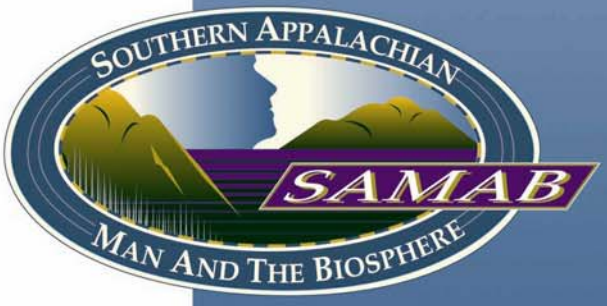
18th Annual SAMAB Conference

Rising to the Challenges of a New Century



October 22-24, 2007

Carnegie Hotel,
Johnson City, Tennessee

Rising to the Challenges of a New Century

18th Annual SAMAB Conference
October 22-24, 2007
Johnson City, Tennessee – Carnegie Hotel

Agenda Overview

Monday October 22, 2007			
11:00 a.m.	Registration opens **(Lower Lobby)**		
1:00 p.m.	Welcome and introductions, Gary Peeples **Plenary Address, Rex Boner**, The Conservation Fund (Director, Southeast Regional Office), *Effective Land Conservation in the 21st Century* **(Grand Soldiers Ballroom)**		
1:50 p.m.	Break		
2:00 p.m.	**A Summit on the Summits** **(Alfred Taylor room)**	**Southern Appalachian Cooperative Ecosystem Studies Unit: Featured Research** **(Century room)**	**Invasives Management and Treatment Options that Work** **(Robert Taylor room)**
3:30 p.m.	Break with refreshments		
3:45 p.m.	**A Summit on the Summits** (cont'd)	**Southern Appalachian Cooperative Ecosystem Studies Unit: Featured Research** (cont'd)	**Invasives Management and Treatment Options that Work** (cont'd)
6:00 p.m.	**Poster Session** with hors d'oeuvres and cash bar (**Lower Lobby**)		
Tuesday, October 23, 2007			
7:45 a.m.	Registration and breakfast **(Lower Lobby)**		
8:30 a.m.	**A Summit on the Summits** (cont'd) **(Alfred Taylor room)**	**Our Land, Our Tomorrow** **(Century room)**	**Workshop: Prevention and Early Detection of Invasives** **(Robert Taylor room)**
9:30 a.m.	**A Summit on the Summits** (cont'd)		
10:00 a.m.		Break	Break
10:30 a.m.	Break	**Our Land, Our Tomorrow** (cont'd)	**Workshop: Prevention and Early Detection of Invasives** (cont'd)
11:00 a.m.	**A Summit on the Summits** (cont'd)		
12:00 p.m.	Luncheon meeting of the Roan Mountain Stewardship Committee (lunch by registration only)	Lunch on your own. See registration area for walking-tour information and directions to ETSU museums	
12:30 p.m.			Lunch on your own.
1:30 p.m.	**A Summit on the Summits** (cont'd)	**Our Land, Our Tomorrow** (cont'd)	**Workshop: Prevention and Early Detection of Invasives** (cont'd)
3:00 p.m.	Break		
3:30 p.m.	**A Summit on the Summits** (cont'd)	**Our Land, Our Tomorrow** (cont'd)	Break
			Workshop: Prevention and Early Detection of Invasives (cont'd)
6:30 p.m.	**Evening Social** at Appalachian Farmhouse and Gallery Entertainment by Ted Olson, presenting folks songs that reflect our attitudes toward the environment in Appalachia, and Jerry Vencill, storyteller		

Wednesday, October 24, 2007			
8:30 a.m.	Roan Mountain field trip **(depart from Lower Lobby)**	**Improving Passage and Habitat Conditions for Fish** **(Alfred Taylor room)**	**Workshop: Prevention and Early Detection of Invasives** (cont'd) **(Robert Taylor room)**
10:00 a.m.		Break	
10:30 a.m.		**Stream Flow Needs for Ecological Health** **(Alfred Taylor room)**	**Workshop: Prevention and Early Detection of Invasives** (cont'd) workshop adjourns at 12:30 p.m.
12:00 p.m.	Sack lunch (by registration)	Lunch on your own. See registration area for walking-tour information and directions to ETSU museums	
1:15	Field trip cont'd	**Stream Restoration** **(Alfred Taylor room)**	**Gray Fossil Site field trip** **(depart from Lower Lobby)**
4:00	Conference activities end at 4:00 p.m.		

18th Annual SAMAB Fall Conference

Rising to the Challenges of a New Century

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October 22-24, 2007
Carnegie Hotel, Johnson City, Tennessee

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1:00 p.m.	Welcome and introductions, Gary Peeples **Plenary Address, Rex Boner**, The Conservation Fund (Vice President for Southeast Region), *Effective Land Conservation in the 21st Century* **(Grand Soldiers Ballroom)**		
2:00 p.m.	**A Summit on the Summits** **(Alfred Taylor room)** Moderator: Carolyn Wells, US Fish & Wildlife Service 2:00 Peter Weigl and Travis Knowles, *Temperate montane grasslands and keystone herbivores: More than just Appalachian grass balds* 2:30 Christopher J. Ulrey et al., *Demography and conservation of two high-elevation southern Appalachian endemic plants,* Geum radiatum *and* Liatris helleri 3:00 Chris Kelly, *Recovery efforts for the endangered Carolina northern flying squirrel: using ecological and population data to guide habitat restoration for the squirrel and other priority high elevation species*	**Southern Appalachian Cooperative Ecosystem Studies Unit: Featured Research** **(Century room)** Moderator: Ray Albright, NPS, Southern Appalachian CESU 2:00 Ray Albright, *What is the Southern Appalachian CESU?* 2:30 Kandace Hollenbach, et al., *Assessing archaeological sites and the preservation of microbotonaical remains: Recent CESU/NPS archaeology at the University of Tennessee* 3:00 Steve Lawson and Nathan Reigner, *Understanding visitor experience and impact at Haleakala and Yosemite National Parks: Virginia Tech and the Southern Appalachian CESU*	**Invasives Management and Treatment Options that Work** **(Robert Taylor room)** Moderator: Anita Rose, USDA Forest Service 2:00 Ken Stolte et al., *Developing risk models for exotic plant species in National Forests of the Southern Appalachian Mountains* 2:30 Andy Brown, Gary Kauffman and Lindsay Majer, *Multi-Agency interface exchange: Federal, state, and non-profit organizations join forces in invasive plant management* 3:00 Lindsay Majer, Julie Judkins and Bob Gale, *Power of partnerships: Collaborative efforts in invasive plant management*
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	Katherine Elliot, et al., *Fire in the southern Appalachians: Restoration of pine/hardwood ecosystems* Richard Foster, *Diagnosis of conditions crucial to* Phalaris arundinacea *invasion of a wetland* K.E. Franzreb, et al., *Mercury contaminating high elevation songbirds in Great Smoky Mountains National Park* Elana Gulas, et al., *Promoting sustainability at ETSU: Changing a university's carbon culture* Qinfeng Guo, *Species invasiveness and habitat invisibility: Research updates* Patricia Hamlett and Donald Malone, *Planning BMPs for stream restoration: Get the most bang for your buck* Shelaine Curd Hetrick, et al., *How can NBII's Geospatial Interoperability Framework help you visualize information?* Hugh Irwin and Sara Dibacco, *Identifying natural barriers for brook trout reintroduction in mountain streams of the Southern Appalachians* Jennifer Knoepp, et al., *Eastern hemlock forest in the southern Appalachians: Vegetation and Soil Characteristics* Travis Knowles and Peter Weigl, *Ghosts of elephants past? Remnant grassland ecosystems and Pleistocene keystone herbivores* Timothy Kuhman, *Land-use legacies and invasive exotic plants in a southern Appalachian forest* Dalenia Medford, *The Detection of Morphological Variation Across Time in Two Roan Mountain Endemics:* Geum radiatum *and* Houstonia montana Chris Morris, et al., *Stream flow monitoring in tributaries of the Little River, Tennessee* Nora Murdock, et al., *Biological inventories by the Appalachian Highlands Network Inventory and Monitoring Program, National Park Service* John Peine, et al., *The Appalachian Trail MEGA-Transect: telling the story of the environmental health of the Appalachian Mountains to visitors, neighbors and the world* Anita Rose, *Current status and mortality rate of hemlock in the Southeastern United States* Nora Schubert and Judy Murray, *History of grassy balds management on the Roan Mountain Massif* Peter Stone, *Intrinsic vulnerability to contamination of wells and springs in the mountains and adjacent piedmont, South Carolina*

Tuesday, October 23, 2007			
7:45 a.m.	Registration and breakfast **(Lower Lobby)**		
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9:30	Moderator: Terry Seyden Panel: *The role of the organizations with a stake in the management of high elevation communities—Their priorities and limitations*	9:30 George Ivey, *Protecting the best of Bethel*	
10:00		Break	Break

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10:30 Charles Bargeron, SE-EPPC early detection & distribution mapping System (EDDMapS)—a mapping tool to identify where known invasive plant threats are relative to your managed area and to report new sitings</td></tr>
<tr><td>11:00 a.m.</td><td>A Summit on the Summits (cont'd)
(Alfred Taylor room)

Facilitated session. Gary Peeples, facilitator. Identifying management priorities that stakeholders collectively agree to work toward</td></tr>
<tr><td>12:00 p.m.</td><td rowspan="2">Luncheon meeting of the Roan Mountain Stewardship Committee (lunch by registration only) (Alfred Taylor room)</td><td rowspan="2">Lunch on your own. See registration area for walking-tour information & directions to ETSU museums</td></tr>
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2:00 Dave Ramsey and Rex Boner, A conservation partnership to protect Rocky Fork
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2:00 Dave Moorhead, Invasive plant responses to silvicultural practices in the South – What to do if you're disturbing the soil</td></tr>
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Tuesday, October 23, 2007, continued			
3:30 p.m.	**A Summit on the Summits (cont'd)** **(Alfred Taylor room)**	**Our Land, Our Tomorrow** (cont'd) **(Century room)**	Break
4:00 p.m.	4:00 Facilitated session. John Peine, facilitator. *Collaborative data objectives for resource management and/or science, collection and documentation standardization, archiving and sharing via restricted NBII website*	3:30 Lisa Huff, et al., *Farming for bio-diversity? A case study of conservation management at Hampton Creek Cove State Natural Area* 4:00 Jerry S. Olson, et al., *Sustainable biomass supply, demand, and landscape resources—To be used well, degraded, or invaded?* 4:30 Elana Gulas, et al., *Promoting sustainability at ETSU: Changing a university's carbon culture*	**Workshop: Prevention and Early Detection of Invasives (cont'd)** **(Robert Taylor room)** 4:00 *Using contracting to minimize invasives introductions*
6:30 p.m.	**Evening Social** at Appalachian Farmhouse and Gallery With entertainment by Ted Olson, presenting folks songs that reflect our attitudes toward the environment in Appalachia, and Jerry Vencill, storyteller		
Wednesday, October 24, 2007			
7:45 a.m.	Registration and light continental breakfast **(Lower Lobby)**		
8:30 a.m.	**A Summit on the Summits (cont'd)** Roan Mountain field trip (depart from hotel's lower lobby)	**Improving Passage and Habitat Conditions for Fish** **(Alfred Taylor room)** 8:30 Anita Laraine Goetz and Andrea Jo Leslie, *Assessment of barriers to aquatic organism passage in the Little Tennessee River Watershed* 9:00 Bart Carter, et al., *Utilizing an engineered waterfall to correct stream flow and protect a restored southern Appalachian brook trout population* 9:30 Hugh Irwin and Sara Dibacco, *Identifying natural barriers for brook trout reintroduction in mountain streams of the southern Appalachians*	**Workshop: Prevention and Early Detection of Invasives (cont'd)** **(Robert Taylor room)** 8:30 Alix Cleveland, *Overview of the USDA Forest Service's (SE region) program status, progress, and emphasis* 9:00 Richard Schwab, *An overview of the interagency Burned Area Emergency Rehabilitation (BAER) program and opportunities for prevention and early detection* 9:45 Rita Beard, *NPS prevention measures and how they can work for your protected areas*
10:00 a.m.		Break	

Wednesday, October 24, 2007, continued			
10:30 a.m.		**Stream Flow Needs for Ecological Health** **(Alfred Taylor room)** 10:30 R.W. Gentry, *Using watershed signals as a means of evaluating sustainability and climate variability for natural resources* 11:00 Carol Harden, et al., *Longitudinal flow comparisons for six tributaries of the Little River* 11:30 W. Brian Hughes, et al., *Water availability for ecological needs in the upper Flint River Basin, Georgia—A USGS science thrust project*	Break
11:00 a.m.			**Workshop: Prevention and Early Detection of Invasives (cont'd)** **(Robert Taylor room)** 11:00 Dave Moorhead, facilitator, *Applying these tools at home: A hands-on exercise to identify situation-specific strategies for prevention and early detection*
12:00 p.m.	Sack lunch on Roan Mountain (by registration)	Lunch on your own.	
12:30 p.m.			Lunch on your own
1:15 p.m.	Field activities cont'd	**Stream Restoration** Moderator: Jenny Adkins, Natural Resources Conservation Service, TN 1:15 Mike Adams, *Restoration of Wallens Bend Creek and bank stabilization along the Clinch River to reduce sediment near threatened mussel shoals* 1:45 Greg Babbit, *An overview of stream restoration design and construction approaches in the southern Appalachians of Tennessee* 2:15 Andrew Bick, *Third Creek restoration project, Knoxville, Tennessee* 2:45 Adam Griffith, *The Rivercane (*Arundinaria gigantea*) Restoration Project: Protecting a resource through scientific investigation and community education*	Please join your colleagues in the stream restoration session.

ACKNOWLEDGMENTS

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

USDA Natural Resources Conservation Service, Tennessee
NPS Southeastern Exotic Pest Plant Management Team
SAMAB Foundation and SAMAB Cooperative

18th Annual SAMAB Conference Planning Committee

Gary Peeples, Conference Chairperson, U.S. Fish & Wildlife Service
Jenny Adkins, USDA Natural Resources Conservation Service, Tennessee
Ray Albright, Southern Appalachian CESU
Barry Clinton, USDA Forest Service, Southern Research Station
Judy Francis, North Carolina Department of Environment and Natural Resources
Zoe Hoyle, USDA Forest Service, Southern Research Station
Sherry Redus, SAMAB Coordinating Office
Anita Rose, USDA Forest Service, Forest Inventory and Analysis
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Terry Seyden, USDA Forest Service
Jim Smoot, USGS

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Judy Murray, Southern Appalachian Highlands Conservancy
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John Peine, USGS Southern Appalachian Field Station
Terry Seyden, USDA Forest Service, National Forests of North Carolina
Curtis Smalling, Audubon – North Carolina
Chris Ulrey, NPS Blue Ridge Parkway
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Nancy Fraley, NPS Southeast Exotic Pest Plant Management Team
Susan Schexnayder, SAMAB

SAMAB leadership team

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Rick Durbrow, EPA Region 4; SAMAB Executive Committee Vice-Chairperson
Charles Van Sickle, SAMAB Foundation President

18th Annual SAMAB Conference

Rising to the Challenges of a New Century

ABSTRACTS

(organized by session, in order of occurrence)

Keynote Address

Effective Land Conservation in the 21st Century

October 22, 2007, 1:00 p.m. (Grand Soldiers Ballroom)

Rex Boner
The Conservation Fund, Southeast Region

A Summit on the Summits

October 22, 2007, 2:00 p.m. – October 24, 2007, 3:00 p.m. (Alfred Taylor room)

Session Moderators:
Gary Peeples, US Fish & Wildlife Service
John Peine, USGS Southern Appalachia Field Laboratory
Terry Seyden, USDA Forest Service, National Forests of North Carolina
Carolyn Wells, US Fish & Wildlife Service

Presentations, October 22, 2007

Temperate montane grasslands and keystone herbivores: More than just Appalachian grass balds

Peter D. Weigl†[1] *and Travis W. Knowles*††[2]
[1]*Department of Biology, Wake Forest University*
[2]*Department of Biology, Francis Marion University*

The origin and persistence of the high elevation grass balds of the southern Appalachians have been the subject of such long standing controversy that the preservation of this special community, with its unique array of plants, animals and habitats, is increasingly threatened. Some biologists have largely dismissed the balds as human artifacts, worthy of only limited conservation efforts. In contrast, since 1986, we have argued that many of these communities are natural and ancient. On the basis of information from biogeography, community ecology, regional history, past agricultural practices and paleontology, we have hypothesized that open grasslands and savannahs have a long Pleistocene history in the Southeast. We propose that grass balds were initially created by severe climatic conditions during glaciation, and subsequently were largely maintained by an array of large keystone herbivores, 23 species of which are known for the area; half of these have been found as fossils from sites near the balds. When these mammals died out, bison, elk and deer kept some peaks open, and were replaced by domestic livestock around 1840. Such a hypothesis is consistent with an extensive literature describing the impact of large herbivores on vegetation structure and diversity from many parts of the world.

In 2005, we learned of the existence of the polonina grasslands of the eastern Carapathian Mountains of Poland, Ukraine and Slovakia and visited the region in 2005. These vast "grass balds" occupy unglaciated ridgelines well below tree line and support arrays of rare species and communities similar to those of the Appalachians. They also have a history of similar climatic and herbivore impacts. We would suggest that a climate-animal influence on temperate vegetation may be a more general phenomenon than formerly realized and that maintenance of montane grasslands might be most effectively accomplished with the use of animals.

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††*Department of Biology, McNair Science Building MSB 201-D, Francis Marion University, P. O. Box 100547, Florence SC 29501-0547; tknowles (at) fmarion.edu*

Demography and conservation of two high-elevation southern Appalachian endemic plants, *Geum radiatum* and *Liatris helleri*

Christopher J. Ulrey†, Eric S. Menges, Gary L. Kauffman, Carolyn L. Wells

Geum radiatum and *Liatris helleri* are federally listed plants, each occupy specialized habitats (cliff faces and rock outcrops) over a small range of the southern Appalachians. Since 2003, we have been monitoring demographic responses of these plants, currently from 19 populations, often using ladders or climbing equipment to reach plants. By following fates of marked plants (n > 400 for each species), we have quantified the high survival rates and slow growth of each species. *L. helleri* populations have been fairly stable, with annual survival > 90% and fewer than 60% of plants increasing in size from year to year. *Geum radiatum* survival is even higher (> 95% annually) with plants increasing in size in most years. Flowering occurs commonly in both species. Seedling recruitment is sporadic and low for both species, especially discouraging for *Geum radiatum*, where few seeds recruit and even fewer survive. We are experimenting with prescribed burning and clipping to encourage plant growth and seedling recruitment in *Liatris helleri*. Plant survival is similar in unburned and burned patches but burned plants were more likely to flower. To date, seedling recruitment has not been strongly enhanced by treatments. For both species, we have collected seeds and propagated seedlings for augmentations. Plants were placed into sites during the summer of 2007. We used substrate enhancement to create stable microsites for *Geum* transplants. We continue to work with colleagues from various agencies to implement monitoring of these two imperiled species. Future monitoring will detect whether populations are showing the expected positive responses to our management treatments, and therefore help guide effective management in the future.

† *National Park Service, Blue Ridge Parkway, 199 Hemphill Knob Rd., Asheville, NC 28803. Chris_Ulrey (at) nps.gov*

Recovery efforts for the endangered Carolina northern flying squirrel: Using ecological and population data to guide habitat restoration for the squirrel and other priority high elevation species.

Chris Kelly†, North Carolina Wildlife Resources Commission

The North Carolina Wildlife Action Plan lists 19 species associated with red spruce-Fraser fir forests as conservation priorities. Among these, the Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*) was federally listed as endangered due to shrinking habitat. Northern flying squirrels in NC are isolated to eight mountaintop islands of their remnant boreal forest. Half of the historical red spruce-Fraser fir forest has been lost due to habitat destruction, fragmentation, or alteration associated with clearing of forests, introduced pests, recreational and second home development, and pollution. Restoration of these mountaintop islands has been repeatedly identified as a top conservation priority. However, while much has been done to protect these habitats on public lands, they are still vulnerable on private tracts and little has been done to restore spruce to its former range. A collaborative effort is needed to map and prioritize potential restoration sites, develop a source of red spruce seedlings, evaluate effective site preparation for planting, and coordinate with landowners.

The unique ecology and the recovery efforts undertaken for the flying squirrel may steer opportunities to restore high elevation forest communities. The northern flying squirrel is a nocturnal, gliding rodent uniquely adapted to conditions of severe weather and low quality foods. The squirrel provides a key ecological function in the perpetuation of its forested habitat through its consumption of mycorrhizal fungi and subsequent dispersal of fungal spores, giving greater significance to conservation of this species. In order to identify, protect, and restore habitat, recovery efforts have focused on ecological and population studies. Nest box surveys, trapping, telemetry, and habitat modeling by North Carolina Wildlife Resources Commission and partners have been used to determine squirrel presence or absence in an effort to assess

population dynamics, determine the distribution of habitat across the landscape, document barriers to dispersal, and guide land management decisions. These efforts have in turn helped steer survey, research, and management objectives, including habitat restoration, for other high elevation species listed in the Wildlife Action Plan.
†Mountain Wildlife Diversity Biologist, North Carolina Wildlife Resources Commission, 46 First Street, Asheville, NC 28803; kellych (at) earthlink.net

History of grassy balds management on the Roan Mountain Massif
Nora Schubert† and Judy Murray, Southern Appalachians Highlands Conservancy

Southern Appalachian grassy balds are among the most globally endangered ecological communities, with a G1 ranking. The grassy balds on Roan Mountain are the most extensive and highest quality remaining. These grassy balds are primarily threatened by woody plant invasion and human disturbance. Roan's grassy balds community has undergone significant succession to blackberry shrubs, heath balds, and spruce-fir and northern hardwood forests. Kenney 1999 concluded that the grassy balds on Roan Mountain may have decreased in area by 50% since about 1980. With the loss of Roan's grassy balds community comes the loss of many rare floral and faunal species dependent upon these high-elevation open areas. This presentation will provide an overview of the planned management that has occurred on Roan beginning in the 1980's. The management direction, field methodology, partner roles, and current issues will be highlighted. In general, annual management has primarily consisted of hand-mowing and cutting, large mechanical mower operations, and cattle grazing. Since management began, there are notable successes to point to such as a marked increase in rare plant numbers like Gray's Lily and in general, retention of rock outcrop communities that harbor several rare floral and faunal species. However, some of the primary concerns are that the (1) amount of area managed over the years falls well short of the proposed number of acres, and (2) effects of management warrant increased levels of monitoring. These short-falls accelerate the rate of woody encroachment and spawn loss in biodiversity. In the absence of natural biological and/or historical anthropogenic disturbances, planned management is required to preserve this community and the many high-elevation floral and faunal species therein. Preservation of this endangered community into the future will require commitment and innovation to acquire resources for continued maintenance and expanded management.
†Stewardship Ecologist – Roan Mountain Area; Southern Appalachian Highlands Conservancy; 6 Lynn Terrace Court Johnson City, TN 37604; nora_schubert1 (at) hotmail.com

A preliminary "then and now" look at 70+ years of historic landscape photos from Roan Mountain, NC-TN
James Donaldson[1]†, Charles Warden[1], and Jennifer Bauer[2]
[1] East Tennessee State University
[2] Sycamore Shoals State Historic Area
†tnplanthunter (at) yahoo.com

Effects of prescribed burns on herbaceous vegetation in southern Appalachian forests
Tim McDowell†, Michael Zimmerman, and Foster Levy, Department of Biological Sciences, East Tennessee State University

Prescribed burns have become a common management practice in Southern Appalachian forests, with over 20,000 acres burned each year in the Cherokee National Forest alone. Although the effects of fire have received much study in various ecosystems (e.g. coastal pine forests, midwestern prairie ecosystems), research on prescribed burns has seldom examined impacts on mesic southern Appalachian hardwood forests. We examined the effects of prescribed fire on the herbaceous layer in the Cherokee National Forest of east

Tennessee. Six previously burned sites (two to five years after burns) were compared with six nearby unburned sites of similar physical and vegetational characteristics. Using plots along line-point transects, we censused the number of individuals by species for herbaceous species and for woody plants under one meter in height. There were no significant differences in soil pH or canopy cover between burn and control sites but soil moisture and leaf litter depth were marginally lower on burn sites. For herbaceous species at three of the matched site pairs, there were significantly fewer species and numbers of individuals on burn sites compared to their matched control sites. In contrast, for woody species, there was no clear pattern associated with burn sites because some had significantly higher diversity and abundance while in others these measures were lower compared to control sites. Among the more common herbaceous species, 11 of 13 showed lower abundance on burn sites while one of the two species that was more abundant on burn sites, *Pteridum aquilinum*, is a known fire-adapted species. Species with ant-dispersed seeds were a group whose numbers were markedly lower on burn sites. The negative impact of prescribed burns on species most characteristic of moist hardwood forest should be considered in managing these forests.

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Modeling the breeding habitat distribution of the Appalachian Yellow-bellied Sapsucker in North Carolina

Scott M. Pearson[1]† and John Gerwin[2]
[1]Mars Hill College
[2]North Carolina Museum of Natural Sciences

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

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Panel discussions and facilitated sessions, October 23, 2007

A summit on the summits: Management roles and management priorities, panel and facilitated discussion

Panel moderators: Terry Seyden, USDA Forest Service, National Forests of North Carolina
Gary Peeples, US Fish & Wildlife Service, Asheville Field Office

The management of high-elevation natural communities is the responsibility of a handful of organizations, both public and private, and each of these organizations has their own reasons for being involved in high-elevation community management; their own goals and mandates; their own resources they can commit; and their own constraints and limitations when it comes to managing these lands. There is also a suite of agencies, organizations and individuals interested in the management and conservation of these areas. Like the management organizations, these stakeholders each bring with them their own priorities, resources, and limitations on the degree of involvement. During these panels, we will hear from representatives from many of the organizations involved in high elevation community management to learn more about the roles of the various organizations and gain a better understanding of what they would like to see accomplished, as well as what resources they can offer and what impediments need to be overcome to achieve those goals.

Organizations participating in the panels include USDA Forest Service, National Forests of North Carolina; National Park Service, Blue Ridge Parkway; Southern Appalachian Highlands Conservancy; Grandfather Mountain, U.S. Fish & Wildlife Service, Asheville Field Office; North Carolina Natural Heritage Program; North Carolina Wildlife Resources Commission; Wake Forest University; and Tennessee Division of Natural Areas.

Collaborative data objectives for resource management and science, collection and documentation standardization, archiving and sharing via restricted NBII website.

John Peine[1] and Thomas Burley[2]†
[1]USGS, Southern Appalachian Field Station
[2]University of Tennessee, Institute for a Secure and Sustainable Environment

This session of the Summit on the Summits Workshop will engage in dialogue of how to best facilitate collaboration on data collection for adaptive natural resource management and science and the adoption of standards for data collection, documentation, and custodianship. The Data Management Toolkit, devised for Roan Mountain grassy balds management, provides a methodology based on federal and best practice standards for documentation, planning, and data considerations. Legacy databases on Roan Mountain were documented utilizing the Toolkit procedures resulting in several examples of utility lost from a lack of adequate documentation and information management. The NBII Portal AT Community now includes a project tilted “Information Sharing on Biological Communities in the Appalachian Highlands” to serve as an impetus for collaboration in this context. Announcements include a list of open questions and summary statements are posted on grassy balds, spruce fir forests, and boulder fields. Numerous additional documents of relevance, journal articles, hotlinks to websites, and contact information are posted. Also posted are responses from selected resource managers on the following topics:

1. What are the priority threats to the sustainability of high elevation biological communities?
2. Information on current research and adaptive management activities on grassy and heath balds, spruce-fir forests, northern hardwood forests, and beech gaps.
3. Information on priority research needs to assess effectiveness of adaptive management practices and risk to vulnerable communities/species.
4. What is the degree of sharing of information that goes on related to

adaptive management strategies and their perceived cost and biological effectiveness?

5. Information regarding the current obstacles and needs related to data management, collection, information sharing, as well as potential interest in establishing a collaborative data management strategy.
6. Information regarding the need for high-level managerial support, the adequacy of funding, and ways for overcoming those issues.
7. Their interest in knowing about this type of information for other high-elevation communities and if they would like to share these types of information with other resource managers and scientists via a centrally accessible web tool.

Responses so far are from Grandfather Mountain, Mt Mitchell State Park, Roan Mountain, and Mt. Rogers.

If you aren't currently a member of the AT Community (http://apptrail.nbii.gov) on the NBII Portal or need help with your account, contact the project leads Tom Burley at tburley@utk.edu or John Peine at jpeine@utk.edu and they will assist you with getting an account.

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SOUTHERN APPALACHIAN COOPERATIVE ECOSYSTEM STUDIES UNIT (SA CESU): FEATURED RESEARCH

October 22, 2007, 2:00-5:30 p.m. (Century room)
Session Moderator: Ray Albright,
National Park Service, SA-CESU

What is the Southern Appalachian CESU?
Ray Albright†, National Park Service, SA-CESU, Tennessee Valley Authority

This session will highlight the Southern Appalachian Cooperative Ecosystems Study Unit (SA-CESU). The SA-CESU is network of federal and private sector partners that joined together in 1999 with a mutual mission to provide usable knowledge in cultural, social, and natural resources to federal land management, environmental and research agencies in the Southern Appalachian mountain region. SAMAB is one of the partners within the SA-CESU.

This session will be a series of presentations about SA-CESU projects and the SA-CESU program. The first session will be primarily focused at what the SA-CESU is all about. The final session will be a business meeting format. Sessions in-between will be about SA-CESU projects. All the sessions are open to everyone. The SA-CESU is also found at http://cesu.utk.edu .

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Assessing Archaeological Sites and the Preservation of Microbotanical Remains: Recent CESU/NPS Archaeology at the University of Tennessee
Kandace D. Hollenbach[1], Michael G. Angst[1], Jessie Duncan[1], Gail L. Guymon[1], Scott C. Meeks[2], Susan C. Mulholland[3], Sally Horn[4], and Sarah C. Sherwood[1]
[1] Archaeological Research Laboratory, University of Tennessee-Knoxville
[2] Department of Anthropology, University of Tennessee-Knoxville
[3] Archaeometry Laboratory, University of Minnesota-Duluth
[4] Department of Geography, University of Tennessee-Knoxville

The CESU cooperative agreement allows the Archaeological Research Laboratory at The University of Tennessee to readily collaborate with the National Park Service. Recently, this has included condition assessments of 535 of the 1300-odd archaeological sites located within Big South Fork National River and Recreation Area; Phase I archaeological surveys at the Tremont Institute and Oconaluftee Visitor Center in the Great Smoky Mountains National Park; and a feasibility analyses to determine whether historic deposits of pollen grains and phytoliths could be recovered to reconstruct the gardens and crops grown during the antebellum occupation of the Melrose estate at the Natchez National Historic Park.

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Understanding Visitor Experience & Impact at Haleakala & Yosemite National Parks: Virginia Tech & the Southern Appalachian CESU.

Steve Lawson and Nathan Reigner†
Department of Forestry, Virginia Tech

Through the Southern Appalachian CESU, faculty and graduate students in the Department of Forestry at Virginia Tech apply diverse methods to understanding visitor experiences and impacts in Haleakala and Yosemite National Parks. As part of Haleakala National Park's commercial services and air tour management planning, researchers are examining the efficacy of persuasive messaging to influence visitor behavior, the effects of helicopter-based scenic air tours on the park's soundscape, and public perceptions of recreation-related social and resource impacts in the park. Research in Yosemite uses computer simulation modeling to facilitate adaptive management of transportation within Yosemite Valley. As alternative transportation systems are considered, their effects on visitor experiences at high use recreation sites can be modeled.

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Using Soil and Sediment Charcoal as a Proxy for the Reconstruction of Fire Regimes in Great Smoky Mountains National Park, U.S.A.

Christopher A. Underwood†, Alisa L. Hass, and Sally P. Horn
Department of Geography, University of Tennessee

Disturbances created by forest fires are garnering increased attention. To better understand the natural fire regime of a forest, we can use proxy records to determine when and how often these forested communities have burned in the past. Currently, the most common type of proxy used in studies of forest fire history is a fire-scarred wood sample from a tree that produces annual rings. Using techniques of dendrochronology, these fire-scarred samples allow detailed reconstructions of the spatial extent and chronology of past fires, including the exact years in which fires occurred. However, such analyses can produce forest fire histories that extend back in time only as far as the tree rings themselves. To document still earlier fires requires a different proxy. Charcoal fragments that persist in soils and sediments provide evidence of past fire that can complement and extend dendrochronological records, while potentially also providing information on vegetation and climate history. This presentation focuses on the abundance, distribution, age, and type of macroscopic charcoal in soils and sediments of Great Smoky Mountains National Park. The soil samples were obtained in 10-cm depth increments from plots established for companion studies of dendrochronological evidence of fire history. The samples were then sieved with a 2 mm mesh screen, and macroscopic soil charcoal fragments were extracted under magnification. Charcoal fragments from the sediments of Gum Swamp in Cades Cove were examined at contiguous 1-cm intervals in profiles recovered with a piston sediment corer. Radiocarbon analyses indicate that much of the charcoal in soils and sediments of Great Smoky Mountains National Park was produced in fires that occurred long before the current forest stands were established. Taxonomic identification of soil charcoal and analysis of pollen grains in sediments may provide evidence for relating long-term fire history to stand composition.

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Southern Appalachian CESU Annual Meeting

Kay Franzreb, SA-CESU Chairperson, USDA-Forest Service

This session will be a short annual business meeting for the Southern Appalachian CESU. Everyone is welcome to attend. The matters of old business and new business will be discussed. Relevant information will be shared. This session will probably extend past the allotted time, but will conclude well in advance of the conference evening events.

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INVASIVES MANAGEMENT AND TREATMENT OPTIONS THAT WORK

October 22, 2007; 2:00-4:45 p.m. (Robert Taylor room)
Moderator: Anita Rose,
USDA Forest Service, Forest Inventory and Analysis

Developing risk models for exotic plant species in National Forests of the Southern Appalachian Mountains

Kenneth W. Stolte[1]†, Andrew Brown[2]††, Lindsay Majer[2], and Sarah Marcinko[2]
[1]USDA Forest Service, Forestry Sciences Laboratory
[2]Equinox Environmental Consultation and Design

Exotic invasive plant species are often introduced on right-of-ways (called Level 1 invasions) in or near National Forest lands. We evaluated whether Level 1 exotic species were subsequently able to move into forest interiors (Level 2 invasion), and whether any biotic or abiotic factors were associated with abundance of each exotic species. The goal is to develop risk models for interior forested areas in the Pisgah, Nantahala, Cherokee, and Jefferson National Forests in the Southern Appalachian Mountains so existing exotic species can be located for eradication and new invasions prevented where possible. Level 1 surveys conducted in 2003 to 2004 found 719 separate introductions of 1 or more of the 12 target species (based on literature and consultations with NFS managers) on roughly 35 miles of trails, roads, and waterways were found—8 of these exotic species were relatively abundant in L1 surveys. Stratified-random Level 2 surveys based on the ecological characteristics (primarily reproductive and habitat preferences) of the L1 exotic species were initiated from areas with abundant L1 sites. Detailed data on physical site characteristics, forest composition and structure, forest floor and soils, and microsites were obtained to explore any consistent habitat characteristics associated with abundance of exotic species. The L2 surveys revealed that Japanese Honeysuckle, Japanese Stiltgrass, Multiflora Rose, and Tree of Heaven were the most frequently encountered species that had invaded forest interiors using streams, canopy gaps, burn areas, and other venues. However, L2 exotic species were not nearly as extensive as exotic species in L1 surveys along roadsides and trails—only 64 establishments of one or more of the 12 target species were identified in the 17 miles of L2 surveys conducted in 2005 to 2006. The occurrence of exotic plant species in forest interiors were often linked to historic forest disturbance, especially in proximity of existing or abandoned roads and trails, some of which predated the formation of the National Forests. About 66% of other exotic species in forest interiors were correlated with canopy gaps. Distinctive habitat preferences were found for some of the L2 exotic species. The highest numbers of Tree of Heaven stems were found on L2 sites with < 2 inches litter-plus-duff cover on southwest aspects around 1700 feet. Alternately, the highest total cover of Japanese Honeysuckle was found on L2 sites with > 5 inches litter-plus-duff cover on northwest aspects around 1500 feet elevation. Level 2 surveys will continue in 2007 and 2008, and FIA and FHM fixed-area Phase 3 plots have been established at some L2 sites to determine the short and long-term effects of exotic plant species on native forest ecosystems.

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Multi-Agency Interface Exchange: Federal, State, and Non-profit Organizations Join Forces in Invasive Plant Management

Andy Brown†[1] Gary Kauffman,[2] and Lindsay Majer[1]
[1]Equinox Environmental Consultation and Design
[2]USDA Forest Service, National Forests of North Carolina

Plants do not follow geographic boundaries and neither should invasive exotic plant management. It is known that invasive plant infestations are abundant at crossroads and intersections of trails and roads, but when it comes to management it often seems that these areas are in no-mans-land. In this unique exchange, National Forests in North Carolina, a federal entity, the North Carolina Department of Transportation, a state entity, and the Appalachian Trail Conservancy, a non-profit organization are crossing district boundaries to address invasive plant management. Multi-agency involvement is key in the effectiveness of management and when organizations join forces, the positive impact is substantial.

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Power of Partnerships: Collaborative Efforts in Invasive Plant Management

Lindsay Majer†,[1] Julie Judkins,[2] and Bob Gale[3]
[1]Equinox Environmental Consultation and Design
[2]Appalachian Trail Conservancy
[3]Western North Carolina Alliance

Invasive Exotic Plant management is an ever evolving practice and so are the partnerships that implement management. SAMAB has been coordinating efforts to identify, monitor, and control invasive plant infestations since 2002. Now in its 5th year, a multi organizational partnership has formed and has greatly enhanced management effectiveness. Funded in part by the National Forest Foundation, SAMAB joins the Appalachian Trail Conservancy (ATC), the Western North Carolina Alliance (WNCA), National Forests in North Carolina, the NC Department of Transportation (NCDOT), and volunteers to eradicate invasive plants on public lands in Hot Springs, NC.

From planning meetings to on the ground control, the process is multifaceted and dynamic as goals and objectives from all organizations are met. There were successes and there were disappointments, but lessons were learned. Most importantly, the exponential effectiveness of the power of partnerships was realized and will serve as an example for future management collaborations.

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Microscale analysis of the distribution of hemlock wooly adelgid in newly colonized and heavily infested forests

F*oster Levy†[1], Jordan Baker[1], Ke Chen[2], Graham Cooke[1], Chris Liu[1], Tim McDowell[1]*
[1]Department of Biological Sciences East Tennessee State University
[2]Department of Economics, Finance & Geography, East Tennessee State University

Hemlock wooly adelgid is spreading rapidly through the southern Appalachian Mountains and into the Cumberland Mountains. We have been mapping trees and evaluating their health status and degree of infestation to understand the pattern by which infestations become established and spread within a populations. Ground-based surveys of individual Canada and Carolina hemlock trees were conducted in three populations of Carolina hemlocks to generate maps for more detailed analysis. Two populations were in the early stages of infestation and one was at a more advanced stage. All populations were on National Park Service lands. For each hemlock, including seedlings, individual location, height and girth were recorded as well as indices of infestation. Infestation was quantified for each individual as the number of cardinal quadrants infested and the density of adelgids. Cluster analysis was used to determine whether infestation and tree health

indicators showed non-random distributions within each population. Spatial clusters were identified via the scan statistic as implemented with SatScan software and based on an ordinal model for infestation and tree condition indicators. In each population there were significant clusters of trees experiencing heavy infestation and/or in poor health. Where sites supported a mixture of hemlock species, clusters also tended include a mixture of species. Carolina hemlocks in the more advanced population had been chemically treated and although trees were in relatively poor condition, infestations tended to be light. Moreover, at this site there were two large clusters of seedlings in excellent condition. Follow-up surveys will be conducted to distinguish spread in a wavelike front, from spread via focal points or a random pattern of spread.

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Invasive plant control methods that work: North Carolina Department of Transportation shares its management prescriptions

Keith Hill†, NC Department of Transportation

How do you get rid of Japanese Knotweed? Have you got Oriental Bittersweet taking over? What's the best way to eradicate Multiflora Rose? These are common concerns that many land managers are faced with while trying to manage invasive exotic plants. The North Carolina Department of Transportation (NCDOT) is responsible for managing invasive exotic plants along roads and rights of way throughout the state. In order to be effective, proper management measures are necessary including mechanical control, proper concentrations of appropriate herbicides, application rates, and time of year. This presentation relays NCDOT experience with successful invasive plant control methods.

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POSTER SESSION

October 22, 2007; 6:00-8:00 p.m. (Lower Lobby)
Organizer and moderator: Barry Clinton,
USDA Forest Service, Coweeta Hydrologic Laboratory

Implications of silvicultural disturbance in Appalachian forests: Results from the Southern Appalachian Silviculture and Biodiversity (SASAB) project

R. Travis Belote†[1], Jessica A. Homyack[2], Chad J. Atwood[3], Eric B. Sucre[3], Carola A. Haas[2], Thomas R. Fox[3], and Robert H. Jones[1]
[1]Virginia Tech, Department of Biological Sciences,
[2]Virginia Tech, Department of Fisheries and Wildlife
[3]Virginia Tech, Department of Forestry

Conserving and sustaining Appalachian forests requires understanding how management activities and altered disturbance regimes affect a suite of biotic and abiotic ecosystem components. Since 1993, we have been investigating the effects of seven silvicultural oak-regeneration methods (which represent a disturbance gradient from uncut control to silvicultural clearcut) on vascular plant diversity, tree regeneration, salamander populations, and soil resource availability in a replicated experimental design within the mountains of Virginia and West Virginia. Plant diversity initially increased with disturbance intensity through colonization and invasion by native and non-native species and tended to decrease 10 years after treatment application and following canopy closure. Oak regeneration was more successful in the treatments with higher levels of disturbance. Terrestrial salamander populations decreased in all treatments that removed a portion of the overstory following timber harvests, and have not recovered despite over 10 years of vegetation regrowth. Decomposing stumps are ubiquitous in all of our experimental units and represent nutrient-rich microsites containing significant quantities of total belowground carbon (C) and nitrogen (N), providing important nutrient pools and fluxes in these oak-forests. In sum, our study suggests that timber harvesting and silvicultural treatments have complex and sometimes conflicting consequences for meeting management objectives and sustaining economic values and ecological attributes. By documenting the diverse responses and the long-term implications of silvicultural alternatives, our field experiment should contribute to managers making more informed decisions regarding forest land use in Appalachia.

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A.T. MEGA-Transect

Laura Belleville†[1], Fred Dieffenbach[2], and Don Owen[3], Additional cooperators
[1] Appalachian Trail Conservancy
[2] Appalachian National Scenic Trail / Northeast Temperate Network
[3] Appalachian National Scenic Trail

For more than 25 years, the Appalachian Trail Conservancy and Appalachian Trail Park Office, who coordinate many government and private non-profit organizations that manage and maintain the Trail, have focused efforts on securing a permanently protected corridor for the Appalachian Trail. Having nearly completed this goal, we have turned our energies toward assessing, understanding, and managing the wealth of natural resources present on the Appalachian Trail's land base, and telling the story of the Trail's environment to the American public. To this end, a group of sixty-five scientists, natural resource

managers, educators, and policy experts from a variety of public and private groups met during a three-day symposium in November 2006 to explore the use of the Appalachian Trail as an environmental monitoring mega-transect. Project cooperators

This poster introduces the results of the process that culminated at the 2006 Symposium, the official creation of the A.T. MEGA-Transect program. The poster describes the current status of the Appalachian Trail's natural resources as well as the knowledge gaps that currently exist, and highlights the monitoring projects to be launched as part of the A.T. MEGA-Transect to fill these gaps and enable better management and protection of the Appalachian Trail's natural resources.

Project cooperators include representatives from U.S. Geological Service, U.S. Forest Service, Cornell University, University of Tennessee and Foundations for Success.

† Appalachian Trail Conservancy, Southwest and Central Virginia Office, P.O. Box 174, Blacksburg, VA 24063; lbelleville (at) appalachiantrail.org

Occurrence, movement, and quality of groundwater in the Bent Creek Experimental Forest

Ted R. Campbell[1], Brad A. Huffman[2], W. Henry McNab†[3]

[1] North Carolina Department of Environment and Natural Resources, Division of Water Quality

[2] US Geological Survey, North Carolina Water Science Center

[3] USDA Forest Service, Southern Research Station

Ground water is one of North Carolina's most important natural resources. About half of the residents of North Carolina rely on ground water for their principal water supply. Equally important, about half of the annual flow in streams and rivers of the mountains is ground water that is discharging to land surface along stream banks and bottoms. Adequate amounts of high-quality ground water are therefore crucial to the health and viability of our streams and rivers.

In contrast to the coastal plain and Appalachian Piedmont regions of North Carolina, relatively little is known about the characteristics of ground water resources in the Blue Ridge Mountains. A ground water investigation is being conducted in the Bent Creek Experimental Forest, a field research facility maintained by the Southern Research Station located about 10 miles southwest of Asheville, as part of the Piedmont-Mountains Resource Evaluation Program. The program of research is funded and carried out jointly by the N.C. Department of Environment and Natural Resources and the U.S. Geological Survey to advance understanding of the occurrence, movement, and quality of ground water in fractured bedrock settings.

The Bent Creek study site is one of a number of long-term resource evaluation stations in the fractured rock of the piedmont and mountains of NC. A range of hydrogeological data is being collected at each of the stations in order to better understand, utilize, and protect this resource. Data collection activities include rock coring, well installation, stream and well sampling, geologic and topographic mapping, and various tests to evaluate the water-bearing properties of the ground water system. The purpose of this poster is to describe the study installation at the Bent Creek site and summarize preliminary findings.

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Taking a closer look at the silent majority: A sample survey of local attitudes towards land use planning

Gabriel Cumming[1], Carla Norwood†[1], Brent Martin[2], and Stacy J. Guffey[3],

[1] UNC Chapel Hill Curriculum in Ecology

[2] The Wilderness Society

[3] Macon County Planning Department

What do people in this rapidly changing region really think about population growth, development, and land use policies? This presentation discusses findings from a sample

survey in Macon County, NC that was administered to 1800 full-time residents in spring 2007. The 12-page questionnaire focused on perceptions of change and attitudes towards growth management policies among residents. We will cover reported levels of support for a variety of land use policies and preferences for types of information that could better inform decision making. The survey also served as an evaluation of a participatory, ethnographic process conducted during 2004-05, and we will discuss the degree to which the preferences expressed by participants in that process were supported by a representative sample of the county's residents.
† carla333 (at) email.unc.edu

Using SCA Conservation Corps Interns for Fire Effects Monitoring on the Cherokee Reservation
Kat DeWitt†, The Student Conservation Association in partnership with the Bureau of Indian Affairs

Celebrating its 50th anniversary in 2007, the Student Conservation Association has assisted federal agency partners and land managers across the country by providing volunteers that have an interest in and are dedicated to conservation.

The SCA Wildland Fire Corps has implemented FIREMON crews with various agencies and tribal offices in over 10 states to assist in fire effects monitoring on Native American lands. The FIREMON program objective is to collect and provide consistent fuels and vegetation data to land managers. The data, in turn, is analyzed in aiding the identification and prioritization of hazardous fuels treatment areas, monitor the effectiveness of past management activities, and influence future restoration efforts.

The Eastern Band of Cherokees (EBCI) has not practiced prescribed burning as a management tool in over 50 years. The SCA in partnership with The Bureau of Indian Affairs is hosting its second SCA FIREMON crew this year in an effort to reintroduce prescribed fire and reduce hazardous fuels on the Cherokee Reservation in North Carolina. The crew will be utilizing FIREMON protocols and the JFIREMON database and will monitor for Tree Data, Fuel Load, and Species Composition. The project leader will present a poster of the project model, the background and mission of the SCA, and the accomplishments of the 2006 and 2007 Eastern Cherokee FIREMON field crews.
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Some changes in the spruce-fir forest of Roan Mountain, North Carolina over the past 60 years as a result of logging
James T. Donaldson†, ETSU John C. Warden Herbarium

In 1934, D. M. Brown quantitatively surveyed the last remaining original spruce-fir forest of Roan Mountain, North Carolina-Tennessee. His study plots were cut within hours of completing the survey. Since the logging, the spruce-fir forest has had sufficient time to return to a mature state. In order to analyze what changes, if any, have taken place in the secondary spruce-fir forest community structure of Roan Mountain as a result of logging, two additional studies of Brown's 1934 plots have been completed. In 1988, J. C. Warden quantitatively surveyed the tree layer. In 1995, the shrub and herbaceous layers were qualitatively surveyed. The changes observed indicate that the forest is slowly recovering and that the species composing the stands now include a number of species found in the beech-maple hardwood forest community lower on the slope.
† ETSU John C. Warden Herbarium, Johnson City, TN. Tnplanthunter (at) yahoo.com

Southern Appalachian mountain "bog" restoration projects in Shady Valley, TN
James T. Donaldson†[1] and Gabrielle Call[2]
[1] ETSU John C. Warden Herbarium
[2] Gabrielle Call, TNC, TN Chapter

Wetlands that were drained primarily for agriculture and "flood control" during the previous century have been at least partially

restored by The Nature Conservancy in an effort to expand isolated remnant mountain "bogs" in Shady Valley, Tennessee's highest valley (ca. 2800 ft elevation). These bogs contain a number of uncommon and rare species including Sphagnum spp., *Vaccinium macrocarpon, Eriophorum virginicum*, *Dryopteris carthusiana*, *D. cristata*, *Toxicodendron vernix*, and *Carex folliculata*. Species diversity and cover were intuitively estimated in 36 five meter radius circular plots in 2 wetland restoration areas totaling over 100 acres. The measure of success was determined at 70% wetlands species coverage (OBL, FACW, and FAC exclusive of FAC-) after a period of 5 years.

† ETSU John C. Warden Herbarium, Johnson City, TN. Tnplanthunter (at) yahoo.com

Roan biodiversity project, part 1: vascular plants, a first synthesis

James T. Donaldson†[1], Jerry Nagel, and Nora Schubert[2]
[1] ETSU John C. Warden Herbarium
[2] Southern Appalachian Highlands Conservancy

Species list based on existing reports (mostly unpublished) with an effort made to resolve taxonomy and synonymy. Over 700 vascular plant taxa are on the Roan Massif. Each species is listed by current name(s) (following Weakley's draft flora and FNA), former name(s) (mostly from RAB), common name, nativity, global rank, state ranks, and Cherokee and Pisgah National Forest ranks. Approximately one-third are tracked by either NC or TN Natural Heritage Programs, suggesting at least some level of concern over their rarity (past, present, and / or future in the case of commercially exploited plants).

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A preliminary "then and now" look at 70+ years of historic landscape photos from Roan Mountain, NC-TN.

James T. Donaldson†[1], Charles Warden[1], and Jennifer Bauer[2]
[1] ETSU John C. Warden Herbarium
[2] Park Manager Sycamore Shoals State Historic Area

This presentation is the first showing of recently collected and interpreted historic landscape photos of Roan Mountain, demonstrating change in management and ecology over time.

Fire in the southern Appalachians: restoration of pine/hardwood ecosystems

Katherine J. Elliott†, James M. Vose, Jennifer D. Knoepp, and Barton D. Clinton
Coweeta Hydrologic Laboratory, Center for Forest Watershed Research, Southern Research Station, USDA Forest Service

The southern Appalachian region has been severely impacted by the most recent southern pine beetle (SPB) epidemic (1999-2003). As a result, thousands of hectares of dead pine trees have created wildfire-hazard conditions. One of the challenges for land managers is how to return fire to these ecosystems after (1) decades of exclusion, and (2) the more recent SPB mortality enhanced fuel loads. Higher fuel loads have the potential to increase fire intensity and severity. At the extremes, fires of high intensity and severity can have a large effect on ecosystem structure and function. In pine/hardwood forests our objectives were to: (1) quantify fuel load reduction methods (pine overstory felling, material left on site followed by prescribed fire (C+B); prescribed fire only (Burn); and no treatment (REF, reference), (2) measure changes in overstory, midstory and herbaceous-layer species composition and diversity, and (3) evaluate the effects of further restoration treatments including planting shortleaf (*Pinus echinata*) pine and seeding native bluestem grasses on ecosystem structure and function in these pine-hardwood forests in the southern Appalachian region. On the Cherokee National Forest in eastern Tennessee, we chose eight pine/hardwood sites

that were heavily impacted by southern pine beetle induced tree mortality: four C+B, two Burn, and two REF sites. Sites were cut in summer 2005 and burned in March 2006. We measured fuel load; vegetation; soil and soil solution chemistry; and forest floor mass, carbon and nitrogen before and after the burn treatments. The burn prescriptions resulted in high intensity, moderate severity fires. Most fine fuels [litter and small wood (1-100 hr fuels)] and 21-30% of the large fuels (1000 hr) were consumed. Large wood consumption was greater on the C+B than the Burn sites. The forest floor humus layer remained mostly intact. Density of understory stems significantly increased after fire on the Burn and C+B treatments. In the herbaceous-layer, percent cover and species richness significantly increased on the C+B treated sites, and there were no significant changes on the other sites. Mortality of planted pine averaged 25% by the end of the first growing season; whereas, success of seeded bluestem grass was marginal.

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Diagnosis of conditions crucial to *Phalaris arundinacea* invasion of a wetland

Richard D. Foster†

Aggressive reed canary grass, *Phalaris arundinacea* L. (Poaceae), a rhizomatous agricultural hay species, interferes with establishment of native cover (Sphagnum sp.) useful for survival of priority native species in an Appalachian wetland restoration. It is difficult to eliminate once established. Soil and water conditions were tested to determine why *P. arundinacea* did not invade all areas of the wetland similarly. Soil characteristics (texture, organic matter, water content, nitrate, total phosphorus, pH) were compared with vegetation cover and species richness across transects containing *P. arundinacea* and native plants. Hydrology was a poor cover predictor. Both the most deeply submerged and driest extremes supported *P. arundinacea* monocultures ($r2 = 0.007$, $p = 0.131$). Its cover varied inversely with plant species richness ($r2 = 0.78$). At $p \leq 0.008$, loose, structured soil correlated with *P. arundinacea* cover. All ground without *P. arundinacea* was exposed consolidated subsoil. Exposed subsoil developed moss and short native plants with clumping habit or runners. No measured soil property correlated well with native plant species richness in the area sampled ($p > 0.05$), implying an indirect relationship between soil and native cover, through exclusion of *P. arundinacea*. Topsoil removal is being used this year to exclude competitive weeds from propagation beds for native cranberries (*Vaccinium macrocarpon*), a weakly competitive native plant that spreads by runners.

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Mercury contaminating high elevation songbirds in Great Smoky Mountains National Park

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Mercury contamination is a primary threat to Great Smoky Mountains National Park due to its high deposition rates, tendency to bioaccumulate, and because relatively little is known about its role in the terrestrial system. This was the first of three years of study investigating the status and effects of mercury toxicity to high elevation songbirds in the Southern Appalachians. We collected 223 feather samples from 21 species of songbirds passively mist netted at 6 high elevation sites in summer 2006. Feathers collected in 2006 had an average total mercury load of 476 µg/kg (range 18 – 1,548 µg/kg, n=219). Total mercury loads were significantly higher in juvenile versus adult birds when all species were combined ($p=0.02$). Feather mercury loads (mean ± SE) in juvenile Dark-eyed Juncos (557 ± 44 µg/kg, n=53) were significantly higher compared to adults (351 ±

28 µg/kg, n=50, p<0.0001). Feather mercury levels in juveniles of 10 high elevation resident species (528 ± 32 µg/kg, n=99) were not significantly higher than those in juveniles of 11 high elevation migrant species (455 ± 17 µg/kg, n=43, p=0.18). Species with the highest feather mercury loads (>1000 µg/kg) included Winter Wrens, Veery, Dark-eyed Junco, Canada Warbler, Golden-crowned Kinglet, Song Sparrow, Black-throated Blue Warbler, and Brown Creeper. Understanding the role of mercury in terrestrial systems could have world-wide implications as data on this topic are extremely limited, and could provide the basis for establishing new environmental thresholds.

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Promoting sustainability at ETSU: Changing a university's carbon culture

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In spring of 2006, an ETSU student group, Initiative for Clean Energy (I.C.E.), formed in response to concerns about regional pollution and environmental issues, with the goal of promoting clean energy, recycling, and sustainability in general on the ETSU campus. The group was formed and works with the help of the Southern Alliance for Clean Energy.

By the end of spring semester 2007, we had developed support from university administrators—including a substantial budget line—to implement a campus-wide recycling initiative. This fall, a new dormitory, Governor's Hall, will be used to showcase environmentally-sound practices, thanks in large part to this student group. We also enter the fall with momentum to push more broadly for green building practices on campus, as well as for conservation and clean energy.

In this presentation at SAMAB, we will describe this sustainability initiative. We'll talk about what we've done so far, and about the challenges we face in the near term as well as the long term. And we'll discuss the initiative in the broader context of what's being done at other universities in the region.

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Species invasiveness and habitat invasibility: Research updates

Qinfeng Guo†, USDA Forest Service-Southern Research Station

Although there is no simple biological predictor of species invasiveness, certain biological traits tend to be associated with invasion success more than others. Life history/genetic information is thus critical for developing early warning/prevention systems, predictive simulation models, risk assessment, and management plans. It is also commonly believed that more diverse habitats are less invasible due to niche occupation. Yet, most recent evidence shows that invasibility is a much more complex issue and may be determined by multiple factors. Currently, we are compiling data for biological traits including life cycle, growth form, woodiness, pollinating agent, and photosynthetic pathways. We also collect information regarding introduction pathways/vectors, introduction time and locations, and current distribution. Metadata regarding various habitat characteristics and invasibility are being collected from diverse ecosystems in the Unites States forest and other ecosystems and around the world. Preliminary observations show that species-rich communities are invasible but may be so at a lesser degree, although individual component species can show highly invader-specific resistance or promotion. Species richness apparently does not work in isolation; it has to work with species abundance in determining habitat

invasibility. A community's ability to preclude species invasions may be dependent upon a threshold level of both species richness and abundance, below which the importance of species interactions is only a weak force. Comparisons among the major community-types within and among geographic regions can provide new insights for both invasion biology and management.
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Planning BMPs for stream restoration: Get the most bang for your buck
Patricia A. Hamlett† and Donald L. Malone
Tennessee Valley Authority

Geographical targeting is the most efficient and cost-effective approach to watershed improvement. The Tennessee Valley Authority (TVA) develops detailed nonpoint pollutant source (NPS) inventories to identify, quantify, and prioritize contributors to environmental problems in watersheds. These land-use and land-activity GIS databases provide the means to effectively prioritize and target watershed restoration funds and, thus, achieve the greatest level of pollutant reduction for the least amount of funding. The comprehensive data — details, such as eroding road and stream banks, livestock sites, illegal dumps, and suspect septic systems — extracted from stereo photographs provides the first step in determining the cause of a pollution problem in the watershed. Data analysis transforms a dispersed, area-wide concern into a defined, site-specific problem by identifying sub-watersheds that are the greatest contributors to the pollution problem. Then, the specific sites that contribute the greatest pollutant loads in each priority sub-watershed can be determined. While providing a foundation for focusing efforts on priority impacted watersheds and identifying most-effective abatement measures for meeting TMDLs, these NPS assessments also serve as documentation of nonpoint sources to support application for water quality improvement grants and to provide the stimulus for agencies, industries, interest groups, and landowners to work toward a common goal.

Based on data from a recently completed watershed restoration project, this poster presentation will illustrate the NPS inventory and assessment process through photographs, maps, charts, and pollutant loading reports.
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How can NBII's geospatial interoperability framework help you visualize information?
Shelaine Curd Hetrick†[1], Brandon League[2], Wimolrat Ratchukool[2], Mike Frame[3], Terri Killeffer[1], and Jean Freeney[4]
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National Biological Information Infrastructure (NBII) is a broad, collaborative program to provide increased access to data and information on the nation's biological resources. NBII has developed the NBII Geospatial Interoperability Framework (GIF) significantly reducing geospatial application development effort, and helps integrate legacy non-geospatial databases and existing ArcIMS based applications. The use of Open Geospatial Consortium compliant web services and the establishment of a catalog of these services are the two most fundamental aspects of GIF. NBII services such as the Catalog, Gazetteer, and the bounding box, can be used by any application without the overhead of hosting and maintaining data and code. The NBII network currently serves around 452 map services with approximately 30,000 data layers.

NBII's Southern Appalachian Information Node (SAIN) has used the NBII GIF and NBII portal technology to seamlessly integrate a variety of existing disparate datasets and geospatial applications into a community called 'Maps of the Region.' Users, with access to the internet, can search the NBII

catalog to find and select GAP data to overlay on maps related to brook trout, invasive plants, as well as significant ecological areas. SAIN's tutorial educates users who are unfamiliar with icons, 'active layers' and how to search the NBII cataloged resources to create a custom map to meet your individual needs.

This team—the co-authors—is an example of NBII-SAIN's collaborative activities to increase access to data and information about the nation's resources. This team includes the U.S. Geological Society (USGS), Information International Associates (IIa), Institute for a Secure and Sustainable Environment (ISSE) and the University of Tennessee. Please contact us (http://sain.nbii.gov) to join the partnership and develop other collaborative initiatives.

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Identifying natural barriers for brook trout reintroduction in mountain streams of the southern Appalachians

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Brook trout (*Salvelinus fontinalis*) has been extirpated from much of its former range in the Southern Appalachian mountains. Many of the streams with remaining populations of brook trout contain the introduced northern strain or a mixture of the northern and southern strains rather than the native southern strain of brook trout. The native southern strain does remain in some of the more remote mountain streams in the region, and the opportunity exists to re-establish healthy native brook trout populations in many stream segments. Introduced rainbow trout (*Oncorhynchus mykiss)* and brown trout (*Salmo trutta)* occupy many of the streams formerly occupied by brook trout in the Southern Appalachians. Brook trout does not compete well with established populations of these species. Thus brook trout reintroduction efforts depend on removing the introduced trout from stream segments before native brook trout can be restored to the segments. If there are unimpeded migration routes, the non-native species can easily reoccupy the stream segments, rendering the brook trout reintroduction ineffective. Thus successful reintroduction efforts depend on finding or establishing barriers to migration that can effectively isolate the reintroduced brook trout.

A study to identify natural barriers within a mountain headwaters watershed in North Carolina will be presented. This watershed, the Fires Creek Watershed in the Tusquitee District of Nantahala National Forest, currently has no known remaining populations of native brook trout. However, it would have been within the range of the species. Most of the watershed falls within parameters favorable for brook trout, but it is occupied by non-native trout species. The US Forest Service and the North Carolina Wildlife Resources Commission both have a strong interest in reestablishing brook trout in this and other suitable mountain watersheds.

A stream survey was conducted on the streams in the Fires Creek Watershed to identify natural barriers that would allow isolation of stream segments so that non-native trout can be removed and native brook trout can be effectively reintroduced from a watershed nearby. Natural barriers, consisting of waterfalls and cascades of sufficient height and extent to block upward movement of trout, were identified through field surveys. GPS points were taken of the barrier locations in order to be able to locate the barriers on GIS maps.

The system of streams and stream segments within the watershed isolated by barriers will be presented. The strategy for using these barriers in the reintroduction effort will be discussed. An effort to use GIS modeling in conjunction with the data from this survey to predict natural barriers will also be discussed. If successful, this modeling could allow stream surveys in other watersheds to be targeted to stream segments most likely to contain natural barriers.

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Eastern hemlock forests in the southern Appalachians: Vegetation and soil Characteristics

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Hemlock trees serve an important ecological role in the southern Appalachians as a keystone species in near-stream areas. The hemlock woolly adelgid is a non-native invasive pest that impacts eastern hemlock (*Tsuga canadensis*) and Carolina hemlock (*Tsuga caroliniana*). Scientists at the Coweeta Hydrologic Laboratory, a USDA Forest Service experimental forest in western North Carolina, are examining the impacts of the adelgid on hemlock forests of the southern Appalachians. As part of this effort, we wanted to assess the vegetation and soil characteristics prior to hemlock decline and mortality. We identified 30 'Hemlock Plots', permanent vegetation plots within the Coweeta basin that had greater than 30% basal area hemlock at the last inventory, 1988-93; 10 adjacent plots without hemlock were selected as 'Reference Plots'. Soil samples were collected from the surface (0-10 cm) and sub-surface (10-30 cm) of each plot. Soil chemical analyses included total carbon (C) and nitrogen, base cation concentrations, cation exchange capacity, and percent base saturation. We determined vegetation composition; including overstory basal area, shrub density and herbaceous cover. Hemlock plots have significantly greater C content in both surface and subsurface soils compared to reference plots. There are no significant differences between hemlock and reference plots in base cation concentrations. All plots have a significant rhododendron (Rhododendron maximum) component; and a comparable hardwood species mix with some variation in abundance of individual species. For example, red maple (*Acer rubrum)* has a greater basal area in reference plots than hemlock plots (red maple basal area averaged 6.99 m2 ha-1 in reference versus 4.34 m2 ha-1 in hemlock plots). We will continue to monitor impacts of hemlock woolly adelgid on vegetation and soil to understand these rapidly changing ecosystems.

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Ghosts of elephants past? Remnant grassland ecosystems and pleistocene keystone herbivores

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Norman Owen-Smith's "keystone herbivore" hypothesis proposes a dominant role for large grazing and browsing mammals as top-down effectors of vegetation structure and diversity through the Pleistocene. We hypothesize that certain temperate, montane, sub-timberline grassland ecosystems may represent a remnant legacy of disturbance by extinct megaherbivores and their successors—mesoherbivores and domestic livestock. We use the comparative method to propose candidate ecosystems as remnants of such interactions, citing evidence from paleontology, shade-intolerant plant diversity, and land use history. Examples include the southern Appalachian grassy balds of the USA, and the East Carpathian poloniny grasslands of Poland, Slovakia, and the Ukraine. For comparison we include a similar ecosystem hypothesized to be primarily fire-dependent: the grassy balds of the Bunya Mountains in Queensland, Australia. We call for renewed consideration and investigation of the role of grazing on grassland plant conservation, especially in North America where the idea has often been overlooked or discounted compared to climatic or edaphic factors.

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Land-use legacies and invasive exotic plants in a southern Appalachian forest

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In this study we considered the relationship between land-use history and the distribution of invasive exotic plants at the Bent Creek Experimental Forest 10 mi. southwest of Asheville in western North Carolina. Areas that were previously in cultivation and abandoned between 1900 and 1910 were compared with nearby sites that were not formerly cultivated. Various biotic and abiotic characteristics were compared between the sites to determine which aspects most influence invasibility. Among these, soil chemistry (total N, organic matter, P, K+, Ca++, Mg++, and pH) and texture were measured, as well as overstory community composition. Land-use history was found to play a major role in determining patterns of invasion at Bent Creek. Soil chemistry, particularly regarding the exchan`geable cations (and total N and pH to a lesser extent), was important in explaining the presence and abundance of invasive plants. The level of these soil nutrients was strongly correlated with the overstory community composition, particularly the abundance of *Liriodendron tulipifera*. We suggest that the agricultural land-use history at Bent Creek may be affecting invasibility by causing elevated soil nutrient levels (especially exchangeable cations) as a result of nutrient cycling by the long-lived, early-successional tree species *L. tulipifera*. If this is indeed the case, the effect of land-use legacies on invasion at Bent Creek is actually a secondary result of succession rather than a direct effect of the former land use itself.

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The detection of morphological variation across time in two Roan Mountain endemics: *Geum radiatum* and *Houstonia montana*

Dalenia Medford, East Tennessee State University (alumnus)

Morphological variation between geographically distant populations has long been recognized. The primary objective of this study was to test whether nonrandom shifts in morphology have occurred across a 150-year time span in two rare, endangered plant species *Geum radiatum* and *Houstonia montana*. During the last century the vegetation on Roan Mountain has undergone numerous environmental pressures that may have produced morphological shifts.

A diverse suite of morphological characters was measured from both species. Characters included vegetative and reproductive structures. Herbarium specimens and direct field measurements were the sources of material used. Results indicated a significant increase in size across time in the majority of characters measured. Results of this study challenge standard taxonomic practices, present questions pertaining to the relationship between genetics and morphology, and raise issues concerning conservation and management strategies of endangered plant populations.

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Stream flow monitoring in tributaries of the Little River, Tennessee.

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Following the EPA designation of the Little River as a Targeted Watershed in 2006, our team has monitored stream flow at 28 sites on Little River tributaries. Our work is part of a larger effort by a group of partner organizations that includes TVA, Blount County Soil Conservation District, the University of Tennessee, the Little River Watershed Association, and the cities of

Maryville and Alcoa. For six of the tributaries, we monitored more than one (2-7) site. Each site also has a staff gage and a rising stage sampler for capturing storm flow. We have obtained at least six flow measurements from each site, spanning one year and different flow conditions. These data are being used to better understand flow patterns and to support analyses of water samples for pathogens and TSS. At each site, we have also measured water temperature, pH, specific conductance, and dissolved oxygen, and characterized bed particle size using pebble counts. At selected sites, we assessed the quality of macroinvertebrate habitat and/or monitored bank erosion with erosion pins.

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Biological inventories by the Appalachian Highlands Network Inventory and Monitoring Program, National Park Service

Nora Murdock†, Robert Emmott, and Patrick Flaherty, National Park Service, Asheville, North Carolina

The Appalachian Highlands Network (APHN) is one of 32 National Park Service Inventory and Monitoring Networks, and is nearing completion of a five-year series of biological inventories designed to document 90 percent of the vascular plants and vertebrates occurring within 3 of the Network parks: the Big South Fork National River and Recreation Area in Kentucky and Tennessee, the Obed Wild and Scenic River in Tennessee, and the Blue Ridge Parkway in North Carolina and Virginia. Legacy data collection from museums, herbaria, and literature searches is also part of the inventory process. In addition to species inventories, the Network is completing detailed vegetation cover maps for each park. Geology and soils mapping are planned or in progress for each park, as well. To support the biological inventory phase, the national I&M Program developed the NPSpecies biodiversity database to serve park-specific, certified, species-level data. Legacy data can often reveal insightful pictures of former habitat conditions in parks, such as historic records for suites of animals and plants that were associated with fire-maintained communities that no longer exist in a largely fire-suppressed landscape.

The spatial extent of the data being collected provides a broad geographic context of species occurrence and richness. While these data are of primary importance to National Park Service managers, they can also be of value to regional or national assessments. Cooperating with other agencies through data and methodology exchange is a key goal of the National Park Service I&M Program. It is hoped that this data collection and exchange will facilitate more-informed management of natural resources within the parks, as part of a larger, landscape-level effort.

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The Appalachian Trail MEGA-Transect: Telling the story of the environmental health of the Appalachian Mountains to visitors, neighbors, and the world

John Peine†[1], Thomas Burley[2], Brandon League[2], and Shelaine Curd Hetrick[3]
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The Appalachian Trail (AT), one of the most recognized trails in the world, traverses the crest of the Appalachian mountain range with it's length of 2,167 miles through 14 states, 8 national forests, 5 national park units and some state forests and parks as well as many universities and NGO's. The AT Community Mission Statement is as follows: The Appalachian Trail Community provides an

Internet-based communication, information repository, and project management tool to aid in facilitating collaboration among those involved in environmental inventory and monitoring along the Appalachian Trail and throughout the Appalachian highlands. The ultimate goal of the Community is to work towards establishing a continental scale mega-transect for monitoring environmental health.

The AT Community project, as part of the AT MEGA–Transect initiative, has both a public-accessible site for information dissemination (http://sain.nbii.gov/ATMEGATRANSECT) as well as the secure-access NBII-SAIN AT Community (http://apptrail.nbii.gov) project on the NBII portal. The secure-access site serves as a primary collaboration and communication tool for the Appalachian Trail MEGA-Transect initiative. Current AT Community membership includes over 300 scientists and resource managers from a multitude of federal agencies, NGOs, state agencies, universities, as well as volunteers. The public-accessible site is hosted by the National Biological Information Infrastructure (NBII) Southern Appalachian Information Node (SAIN) and provides a list of publicly available key ecosystem data themes to place the 'state of the environment' in a continental-scale context. The data themes will be made available as standards-compliant web map services and interactive maps that are integrated with NBII data and tools. These tools will serve as an impetus for collaboration and discussion among key AT scientists involved in natural resource management. Please visit our web site to learn more about and how to become a part of this initiative.

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Current status and mortality rate of hemlock in the Southeastern United States

Anita K. Rose†, US Forest Service Southern Research Station

Eastern hemlock (*Tsuga canadensis* [L] Carr.) and Carolina hemlock (*T. caroliniana Engetm.*) are susceptible to numerous pests and pathogens. Of particular concern, currently, is the hemlock woolly adelgid (*Adelges tsugae Annand*), first reported in Virginia in the 1950's. Now in 16 states, from Georgia to Maine, it has caused widespread injury and mortality. The current status and mortality rate for hemlock were determined using data from the Forest Service's Forest Inventory and Analysis (FIA) program. As of 2005, hemlock (Tsuga spp.) was tallied in 129 counties of 7 southeastern states (AL, GA, KY, NC, SC, TN, VA). The density of live overstory trees (≥ 12.7 cm d.b.h.) averaged 9.3 trees/ha for these 129 counties. North Carolina had the highest density of live trees (15.4 trees/ha) and saplings (≥ 2.5 cm d.b.h., but < 12.7 cm d.b.h.) (39.4 saplings/ha). Mortality rates were calculated for trees that were measured over two points in time. The sample included 2,242 trees measured on 543 plots. Most were initially measured between 1998 and 2002 and re-measured between 2003 and 2007. Overall, mortality rates averaged 0.6 % per year for trees and 1.2 % per year for saplings. Virginia had the highest mortality rate for both saplings (3.6 % per year) and trees (1.9 % per year), and North Carolina had the 2nd highest rate for trees (1.3% per year). This agrees well with the onset of adelgid infestation, where hemlocks showed infestation in the early to mid 1990's in Virginia and North Carolina, while Tennessee and Kentucky have shown signs of infestation more recently. Although the scale at which FIA collects data is broad, this program is the only one that conducts systematic surveys of forest land across the U.S. Without landscape-scale information, critical biological thresholds that indicate population decline are difficult to ascertain.

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History of grassy balds management on the Roan Mountain Massif

Nora Schubert† and Judy Murray, Southern Appalachian Highlands Conservancy

Southern Appalachian grassy balds are among the most globally endangered ecological communities, with a G1 ranking. The grassy balds on Roan Mountain are the most extensive and highest quality remaining. These grassy balds are primarily threatened by woody plant invasion and human disturbance. Roan's grassy balds community has undergone significant succession to blackberry shrubs, heath balds, and spruce-fir and northern hardwood forests. Kenney 1999 concluded that the grassy balds on Roan Mountain may have decreased in area by 50% since about 1980. With the loss of Roan's grassy balds community comes the loss of many rare floral and faunal species dependent upon these high-elevation open areas. This presentation will provide an overview of the planned management that has occurred on Roan beginning in the 1980's. The management direction, field methodology, partner roles, and current issues will be highlighted. In general, annual management has primarily consisted of hand-mowing and cutting, large mechanical mower operations, and cattle grazing. Since management began, there are notable successes to point to such as a marked increase in rare plant numbers like Gray's Lily and in general, retention of rock outcrop communities that harbor several rare floral and faunal species. However, some of the primary concerns are that the (1) amount of area managed over the years falls well short of the proposed number of acres, and (2) effects of management warrant increased levels of monitoring. These short-falls accelerate the rate of woody encroachment and spawn loss in biodiversity. In the absence of natural biological and/or historical anthropogenic disturbances, planned management is required to preserve this community and the many high-elevation floral and faunal species therein. Preservation of this endangered community into the future will require commitment and innovation to acquire resources for continued maintenance and expanded management.

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Intrinsic vulnerability to contamination of wells and springs in the mountains and adjacent piedmont, South Carolina

Peter Stone†, Bureau of Water, SC Dept. Health and Environmental Control

Ground water from wells and springs is an important source of drinking water in the mountains and adjacent geologically related piedmont. Wells serve both individual homes and public systems, while springs are important sources for bottled water. Porous earthy regolith overlies hard rock here and the deeper ground water travels in narrow rock fractures or cracks that are intercepted by rock wells (some shallow home wells tap the overlying regolith). Springs may discharge from the highly fractured uppermost rock or, apparently, from deeper-seated fractures that angle to the surface. Conceptual hydrogeologic evaluation of this terrain strongly suggests that percolating rainwater typically does not travel far underground before discharging to wells or springs. Short flow paths and accompanying short flow times are major factors in raising risk of contamination of ground-water supplies from accidental or careless release of contaminants to the land surface (e.g., dumping, spills, heavy fertilizer use) or to the shallow subsurface (e.g., leaking underground tanks, drainfields). Where "young" ground water is used for drinking, extra protection is deserved for the close-by recharge area to prevent entry of serious contaminants. This conceptual interpretation was tested for a scattering of wells and springs in South Carolina whose small area of mountains is under increasing pressure from residential development. Tritium (a radioisotope of hydrogen, 3H) marks all rainfall worldwide since the aboveground hydrogen-bomb tests of the 1950-60s. Finding elevated tritium in well and spring water shows that much or all of that water passed into the ground since that fairly recent time. In contrast, low-vulnerability

coastal-plain aquifers commonly contain water thousands of years old. Of eight major wells in the mountains and six springs in mountains or nearby piedmont, all but one of each clearly showed “bomb” tritium, thus confirming a general high vulnerability to contamination of these Appalachian-terrain water supplies.

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OUR LAND, OUR TOMORROW

October 23, 2007, 8:30 a.m. – 5:00 p.m. (Century Room)
Moderators:
Jim Stokoe, Land-of-Sky Regional Council
Barry Clinton, USDA Forest Service-SRS, Coweeta Hydrologic Laboratory
Roy Settle, Appalachian Resource Conservation and Development District

Landcare and green infrastructure: Changing landscapes, lifestyles, and livelihoods in Appalachia and beyond (a panel discussion)

Two presentations anchor this panel discussion. They are as follows:
"Landcare efforts in Western North Carolina," by Jim Stokoe†, Land-of-Sky Regional Council, Asheville, NC and Ron Nalley, Town Administrator, Town of Montreat, NC.

"Landcare and green infrastructure in the headwaters region of Virginia: An overview of current initiatives," by Glen N. Stevens, Conservation Management Institute, College of Natural Resources, Virginia Tech, Blacksburg, VA.

One of the greatest challenges faced by Americans today is unprecedented patterns of urbanization, especially exurban residential development of rural lands resulting in significant loss of working farms and forest lands. Other challenges include economic restructuring and the implications for local communities of global competition for natural resources. In general, the challenge for Americans, and people worldwide, is to develop Landcare management systems for the sustainable production and consumption of quality food, fiber, water, and energy to meet the needs and desires of a growing human population. Landcare practices maintain and improve green infrastructure, ecosystem services, and the public benefits that flow from private lands. In this panel, we will describe the Landcare movement and industry in the United States, especially western North Carolina and Virginia where Landcare has been especially active in recent years. From our point of view, Landcare is the next generation of land conservation and development. It is citizen-led, community-based, civic-minded, state-supported sustainable land management for the 21st Century. It is local people working together to improve local economic, social, and environmental conditions. It is citizens and their communities collaborating with government agencies, businesses, and other key partners to achieve shared goals and common objectives that no one can accomplish alone. As such, it is appropriate for today's increasingly urban and global society. Landcare is land management for the future.
† Land-of-Sky Regional Council, 25 Heritage Drive, Asheville, NC 28806; jim (at) landofsky.org

Protecting the best of Bethel
George Ivey†, Bethel Rural Preservation Project

The Bethel Community of Haywood County in Western North Carolina seems to have it all, but maybe that's the problem.

The Blue Ridge Parkway curves gracefully along its high southern border, while Highways 215 and 276 form the Forest Heritage Scenic Byway. From almost any direction, you can spot Cold Mountain, the

peak made famous by Charles Frazier's novel and subsequent movie. Tourists and residents hike and camp in two wilderness areas within Pisgah National Forest, while others fish for trout in the upper reaches of the Pigeon River. The Pigeon also provides water for the Town of Canton and for Blue Ridge Paper, the county's largest employer. The river's bottomlands contain some of North Carolina's most unique alluvial soils, where farmers grow excellent tasting tomatoes, peppers, and other crops.

These great resources also attract development, and Haywood County has already lost 80% of its prime farmland. However, in a recent telephone opinion survey, 94% of local residents stated that they would like Bethel to continue to be a rural agricultural community.

There is no magic solution for saving Bethel – or any other rural community in the Southern Appalachians or elsewhere in America. However, the Bethel Rural Community Organization is working hard to do what it can – engaging landowners and agencies in conservation planning, promoting land conservation programs, encouraging better markets for local agricultural products, celebrating its local historic sites, and more.

The Bethel story fits very well within the conference theme of "Our Land, Our Tomorrow – a study of community-based responses to growing development pressure." Through a 15-minute video, brochures, and an update on recent activities in the Bethel area, attendees will discover an excellent example of a local community finding ways to protect its cultural and natural heritage.

† Bethel Rural Preservation Project, 154 Ridgeview Lane, Canton NC 28716; georgeivey (at) earthlink.net

Reflections on a participatory research project to promote conversations about land use change and development in Macon County, NC (a panel discussion)

Panelists:
Gabriel Cumming†, UNC Chapel Hill Curriculum in Ecology
Carla Norwood, UNC Chapel Hill Curriculum in Ecology
Stacy J. Guffey, Macon County Planning Department
Ben Brown, Consultant

This presentation discusses findings from a mixed-method study of *community ecological narratives*—shared stories through which community members articulate their relationship to the environment. During 2004-05, we interviewed residents of Macon County, NC about their connections to place, perceptions of environmental change, and hopes for the future of the local landscape. Excerpts from the interviews were included in a video documentary, which was presented at public community meetings to stimulate dialogue around landscape change. From this participatory research process, we identified narratives that could motivate community members to collectively protect valued natural resources. A sample survey and focus groups were then used to gauge support for these narratives among community members at large. Results suggest that calls for collective natural resource management can garner widespread community support if framed through locally-salient narratives.

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Land use change and water quality in the southern Appalachians

Barton D. Clinton† and James M. Vose
USDA Forest Service Southern Research Station, Coweeta Hydrologic Laboratory

The rapid pace of land use change associated with human population growth requires that we understand the impacts of various land uses on water quality. In the southern Appalachians, the most notable change is an increase in urban/suburban land use, and a decrease in forest land uses. Resource managers, planners, and policy makers need to understand the trade-offs of land use decisions on water quality. We present results from two studies; 1) cumulative effects of land use practices, 2) impacts of urbanization and mitigating effects of forests.

We monitored stream chemistry, pH, conductivity, temperature, and bacteria. For cumulative effects, variation in water quality was related to changes in several landscape variables. In the urban study, we examined a forested landscape's influence on water quality of a stream originating in an urban setting. In the cumulative effects study, baseflow water quality was high and consistently decreased downstream. Large, steep gradients in parameters were observed during stormflow. Most parameters exhibited significant relationships with landscape variables. In the urban study, water quality was consistently higher as you move downstream from the urban into the forest site. These results suggest that even small reaches of undisturbed forest streams can improve water quality through in-stream processing and dilution.

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The Strategic Conservation Plan for North Carolina: Utilizing the green infrastructure approach

Judy Francis†[1] and Kim Douglas[2]
[1] NCDENR Office of Conservation & Community Affairs
[2] NCDENR Natural Heritage Program

North Carolina is experiencing intense growth pressure and the trend is expected to continue for at least the next 25 years. The spatial characteristics of that growth are having a significant impact on our state's natural heritage and our ability to undertake effective conservation and preservation activities. Though the state has a very respectable conservation budget, decisions about acquisitions and preservation efforts are often made with little understanding of how each effort fits into a larger picture. Utilizing a "Green Infrastructure" approach, the state of NC has undertaken a statewide conservation planning initiative with the goal of identifying, evaluating, and prioritizing an interconnected network of essential ecosystems including ecological, recreational, working lands and coastal habitat characteristics. This emerging tool will help us make better informed funding decisions, establish effective partnerships, and facilitate more effective conservation outcomes.

The presentation will consist of a PowerPoint show with two parts. First, an overview of the concept of Green Infrastructure including its fundamental premises, types and scales of applications, and benefits of the approach. The second part of the presentation will include specific information about the type of information the NC planning process is compiling, the challenges we are facing, and a timeline for availability of applications. There will also be a discussion about user group feasibility and access to the data used in the maps. The session will conclude with Q &A and an invitation to participate in an online peer-review survey. The results of this survey will be used to refine the plan and improve its usefulness as a tool for a variety of organizations involved in conservation activities.

† NCDENR Asheville Regional Office, Office of Conservation and Community Affairs, 2090 U.S. 70 Highway, Swannanoa, NC 28778; judy_francis (at) ncmail.net

A conservation partnership to protect Rocky Fork

Dave Ramsey and Rex Boner

This presentation offers an overview of the Rocky Forks area and the partnership among the Appalachian Trail Conservancy, The Conservation Fund, the US Fish & Wildlife Service and others approach to conserving it. Rocky Fork is a large contiguous forested tract previously owned by a private forestry company.

Sustainable Community Forestry Program: Making the shade

Larry Morris†, Georgia Forestry Commission

This presentation explores how public/private partnerships can use trees to effectively address community health issues.)

Perhaps the most overlooked aspect of playground safety in public schools is the lack of students' protection from the sun. The traditional design of elementary schools typically eliminates existing shade trees and the safety and health benefits they provide. Recent studies have revealed several alarming facts:

- Elevated surface temperatures of playground equipment can cause 2nd degree burns within 3-5 seconds after contact with a child's skin.
- Children's skin damage can occur in as little as 15 minutes of overexposure to ultraviolet radiation.
- Elevated playground temperatures reduce air quality and increase risks for children with asthma and other lung-related issues.
- Children are more susceptible to ground level ozone because they often play outside on hot, muggy days.

To combat safety and health related problems on playgrounds, in January 2006 the Georgia Forestry Commission's Sustainable Community Forestry Program (SCFP) developed "Making the Shade." This unique program was designed to be a national model for the strategic placement of shade trees around school playgrounds. "Making the Shade" began with the selection of two demonstration schools in Marietta and Athens, each of which received grant funding from SCFP. SCFP also met with the LaGrange, Georgia-based Floor Covering division of Milliken & Company, an international textile and chemical manufacturer.. For more than a century, Milliken has been an active proponent of environmental stewardship, including tree planting in Georgia and other states. Milliken immediately recognized "Making the Shade" as an innovative opportunity to enhance the health of communities in Georgia where they have manufacturing facilities and agreed to fund a third school in LaGrange.

The completed projects for the 2006/07 planting season are detailed as follows:

School	# of students	# of Trees Planted	Funding Amount	# of Partners	Matching Funds by Partners
Cheatha	1014	47	$9947 by SCFP	5	$11,000
m Hill Elem.					
Franklin Forest Elem.	503	24	Confidentiality requested by Milliken	5	$7180
Gaines Elem.	423	60 trees, 130 seedlings	$7500 by SCFP	10	$11,976

For the 2007/08 planting season, funding for "Making the Shade" is again available from SCFP and from Milliken & Company on a competitive basis so that students will have a healthier, safer environment in which to study and play.

† Sustainable Community Forestry Program, 1055 East Whitehall Road, Athens, Ga. 30605; lmorris (at) gfc.state.ga.us

Farming for Bio-diversity? A Case Study of Conservation Management at Hampton Creek Cove State Natural Area.

Lisa Huff†, Tennessee Division of Natural Areas, East Tennessee Section

Hampton Creek Cove (HCC) is a 693-acre natural area located in Carter County, Tennessee near Roan Mountain State Park. The upper boundary is contiguous to the Cherokee National Forest just below the Appalachian Trail (AT) as it crosses the Little Hump and Hump Mountains. The cove has been used by settlers since before the American Revolution. Past land use is apparent at places like the Shell cabin ruins, where there are vestiges of mature butternut trees and remnants of stonewalls built circa late 1800s to early 1900s.

Besides its historical significance, HCC is a panoply of plant and animal bio-diversity. The cove lies between 3,000 to 4,800 feet elevation. The elevation change contributes to the bio-diversity, as do the complex terrain and the Left Prong of Hampton Creek, which drains young and mature forests, seeps, and farmland within the cove. The Left Prong is one of the most productive native trout streams in East Tennessee and is presently undergoing

brook trout restoration and protection, directed by Trout Unlimited and the Tennessee Wildlife Resource Agency. Seeps and boggy habitats are found on nearly all slopes and provide habitat for burrowing crayfish and salamanders.

Hampton Creek Cove is managed by the Southern Appalachian Highlands Conservancy (SAHC) in partnership with the Tennessee Division of Natural Areas. SAHC employs a caretaker, born and raised at Hampton Creek Cove, who grazes cattle and horses on approximately 100 acres of pastureland within the area. He also raises several acres of crops, predominantly potatoes. Miles of fencing have been installed to protect the integrity of the creek and other riparian areas from the livestock operations.

The old field/forest succession provided by the livestock operations at HCC is excellent nesting habitat for golden-winged warblers, a declining neo-tropical migrant species. Because the area is so important to this warbler, the National Audubon Society designated it an "Important Bird Area" in 2005.

This presentation provides an overview of the life forms cataloged at HCC thus far and highlights the management partnerships necessary to maintain bio-diversity.

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Sustainable biomass supply, demand, and landscape resources—To be used well, degraded, or invaded?

Jerry S. Olson†, Virginia Dale[1], Wilfred (Mac) Post[1], William Hargrove[2], Tristram West[1], Elizabeth Peelle
[1]Environmental Sciences, Oak Ridge National Laboratory
[2]Eastern Forest Threat Assessment Center, USDA Forest Service, Asheville

Planned biomass technologies and facilities require "catching up" on ecology of biomass and optimizing of credible fuel uses. Man and Biosphere (MAB) consortium sponsors are separately pushing cellulose growth (DOE, USDA) and threats [Forest Service, the National Park Service (NPS), Nature Conservancy, and grass-roots protection groups]. How will risks and choices by and for communities affect landscape-scales? Many generations of plants, pests, and people will change southern Appalachian sub-regions! Decisions and actions will vary. Geographic Information Systems (GIS) maps can serve citizens, researchers, and managers, on contrasting geographic scales. Dynamic models could help to quantify choices and effects of biomass energy—for Appalachia, and the world:

Previous research by the lead author identified world ecosystems, ranked by plant biomass, where there is potential for energy harvest and renewal—from plants' photosynthesis. Finer resolution [from 30 arc-minutes, to 10' to 30" (~1 km): databases can now be coupled with dynamic models about the balance—or imbalance—of biomass and its organic carbon.. Globally, MAB can treat equations affecting greenhouse gases and climate change (Olson 1991). But the latter (Waseda University overview) warned of risking American or Asian cultural values. Zoom to 30 meter pixels (of Thematic Mapper, TM; Iverson et al. 1988) can help human community choice of land uses that complement mere burning of fuels and biological communities. From Oak Ridge to the Cumberland Mountains and Plateau (Druckenbroad, Dale, and Olsen SAMAB poster 2004), can biodiversity and terrain uses besides biofuels be reconciled with optimal, sustainable cellulose fuel harvest? A UT student assessment of credible cogeneration burning and fluid fuel technology aimed for compatibility with conservation priorities in my Ecological Assessment class of the early 1980s. "But can large-scale clearcut chipping, like 'cheapest possible' pulp harvest cycles, or more selective (coppice with standards?) even be reconciled with energy costs of transport? And of management overhead investments?" We propose Tennessee RD&D tests to answer this question and to reconcile dedicated amenity and wildlife planning with market-driven woodlot and biofuel cropping. West's 30 m database to North Dakota can evaluate farm-crop options. Peelle's farmer production

and demand progress in North Dakota could span the intervening states, with realistic societal constraints. Test areas can be nested within Hargrove's sub-km grids, that the Forest Service will be updating in ~real time for the rest of the 48 states—before biomass crop trends go farther than anybody likes.

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Promoting sustainability at ETSU: Changing a university's carbon culture

Elana Gulas†[1], Micky Morton[2], Kevin O'Donnell††[3], and John Paul Plumlee[4]

[1] Business Department and Initiative for Clean Energy (I.C.E.), East Tennessee State University

[2] Department of Education and Initiative for Clean Energy, East Tennessee State University

[3] English Department and Environmental Studies Academic Program, East Tennessee State University

[4] Southern Alliance for Clean Energy

In spring of 2006, an ETSU student group, Initiative for Clean Energy (I.C.E.), formed in response to concerns about regional pollution and environmental issues, with the goal of promoting clean energy, recycling, and sustainability in general on the ETSU campus. The group was formed and works with the help of the Southern Alliance for Clean Energy.

By the end of spring semester 2007, we had developed support from university administrators—including a substantial budget line—to implement a campus-wide recycling initiative. This fall, a new dormitory, Governor's Hall, will be used to showcase environmentally-sound practices, thanks in large part to this student group. We also enter the fall with momentum to push more broadly for green building practices on campus, as well as for conservation and clean energy.

In this presentation at SAMAB, we will describe this sustainability initiative. We'll talk about what we've done so far, and about the challenges we face in the near term as well as the long term. And we'll discuss the initiative in the broader context of what's being done at other universities in the region.

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STOP INVSIONS NOW!
A WORKSHOP ON THE PREVENTION AND EARLY DETECTION OF INVASIVE PLANTS

October 23-24, 2007 (Robert Taylor room)

Organizers:

Nancy Fraley, National Park Service, Southeast Exotic Pest Plant Management Team

And Rita Beard, National Park Service Invasive Plant Coordintor

Moderator:

Nancy Fraley

Land and water managers have learned that managing an invasive plant once it is established in an area is an expensive and time consuming effort, and often success is uncertain. Success with invasive species is most likely if we prevent their introduction or identify them so early that populations do not become established.

Some of the country's leading experts in management practices that prevent introductions and enhance early detection will share what are now becoming "best practices" for all types of activities that might spread invasives. Their presentations will help participants learn how to adapt these management practices to fit their specific management objectives. Presentations also address Cooperative Weed Management Areas—that involve state, federal, municipal and private partners—and how these partnerships can be structured for greatest effectiveness.

Success at limiting new introductions to the southern Appalachians will require the collective efforts of all of us who have responsibility for land and water resource management. Park and protected land managers, watershed managers, foresters, transportation biologists, and many others will benefit—and have a key role in—preventing introduction and minimizing the spread of new invasive species. Every effort at prevention reduces costly management needs later.

Presenters and their topics are as follows:

Introduction, *Nancy Fraley and Rita Beard*

The state of the regions, *participants*

Invasives on the move and what you can do about them!!! Preventing and monitoring for invasions in a transportation context, *Bonnie Harper-Lore, Federal Highway Administration, Restoration Ecologist*

SE-EPPC early detection and distribution mapping system (EDDMapS)—A mapping tool to identify where known invasive plant threats are relative to your managed area and how to report new sitings, *Charles Bargeron, Technology Coordinator, University of Georgia*

CWMA "Cookbook": A step-by-step guide on how to develop a Cooperative Weed Management Area in the eastern United States, *Nancy Fraley, National Park Service Coordinator for the SE Exotic Pest Plant Management Team*

Invasive plant responses to silvicultural practices in the South—What to do if you're disturbing the soil, *Dave Moorhead, Professor of Silviculture, Warnell School of Forestry, University of Georgia*

Using contracting to minimize invasives introductions

An overview of the USDA Forest Service's (Region 8) program status, progress and emphasis, *Alix Cleveland, USDA Forest Service Region 8, Botany/Range Program Manager*

An overview of the interagency Burned Area Emergency Rehabilitation (BAER) program and opportunities for prevention and early detection, *Richard Schwab, Department of Interior, BAER Program Coordinator*

National Park Service prevention measures and how they can work for your protected areas, *Rita Beard, National Park Service, Invasive Plant Coordinator*

Applying these tools at home: A hands-on-exercise to identify situation-specific strategies for prevention and early detection, facilitated by *Dave Moorhead, Professor of Silviculture, Warnell School of Forestry, University of Georgia*

IMPROVING PASSAGE AND HABITAT CONDITIONS FOR FISH

October 24, 2007, 8:30 – 10:00 a.m. (Alfred Taylor Room)

Assessment of Barriers to Aquatic Organism Passage in the Little Tennessee River Watershed

Anita Laraine Goetz[1] and Andrea Jo Leslie†[2]
[1] U.S. Fish and Wildlife Service
[2] Ecosystem Enhancement Program, NC Department of Environment and Natural Resources

Recent studies in the southeastern United States have demonstrated that culverted road crossings are significant barriers to the movement of aquatic organisms, especially small-bodied fish. Much of the culvert assessment work performed in the southeast has been on US Forest Service lands. A majority of the land in the southern Appalachian Mountains is in private ownership.and undergoing significant development pressure. While there has been substantial information collected at dams, no assessment and inventory work has been performed on culverted road crossings and other small barriers on private land in North Carolina. This study will determine how significant culverts and other structures are in impeding aquatic organism passage in tributary streams of the upper Little Tennessee River, in Macon and Swain Counties.

A collaborative team of scientists and environmental managers has developed a plan to inventory and assess barriers to small-bodied fish movement on private lands and Department of Transportation right-of-ways on tributaries to a 23 mile section of the Little Tennessee River. The Little Tennessee River hosts the greatest diversity and abundance of native aquatic species in western North Carolina; it is also home to a number of state and federally-listed threatened and endangered species, some of which are in recent decline.

This study uses modified US Forest Service protocols to assess culverts and other potential barriers, measuring physical dimensions of the structures and applying models of swimming ability developed for fish of the Appalachian region. Fish communities will be assessed upstream and downstream of a subset of potential barriers in order to inform determinations on passability. This study will result in the identification of barriers to small-bodied fish movement and will prioritize each barrier for replacement or rehabilitation. Methods developed to inventory and assess barriers to aquatic organism passage in this study will be useful to future inventory and assessment work in other streams in North Carolina.

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Utilizing an Engineered Waterfall to Correct Stream Flow and Protect a Restored Southern Appalachian Brook Trout Population

Bart D. Carter†[1], John S. Morrow[2], Joseph C. Zimmerman[2], Marcia S. Carter[3], Scotty J. Myers[3], Lisa Huff[4], Judy Murray[5], and the members of the Overmountain and Cherokee Chapters of Trout Unlimited.
[1]Tennessee Wildlife Resources Agency
[2]Natural Resources Conservation Service
[3]USDA Forest Service
[4]Tennessee Department of Environment and Conservation
[5]Southern Appalachian Highlands Conservancy

An engineered waterfall was installed in 2007 in Left Prong Hampton Creek (Hampton Cove State Natural Area, Carter County) to replace a failing rainbow trout passage barrier installed in 1997. The new waterfall also corrected stream channel alignment and water

flow obstruction created by an existing culvert at a road crossing. An Embrace-A-Stream Grant was secured by the Overmountain and Cherokee Chapters of Trout Unlimited (TU) to partially fund the project. Ensuing, partnerships between TU, Tennessee Department of Environment and Conservation (TDEC), Southern Appalachian Highlands Conservancy (SAHC), Natural Resources Conservation Service (NRCS), USDA Forest Service (USFS), and Tennessee Wildlife Resources Agency (TWRA) were formed. The trout passage barrier/road crossing was completed in August 2007 and is now functioning as an effective road crossing for administrative use and as a protective barrier to Tennessee's most abundant southern Appalachian brook trout population.

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Identifying natural barriers for brook trout reintroduction in mountain streams of the southern Appalachians

Hugh Irwin†[1] and Sara Dibacco[2]
[1] Southern Appalachian Forest Coalition
[2] Nicholas School of the Environment, Duke University

Brook trout (*Salvelinus fontinalis*) has been extirpated from much of its former range in the Southern Appalachian mountains. Many of the streams with remaining populations of brook trout contain the introduced northern strain or a mixture of the northern and southern strains rather than the native southern strain of brook trout. The native southern strain does remain in some of the more remote mountain streams in the region, and the opportunity exists to re-establish healthy native brook trout populations in many stream segments. Introduced rainbow trout (*Oncorhynchus mykiss)* and brown trout (*Salmo trutta)* occupy many of the streams formerly occupied by brook trout in the Southern Appalachians. Brook trout does not compete well with established populations of these species. Thus brook trout reintroduction efforts depend on removing the introduced trout from stream segments before native brook trout can be restored to the segments. If there are unimpeded migration routes, the non-native species can easily reoccupy the stream segments, rendering the brook trout reintroduction ineffective. Thus successful reintroduction efforts depend on finding or establishing barriers to migration that can effectively isolate the reintroduced brook trout.

A study to identify natural barriers within a mountain headwaters watershed in North Carolina will be presented. This watershed, the Fires Creek Watershed in the Tusquitee District of Nantahala National Forest, currently has no known remaining populations of native brook trout. However, it would have been within the range of the species. Most of the watershed falls within parameters favorable for brook trout, but it is occupied by non-native trout species. The US Forest Service and the North Carolina Wildlife Resources Commission both have a strong interest in reestablishing brook trout in this and other suitable mountain watersheds.

A stream survey was conducted on the streams in the Fires Creek Watershed to identify natural barriers that would allow isolation of stream segments so that non-native trout can be removed and native brook trout can be effectively reintroduced from a watershed nearby. Natural barriers, consisting of waterfalls and cascades of sufficient height and extent to block upward movement of trout, were identified through field surveys. GPS points were taken of the barrier locations in order to be able to locate the barriers on GIS maps.

The system of streams and stream segments within the watershed isolated by barriers will be presented. The strategy for using these barriers in the reintroduction effort will be discussed. An effort to use GIS modeling in conjunction with the data from this survey to predict natural barriers will also be discussed. If successful, this modeling could allow stream surveys in other watersheds to be targeted to stream segments most likely to contain natural barriers.

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STREAM FLOW NEEDS FOR ECOLOGICAL HEALTH

October 24, 2007, 10:30a.m. – 12:00 p.m. (Alfred Taylor room)

Using Watershed Signals as a Means of Evaluating Sustainability and Climate Variability for Natural Resources

R.W. Gentry†, Institute for a Secure and Sustainable Environment, University of Tennessee, Knoxville

Resource managers in the future will be required to make decisions regarding complex systems under extreme uncertainty and to evaluate the sustainability of these systems. Emerging tools to help decision makers are currently being researched and may show long-term promise. However, data is not often collected at a frequency interval that is useful, or necessary. Some of these new emerging techniques will be explored along with a conceptual framework for their use.

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Longitudinal Flow Comparisons for Six Tributaries of the Little River

Carol Harden[1]†, Christopher Morris[1], Anne Wambersie[1], Keri Johnson[2]

[1] Department of Geography, University of Tennessee

[2] Tennessee Valley Authority

Effective protection of minimum in-stream flow requires knowledge of the locations of water sources and sinks for a stream, especially under low flow conditions. The extent to which different areas of a watershed are water sources for a stream at a given time can be initially assessed using longitudinal flow data. We measured flow in eight tributaries of the Little River (Blount County, Tennessee) periodically between September 2006 and July 2007 as part of a larger effort to document flow and water quality in the Little River watershed. In six of the tributaries—Ellejoy, Nails, Pistol, Crooked, Reed, and Carr Creeks—we monitored flow at two or more cross-sections, thereby gaining the opportunity to compare flows longitudinally for sets of measurements made within hours in dry conditions.

Flow does not always increase downstream. In Reed and Carr Creeks, east of the Little River and southeast of Chilhowie Mountain, downstream sites had lower flows than upstream sites throughout the year (Carr Ck.) or in the dry summer (Reed Ck.). In Crooked, Ellejoy, Nails and lower Pistol Creeks, in the Ridge and Valley ecoregion, the proportion of flow at upstream and downstream sites varied throughout the year, but maintained a similar, downstream-gaining, trend. Crooked Creek, in which five sites were monitored, showed relatively consistent ratios of flow between sites over a range of flow regimes. Flow relationships in lower Pistol Creek, from Bessemer Street (below the dam in Maryville) to the mouth, were more variable than in other streams. We rarely found channel segments serving as conduits; rather, water sources appeared to be widely distributed in these subwatersheds.

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Water availability for ecological needs in the upper Flint River Basin, Georgia—A USGS Science Thrust project

W. Brian Hughes†[1], Mary C. Freeman[2], M. Brian Gregory[1], and James T. Peterson[3]
[1] U.S. Geological Survey Georgia Water Science Center,
[2] U.S. Geological Survey Patuxent Wildlife Research Center, Institute of Ecology, University of Georgia, Athens, Georgia
[3] U.S. Geological Survey Georgia Cooperative Fish and Wildlife Research Unit, D.B. Warnell School of Forest Resources, University of Georgia, Athens

The Flint River Science Thrust project of the U.S. Geological Survey is part of a federally-funded program to address key National science priorities including landslides/debris flows, fire science, integrated landscape monitoring, and water availability. The purpose of the project is to advance the science needed to specify the hydrologic conditions necessary to support flowing-water ecosystems. This information is critical for management of water supplies. Specific project goals include:

- Develop conceptual models that relate hydrology, geomorphology, and water quality to biological management objectives.
- Evaluate and determine the major factors driving the conceptual models and determine additional data needs.
- Use the upper Flint River Basin in Georgia to demonstrate a spatially-explicit predictive model for evaluating water-supply development options that links watershed conditions to biological management objectives.
- Identify research and monitoring needed to address critical uncertainties and data gaps determined during model development.

† U.S. Geological Survey Georgia Water Science Center, 3039 Amwiler Road, Suite 130, Atlanta, GA, 30360-2824, wbhughes (at) usgs.gov.

STREAM RESTORATION

October 24, 2007 1:15 p.m. – 3:15 p.m. (Alfred Taylor room)
Moderator: Terry Seyden, USDA Forest Service, National Forests of North Carolina

Restoration of Wallens Bend Creek and Bank Stabilization along the Clinch River to Reduce Sediment near Threatened Mussel Shoals

Mike Adams†, FMSM Engineers, Ecosystem Restoration Group

The Clinch River in Northeastern Tennessee supports some of the most diverse, and threatened, mussel shoals in the world. Sediment produced by agriculture, mining, and other anthropogenic activities upstream has endangered the stability of this fragile ecosystem. The Tennessee Stream Mitigation Program, in conjunction with The Nature Conservancy and the Tennessee Wildlife Resources Agency, identified a tributary to the Clinch River called Wallens Bend where suitable restoration practices could significantly decrease the amount of erosion and sediment subsequently entering the Clinch River system. The Wallens Bend site was a 2,400 linear foot tributary that had been channelized and was actively incising into the valley floor. In addition, approximately 400 linear feet of a section of bank along the Clinch River was selected for stabilization due to excessive bank erosion. This presentation discusses the process of identifying potential restoration sites; conducting assessments to identify the existing condition of impacted streams; collecting and analyzing relevant geomorphic and sediment data; developing channel plan, dimension and profile geometry; selecting appropriate vegetation; acquiring agency buy-in for restoration in an environmentally sensitive watershed; and constructing the project in an environmentally sensitive area and according to plans. The project was designed utilizing a combination of empirical and theoretical methods. Dimensionless ratios derived from a reference condition provided the foundation on which the design was developed; however, before the design was finalized a series of analytical equations were utilized to assess the sediment transport characteristics of the stream. To minimize the intrusion of equipment into an environmentally sensitive area, the tributary was relocated in the historic valley bottom and the sinuosity was greatly increased, adding approximately 2,000 linear feet to the channel. The eroding bank along the Clinch River was reconstructed by decreasing slope, adding a bench for energy dissipation and adding hydraulic structures to not only divert flow but to protect the existing mussel habitat. The net result of the project is a significant reduction in bank erosion at both sites and an increase in biodiversity in the channel bottom and riparian corridor.

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An overview of stream restoration design and construction approaches in the Southern Appalachians of Tennessee

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The term “stream restoration” can mean many things depending on the eye of the beholder. The National Research Council’s (NRC) official definition in its 1992 report, *Restoration of Aquatic Ecosystems*, defined restoration as the "return of an ecosystem to a

close approximation of its condition prior to disturbance." In the same report, a more detailed definition states that "the term restoration means the reestablishment of pre-disturbance aquatic functions and related physical, chemical and biological characteristics." While restoration in its purest since is not always practicable or attainable given current landscape conditions, objectives that aim to improve channel stability, water quality, aquatic and riparian habitat and the overall function of significantly degraded streams are commonplace. This presentation focuses on recent strategies that incorporate process (analytical) and form (analog) based design approaches using natural materials to remedy the causes of physical degradation. Examples of before, during and after project implementation illustrate different design approaches and construction techniques. The presentation includes insight into lessons learned and raises questions about measuring the success of restoration projects in light of attaining their objectives.

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Third Creek restoration project, Knoxville, Tennessee

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The Tennessee Stream Mitigation Program, in partnership with the City of Knoxville and the Knoxville Utilities Board, has sponsored the restoration of 6,900 linear feet of Third Creek and 700 linear feet of an unnamed tributary in Knoxville, Tennessee. The purposes of the project are to improve habitat and water quality while providing stream mitigation credits within the Fort Loudon Tennessee River Reservoir watershed. Third Creek and the tributary have been impacted by watershed urbanization, utility construction and dredging. In addition to being unstable in terms of erosion and deposition, Third Creek is listed on the state's 303(d) list of impaired waters due to nutrients, siltation, habitat alteration, and pathogens.

The restoration project as designed includes the following elements:

- Constructing sections of new stream off-line of the original streams, with dimensions and slopes in balance with sediment movement and with features that promote habitat diversity.
- Restoring the floodplains by lowering the bank heights and allowing flood flows to spread out, reduce stress on the channel and help filter pollutants through planted vegetation.
- Removing invasive species (including bamboo and privet) and planting native riparian trees, shrubs and grasses to provide shade, improve bank and floodplain stability and enhance the terrestrial habitat.
- Establishing a Land Preservation Agreement to protect the restoration project in a permanent conservation easement.

Construction took place between August 2006 and April 2007. A geomorphic and vegetation monitoring phase is currently underway.

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The Rivercane (*Arundinaria gigantea*) Restoration Project: Protecting a resource through scientific investigation and community education

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Rivercane (*Arundinaria gigantea*) is one of three bamboos native to the U.S. and was once abundant in the southeastern states, growing on the floodplains of low energy rivers and streams. Since European settlement, development and agriculture have decimated and fragmented rivercane habitat in western North Carolina. The few large cane patches

that remain are at continued risk of destruction. From an environmental perspective, rivercane is an important riparian ecosystem with great bank stabilization potential. From a cultural perspective, the destruction of rivercane "brakes" has been a disaster for the Eastern Band of Cherokee Indians (EBCI). Rivercane with desirable physical characteristics for use by artisans (high branches and large culms) is no longer abundant. In response to this loss, the Rivercane Restoration Project (RRP) has been initiated with two objectives: establish biophysical controls of *A. gigantea* and educate landowners, students, and the public about the merits of *A. gigantea*.

To establish biophysical controls on the plant, soil from 20 sites was characterized for hydraulic and nutrient properties. Restoration potential appears highest in sandy, well-drained soils and soil texture analysis using the "feel" method finds sands and loams to be dominant. Munsell soil color analyses indicate chromas of 3 or 4 and the saturated soil hydraulic conductivity of soils is high. Both of these data indicate non-hydric soils despite current facultative wetland status for the plant. For the educational outreach, land owners were contacted on data collection visits and informed of the merits of the plant while the general public was engaged at regional fairs and festivals through our informational tent and EBCI basket weaving demonstrations. Project t-shirts and media coverage have also boosted public awareness. This fall, members of the RRP will engage middle and high school students in the public school system in Cherokee to teach about some of the discoveries made through the RRP.

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