compared to mature forest, beginning 2 or 3 years after harvest. Recent clearcuts may provide over 10 times more dry biomass of forage and browse than mature forest. Litter dwelling arthropods are generally more abundant in mature forest where shade and thicker leaf litter provide a cooler, moister microclimate relative to young stands. However, flying and foliar arthropod abundance and biomass is higher in young stands, likely because of a higher density and palatability of young plant foliage. Herbaceous plants attract pollinating insects, and may positively affect their abundance in recent clearcuts, prescribed burns that kill trees, and forest roads. Disturbances that reduce leaf litter depth and moisture and increase light and temperature at the forest floor may detrimentally affect some salamander species but benefit some reptile species. Breeding bird density and richness are generally higher in disturbed habitats including treefall gaps, intensively burned forest, and recently harvested young forests, particularly if some tree canopy is retained. Indeed, many wildlife species forage opportunistically for insects and fruit in resource-rich young forest patches.

Ecological Processes and Restoration of Habitat Structure and Composition for Wildlife in the Southern Appalachians
Kendrick Weeks

There has been a steady shift for many years by wildlife biologists and other conservationists to move towards a more ecological and ecosystem based approach of managing natural resources in addition to conserving species of greatest conservation need. This paradigm is grounded by scientific research on climate, soils, hydrology, vegetation, disturbance, wildlife, economics and their interactions, present, past, and future. Although much of the landscape in the Southern Appalachians is privately owned and managed for individual human values, public land is abundant and has been managed for and in consideration of the multiple goals of a diverse public. Some of the ecological processes that sculpt ecosystems in the absence of humans must be emulated by humans because of our

integration with ecosystems and the deleterious effects of allowing natural disturbances to occur willy-nilly. Although some processes are beyond human control and remain 'natural' processes and some have been adversely altered by human development, many science-based tools are now available to plan restoration and management of public lands on a landscape scale that allow managers to better mimic natural disturbances and other ecological processes. These same tools can be used to identify private lands for which management incentives can best be utilized. Predicted vegetation models, disturbance probability models, and current land cover data are valuable tools for planning and implementing ecological restoration in the context of multiple human values, the existing land cover across the landscape, and global climate change. An adaptive management framework will improve these tools immensely and is essential to maximizing effectiveness. Partnerships among all conservation camps and land ownerships will be necessary to make ecological restoration and conservation a success in the Southern Appalachians.

Restoration of Fire-adapted Ecosystems in the Central and Southern Appalachians

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Land managers and ecologists from several Appalachian states met in 2006 to develop approaches for restoring fire-adapted ecosystems on Warm Springs Mountain in Virginia's Allegheny Highlands. Through a series of meetings participants discovered a common interest in working together to meet the challenge of restoring Appalachian pine and oak dominated forests across the region. This launched the Central Appalachian and Southern Blue Ridge Fire Learning Networks (FLN), a regional collaboration of ten demonstration landscapes representing nine states. Using FLN methodology based upon The Nature Conservancy's Conservation Action Planning process, the partners (including federal, state, non-profit and university representatives) have developed strong conceptual ecological models, collaborative goal statements and maps of current and desired conditions, all of which help guide management decisions and on the ground implementation of projects. Since 2008, FLN partners have conducted controlled burns on over 10,000 acres, adopted a standardized fire effects and habitat composition monitoring protocol, and sponsored on-going fire history research. Partners are now utilizing maps of potential ecological systems and current conditions, developed from field plots and digital terrain models integrated into a geographic information system, to: 1) locate and prioritize future restoration efforts, 2) develop vegetation departure indices and refine current conditions through integration with LANDFIRE satellite imagery and local data, and 3) specifically in the Allegheny Highlands, implement a new monitoring program that will document changes

in bird community response to controlled burns in different ecological systems. Additional accomplishments include completion of environmental assessments under NEPA for over 30,000 acres of prescribed fire within the FLN boundaries and expansion to include additional partners. In just a few short years, these two Fire Learning Networks have generated enormous potential for restoration, due to the collaborative nature of this effort.

Options for Increasing Structural Diversity on National Forest Lands
Steve Lohr

Structural diversity within forested landscapes is essential in providing a variety of habitats for flora and fauna. This is particularly important in the southern Appalachians where species with more southerly and northerly ranges and diverse habitat requirements come together. Many species prefer areas of smaller or within-stand disturbance while others tend to occur in or near larger, or landscape scale disturbances. Historically, structural diversity was maintained by frequent small scale and infrequent large scale natural disturbances. Today, these disturbances still occur but the effects of the larger scale events are minimized by the interrupted nature of our forested landscapes. Creating disturbances to provide for a diversity of species in a managed landscape where the needs of recreation and timber production must be met is a challenging and often controversial proposition on public lands in the southern Appalachians. Most recent landscape level management actions on the National Forests in North Carolina have predominantly been in the form of shelterwood with reserve harvests. Within stands, management actions have consisted mostly of group selections, thinning treatments, and prescribed fire. Though these management options have been successful in increasing structural diversity, there may be ways to improve these treatments to have a greater ecological benefit. Clearly defining specific objectives of each treatment is crucial in developing prescriptions that will improve the structure of our forests. With increased emphasis on restoration activities on National Forest lands in recent years, managers need to use a variety of tools and develop new and innovative methods to accomplish these objectives.

The Importance of Old Growth and Reestablishing Natural Forest Structure in Ecological Restoration Efforts
Hugh Irwin

The lack of early succession habitat for certain wildlife species in forests of the Southern Appalachians is frequently cited as an issue that needs to be addressed through ecological restoration. A decrease of natural disturbances in relatively young forests and forests that are mostly even-aged could account for a decrease of early succession habitat below natural ranges of variation. In addition, loss of habitat to development and agriculture has created a different landscape pattern of forests and the availability of early succession than would be expected in a landscape dominated by natural disturbance regimes.

However, the lack of early succession habitat is only one manifestation of a legacy of anthropogenic changes to forest structure in the Southern Appalachians. We are still experiencing the results of these anthropogenic alterations to forest structure, particularly those due to the massive logging that occurred at the turn of the twentieth century. These alterations have resulted not only in a shortage of early succession habitat but also a deficiency of true old growth forest and a homogenization of forest structure throughout our forests. These issues should not be viewed as separate issues but are in reality different manifestations of the same alterations in structural diversity due to past management. These forest structural issues should be addressed together in ecological restoration efforts.

Discussion period
This is a question-answer period with members of the panel and/or other experts.

Session: Agency and NGO Initiatives

November 17, 2010; 1:30 – 5:30 p.m.
(Dogwood II)

Session Moderator:
Rick Durbrow, United States Environmental Protection Agency

Great Smoky Mountain National Park Wetland Inventory, 2010

Tom Remaley, Ecologist, Great Smoky Mountains National Park, 1316 Cherokee Orchard Road, Gatlinburg, TN 37738; (865)-436-1736; Tom_Remaley@nps.gov

Wetlands are an important ecological focal point in the Southern Appalachian landscape. Wetlands are 1) important landscape expressions of hydrology, 2) nutrient and possibly contaminant "sinks", 3) obligate habitats for rare/vulnerable plants and animals, and 4) are often globally rare natural communities, which adds to the heterogeneity of natural biodiversity at the landscape level.

The park has never had a systematic survey for wetlands. Most wetlands in the Smokies appear to be small, are obscured by the tall forests often with multiple canopies, and contain evergreen shrubs, including Rhododendron. This makes using remote sensing difficult. Aerial photos have proved somewhat ineffective, and use of thermal Infrared imagery is dependent on the absence of evergreen shrubs or tree layers. Rhododendron thickets are very common in the moist areas of the park; 18% of the park is covered by dense Rhododendron. Many of our wetlands appear to be in flatter valley bottoms, especially near the bottom of slopes. This makes a ground survey of the limited flatter areas in the park (~5^{O} slope or less) feasible.

Project Goals:

1.) Complete an on-the-ground inventory of wetlands in several prioritized watersheds on both sides of the park.
2.) Develop a protocol to collect basic wetlands data that can be completed quickly, so that the survey is more geographically extensive rather than intensive. As a pilot, the protocol will adapt to required skills and conditions as necessary. Once completed, these data should provide the first comprehensive documentation of the wetlands, their attributes and stressors for the watersheds chosen.

Stakeholder Engagement and Conducting Climate Assessments in Western North Carolina

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Climate and climate change are new challenges that decision makers are forced to cope with and prepare for. Complex issues, including information access, assessing uncertainty, and considering vulnerabilities, challenge the way information is integrated and communicated in the decision making process. As our society begins to evaluate climate and climate change impacts, it is critical that decision and policy makers are able to assess risk and develop adaptation strategies at local levels. Traditional climate assessments have primarily used a top-down approach, but a bottom-up approach is needed, where stakeholders are engaged from the beginning, ensuring that the assessment considers specific issues at the scale that is relevant to the decisions being made.

The University of North Carolina at Asheville's National Environmental Modeling and Analysis Center, with support from NOAA's National Climatic Data Center, has engaged with stakeholders from multiple sectors to develop climate assessments for Western North Carolina. This includes combining climate data with stakeholder values to guide the application of climate information from "global to regional to local levels," and for communicating with decision makers. These climate assessments emphasize the current state of the climate along with associated impacts to both natural and human systems and the services they provide.

The approach of conducting climate assessments through stakeholder engagement has supported better understanding of climate-related dependencies and vulnerabilities in Western North Carolina. Assessments of the various sectors in Western North Carolina, including forests and biodiversity, energy, transportation, human health, and cultural resources, have been used in developing climate change adaptation strategies, future infrastructure planning, and sustainable initiatives for local communities. These assessments provide a transparent way for decision makers to integrate efforts and to re-evaluate as more information becomes available. Also, information gained and lessons learned from this user-engaged approach offer insight for conducting regional climate assessments across the Southern Appalachians and the Southeast.

North Carolina Ecosystem Response to Climate Change: DENR Assessment of Effects and Adaptation Measures

Laura Gadd, Natural Areas Specialist, North Carolina Natural Heritage Program; 1601 Mail Service Center, Raleigh, NC 27699-1601; (919)-715-7808; Laura.Gadd@ncdenr.gov

The North Carolina Department of Environment and Natural Resources (DENR) has made it a priority to comprehensively address climate change in our state, using mitigation and adaptation efforts to increase the resilience of our state's natural resources to these complex changes. The mitigation sector will work on reducing carbon emissions and developing regulations for greenhouse gas emissions, green energy

initiatives, and carbon sequestration. The adaptation sector will proactively prepare for changes that cannot be prevented and will address potential impacts to natural resources that the Department is charged with protecting. As part of the adaptation side of this Initiative, the Natural Heritage Program, with input from other conservation agencies, is evaluating the likely effects of climate change on North Carolina's ecosystems and species.

We conduct this analysis at several levels of biological organization and, where appropriate, over several different regions of the state: the Mountains, Piedmont, and Coastal Plain. In all cases, impacts that are identified at the higher levels are believed to translate downward within the organizational hierarchy, although we also expect and identify impacts that are likely to be unique to each separate unit within the levels. Information generated from our analysis is stored in an Access database, which is easily updatable and from which customized reports can be generated as needed. Reports will be produced on a regular basis and sent out to our conservation partners, both within DENR and outside DENR. Comments received will then be fed back into the database: the entire process is iterative and we expect to continue making improvements to our assessments and recommendations as new predictions about the effects of climate change become available or as empirical evidence of the effects begins to accumulate.

Integrating Climate Change into the North Carolina Wildlife Action Plan

Cindy Carr, Wildlife Action Plan Coordinator, North Carolina Wildlife Resources Commission, 1721 Mail Service Center, Raleigh, North Carolina , 27699-1721; (919)-707-0227; cindy.carr@ncwildlife.org

Cindy Carr earned her Master's degree from North Carolina State University in fisheries and wildlife science and has over 10 years of experience in the field of wildlife conservation, stream and wetland delineation, and regulatory permitting as a consultant in the private sector. Cindy also has diverse experience in multi-project management and coordination, environmental review, data management, and GIS mapping. She is certified as a Professional Wetland Scientist by the Society of Wetland Scientists. As the Wildlife Action Plan Coordinator for the North Carolina Wildlife Resources Commission (NCWRC), Cindy is responsible for guiding the NCWRC through its first revision of the Wildlife Action Plan. Cindy works jointly with the NCWRC Division of Inland Fisheries and Division of Wildlife Management.

Appalachian Landscape Conservation Cooperative – a Science Management Partnership to Address Landscape Scale Conservation

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The Department of Interior has been leading the establishment of Landscape Conservation Cooperatives (LCCs), funding an initial eight LCCs in Fiscal Year 2010. Landscape Conservation Cooperatives were identified in Secretarial Order No. 3289 (Climate Change) issued by the Secretary of the Interior in September 2009. "A

network of Landscape Conservation Cooperatives will engage DOI and federal agencies, states, tribal and local governments and the public to craft practical, landscape-level strategies for managing climate change impacts…." LCCs were also identified in the USFWS's Draft Strategic Plan for Responding to Accelerating Climate Change. LCCS are designed to be resource management science partnerships. They will acquire science to help inform on-the-ground implementation of landscape scale conservation actions. LCCs will also work together across the landscape as a seamless network.

LCCs are designed to further collaborative approaches, to eliminate duplication, to collaboratively address climate change and other impacts to resources, and to achieve gains for landscape scale conservation. Discussions within the Appalachian Region have been held with interested Federal agencies, state agencies and organized partnerships such as Joint Ventures and Fish Habitat Partnerships. A workshop will be held soon to bring partners together to discuss how to organize an Appalachian LCC partnership, how to develop a governance structure, identify key high-priority science needs, and key communication needs.

Monitoring Climate Change Effects on Ridge Ecotones of the Appalachian Trail

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Global climate change is expected to affect forest ecosystems in the U.S. In the eastern U.S. the Appalachian Trail (AT) runs a northeast to southwest direction through major forest types like spruce-fir, maple-beech-birch, and oak-hickory. Ecotones on forested ridges should provide an early warning of where adjacent forests are likely to be affected later. Ecotones have long been recognized as areas that were affected by changing environmental conditions. Tree lines and changes in forest types due to elevation or latitude can change in location and composition. Test plots in 2010 indicated stratification of ridge ecotones by size would be most amenable to monitoring using Forest Inventory and Analyses phase 3 (P3) fixed-area plots. These plots are composed of 4-subplots that best describe adjacent forests and ridge ecotones that are 50 to 100 feet wide and adjacent forests found on 20 to 70 percent slopes. Ridge ecotones are highly vulnerable to change in species composition and abundance (temporal ecotones) compared to tree line and other border ecotones (spatial ecotones). Test P3 plots revealed different species compositions on the ridge ecotones compared with forests on adjacent slopes. We propose that a tandem pair of P3 plots be established at each sampling point on the AT: one to address the general condition of forests along the AT; and one to evaluate initial climate change effects on ridge ecotones. This monitoring system is part of a larger AT project involving NASA, University of Rhode Island, NPS, USGS, ATC, and others.

How Organizations Posted on the NBII-SAIN Best Sustainability Practices Website are Addressing Climate Change

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There are currently 80 examples of Best Sustainability Practices in Southern Appalachia posted on the subject web site which is hot linked on the SAMAB home page: http://www.nbii.gov/portal/server.pt/community/best_sustainability_practices/1388 as well as 20 consultative organizations associated with this topic. There are 43 key words for searching for specific topics on the web site. Needless to say there is a wide diversity of activities included among these forward thinking leaders on the landscape. They will all be queried as to whether or not they have incorporated any climate change dimension to their programs and/or services. And for those that have taken such action, we will invite them to describe their actions, how they have been utilized, and request that they update their information posted on the subject website. The responses to that inquiry will be reported in the presentation at the SAMAB 2010 Fall Conference.

Session: Communicating Climate Change

November 18, 2010; 8:30 – 10:00 a.m.
(Dogwood II)

Session Moderator:
Judy Francis, North Carolina Department of Environment and Natural Resources

PANEL:
Communicating Climate Change in an Uncertain and Pre-Occupied World

Moderator and Panelist: **Judy Francis**
AICP, North Carolina Department of Environment & Natural Resources; 2090 U.S. Highway 70, Swannanoa, NC 28778; (828)-296-4523; Judy.Francis@ncdenr.gov

Judy Francis, AICP, has a BA Political Science, a BS Plant Ecology, and a MA Environmental Policy and Public Administration, all from Colorado State University. She has been involved in planning activities in Florida, Colorado, and North Carolina as a designer, planner, county planning director, and currently serves as the western field officer for the NC Department of Environment & Natural Resources Office of Conservation Planning and Community Affairs. In that capacity, she establishes partnerships between federal, state, and local governments as well as property owners to identify and preserve significant natural areas. Most of these projects have involved lands of state and national environmental significance. She is the Chair-Elect of the National Association of County Planners (an affiliate of NACo), is Vice-Chair of the County Planning Division of the American Planning Association (APA), serves on the Executive Board of the North Carolina Chapter of APA, and is a member of the American Institute of Certified Planners. She also serves on the Pigeon River Fund Board of Directors and is Vice –Chair of the Southern Appalachia Man & the Biosphere inter-agency collaborative. She is an adjunct faculty member in the Environmental Studies Department at Warren Wilson College where she teaches an upper-division class about land use planning techniques, the responsibilities of citizenship, and the role of democracy in the planning process. Judy lives in Morganton and is a quilter, a frequent backpacker, and a devoted flyfisher.

Panelist: **Scott Shuford**

AICP, Onslow County Planning & Development; 604 College Street, Jacksonville, NC 28540; (910)-989-3085; Scott_shuford@onslowcountync.gov

Scott Shuford, AICP, is the Planning and Development Director for Onslow County, NC. He is a plural graduate from the University of North Carolina Chapel Hill with both Bachelor of Arts (1978) and Master of Regional Planning (1981) degrees. His extensive local government planning experience in North Carolina and Florida attracted the attention of the University of North Carolina Asheville and NOAA's National Climatic Data Center for whom he wrote a handbook on climate change for professional planners. Much of the handbook is incorporated in a 2010 Planning Advisory Service report titled *Planning for a New Energy and Climate Future* published by the American Planning Association. Mr. Shuford is a frequent speaker on climate change, sustainability and smart growth, including presentations at the 2008, 2009 and 2010 American Planning Association National Conferences, the 2010 Interagency Leadership Team Climate Change Adaptation Workshop, the 2010 EPA Region 4 Climate Change Adaptation Workshop, the 2009 NC Association of County Commissioners Annual Conference, the 2009 NCAPA Annual Conference, and the 2008 Rocky Mountain Land Use Institute Annual Conference. He is a member of the American Institute of Certified Planners and serves on the Southeast Regional Climate Center's Technical Advisory Committee.

Panelist: **Tim Owen**

NOAA's National Climatic Data Center; Federal Building, 151 Patton Avenue, Asheville, NC 28801; (828)-271-4358; Tim.Owen@noaa.gov

Tim Owen is Deputy Chief of the Climate Services Division at the National Oceanic and Atmospheric Administration's National Climatic Data Center (NOAA/NCDC). Mr. Owen has worked on a variety of projects at NCDC, including climate data validation, urban heat-island research, climate normals generation, climate applications using GIS, assessment of socioeconomic information, and the start of drought.gov - the web portal of the National Integrated Drought Information System. He holds graduate degrees from Penn State (M.S., Meteorology, 1995) and UNC Chapel Hill (M.R.P., City and Regional Planning, 2000), where he respectively conducted research on remotely-sensed urban morphology and viewshed-based environmental planning and hazards mitigation. In recent years, he has served as NCDC's National Partnership Liaison and Executive Officer. He has published over a dozen peer-reviewed articles, and has provided input to both the 2007 IPCC and 2009 Climate Change Impacts reports. Mr. Owen maintains an active research interest in climate adaptation issues at the local, state, and regional level.

Panelist: **Jim Fox**

National Environmental Modeling & Analysis Center; UNC-Asheville, One University Heights, Robinson Hall, CPO #2345, Asheville, NC 28804; 828-250-3890; jfox@unca.edu

James (Jim) Fox is the Director of UNC Asheville's National Environmental Modeling and Analysis Center. In that position, he serves as the team leader and principal investigator for several major collaborations that deal with utilizing large environmental databases, spatial visualizations and other high end technologies to create products for

decision making in complex situations. One project is in partnership with the U.S. Forest Service Eastern Forest Environmental Threat Analysis Center and addresses threats to our nation's forests. A second project is a partnership with NOAA's National Climatic Data Center that focuses on climate literacy education and providing data at a local scale for decision makers across a variety of sectors. A third project is the local engagement site for RENCI, the Renaissance Computing Institute for North Carolina. The center uses 3D visualizations, web tools and decision support tools to address climate change related issues that include flood mitigation, water resources and future land use planning. Mr. Fox holds undergraduate degrees in Geology/Geophysics and Communications and a Masters Degree in Information Technology for Informal Education. He spent 25 years working in the oil exploration business, a job which took him all over the world. He sold his successful oil exploration company in 2001 to return home to North Carolina. His passion is utilizing community collaborations and computer technologies to aid in complex decision making. Over the years, he has designed and taught many workshops with a foundation in hands-on learning through application of tools to real life problems. In addition, he has designed and installed exhibits at a collection of museums and National Parks nationwide.

Panelist: **Linda Giltz**
AICP, Land-of-Sky Regional Council; (828)-251-6622 (main) or 251-7453 (direct), linda@landofsky.org

In her role as regional planner for Land-of-Sky Regional Council, Linda Giltz addresses land use, transportation, and growth management issues. She has worked to bring together local leaders to address issues surrounding regional growth, especially with regard to the I-26 corridor. She has also worked on a project to identify and plan for alternative modes of transportation and for connections between the region's existing modes of transportation. Giltz received her undergraduate degree in computer science from Duke University and a master's degree in geography from UNC Charlotte, focusing on urban and rural planning.

Presentations:

Western Field Officer for the NC Department of Environment & Natural Resources Office of Conservation and Community Affairs *Judy Francis* will describe some of the communications challenges planners face in addressing climate change and discuss amendments to the American Planning Association's Climate Change Policy that she initiated.

NOAA's National Climatic Data Center Deputy Chief of the Climate Services Division and contributor to the Nobel Prize-winning IPCC Fourth Assessment Report *Tim Owen* will discuss a critical climate change communication resource, Global Climate Change Impacts in the United States produced by the U.S. Global Change Research Program (2009). Written for a non-scientific audience, this book provides a clear, practical assessment of climate change impacts facing the U.S. as a whole and by region.

National Environmental Modeling and Analysis Center Director *James Fox* will provide practical guidance on communicating and managing climate change issues over extended periods of time using real-life examples from western North Carolina. The audience will be introduced to tools such as impact visualization, scenario development, dealing with multiple stakeholder values, and online input and data management.

Onslow County Planning and Development Director and co-author of APA PAS Report 558 *Planning for a New Energy and Climate Future* (February 2010) *Scott Shuford* will address climate change communication case studies from his work with APA and NOAA, provide additional APA resources for planners interested in climate change issues, and conclude the session with a tongue-in-cheek presentation entitled "Cigarettes and Sea-Level Rise."

Linking Lands and Communities – Climate Adaptation with Resilient Ecosystems
Linda Giltz

Linking Lands and Communities is a regional project that has brought together the best available scientific data with a large and diverse group of experts and leaders from around the four-county Land-of-Sky Region* to develop a "green infrastructure" network to guide conservation and development efforts. The network and corresponding resource assessments identify the most valuable lands for water quality, agriculture and wildlife habitat and biodiversity. The Regional Network identifies hubs and corridors connecting the hubs, where it is most important to preserve existing habitats, biodiversity and ecosystems. The project has developed a set of maps, data layers, implementation tools and documentation that will help local governments, developers, land trusts and landowners make more informed land use and development decisions and plans.

In discussing climate change and adaptation, project partners realized that the more resilient our ecosystems are, the better they will be able to adapt to both natural and man-made changes (flooding, drought, fire, climate change, etc.). Several factors built into the Linking Lands green infrastructure network design tend to favor ecosystem resilience: (1) hubs, with a minimum size of 100 acres, provide large areas of interior forest; (2) corridors contain lands of high ecological value and allow for movement of species as conditions change; (3) corridors generally do not pass through urban areas, minimizing the spread of invasive species outward from urban areas. Thus, as the network is implemented over time, the resilience of these ecosystems should increase.

I will share the data, process and methodology, network design and resulting maps as part of the presentation. More information on the project available at: www.linkinglands.org.

** The Land-of-Sky Region contains Buncombe, Madison, Henderson and Transylvania counties in Western North Carolina.*

Discussion period
This is a question-answer period with members of the panel and/or other experts.

Plenary Collaborative Session

Science to Action: Your Input, Continuing the Discussion Collaborating On the Next Steps

November 18, 2010; 10:15-11:45 a.m.
(Dogwood I & II)

Session Facilitator:
Alice Cohen, U.S. Forest Service, National Forests in North Carolina

In this session, all conference participants are invited to address the theme of translating climate change science into action. Participants will offer their agency/organization's perspective, expertise and available tools to address the topic.

The conference concurrent sessions and panels of the previous days will feed directly into this collaborative plenary session. We will synthesize the information and identify the gaps in accomplishing the goal of taking action on climate change. Most significant will be your broad perspectives, diverse experience and varied roles in addressing climate change.

SAMAB is committed to guiding the process through the coming year, coordinating actions identified during this final session of the conference. Your participation will help shape the role of SAMAB during the coming year.

Alice Cohen, Public Affairs Specialist
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Field Trip

Thursday, November 18th, 2010; 1:00 – 5:00 p.m.
(Meet in Hotel Lobby)

Great Smoky Mountains National Park

Susan Sachs

Visit the new Twin Creeks Science Center, located just outside of Gatlinburg in Great Smoky Mountains National Park. This facility is certified at the Gold level under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system. During our tour, you will learn about the direction of climate change research in the Smokies, tour the Science Center including the Art Stupka Collections Facility and meet with Keith Langdon, Inventory and Monitoring Coordinator in the Smokies. We will also head outside with Education staff in the park to collect data in an educational phenology monitoring study area and will discuss the role of citizen science in assisting with gathering valuable data for the park.

This field trip will last approximately 3.5 hours. Please dress in comfortable clothing appropriate for the weather as we will be outside half of the time. Meet in the hotel lobby to carpool to the center at 1:00. Transportation on own; carpooling encouraged.

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