Meeting the Challenges of a Changing Region

14th Annual SAMAB Conference
November 4-6, 2003
Renaissance Hotel
Asheville, North Carolina

SOUTHERN APPALACHIAN MAN AND THE BIOSPHERE
SAMAB

14th Annual SAMAB Conference: Overview

Tuesday, November 4			
8:30	Welcome and Opening Remarks: Larry Hartmann, Robb Turner, Gary Peeples (Salon A)		
9:00	Keynote Address Barbara Weber, USDA Forest Service, Associate Deputy Chief for Research and Development (Salon A)		
10:00	Break		
10:30	Facing the Threat of the Hemlock Woolly Adelgid (Salon A)	Managing Growth Around Protected Areas: Empowerment through Collaboration (working lunch: cost payable at conference registration or at the workshop) (Swannanoa)	Traversing the Landscape: Highways and Trails (Victoria)
12:00	Lunch on your own		Lunch on your own
1:30	Facing … Hemlock Woolly Adelgid (cont'd) (Salon A)		Mapping and GIS for Planning and Protection (Victoria)
3:00	Break		Break
3:30	Facing … Hemlock Woolly Adelgid (cont'd) (Salon A)		Mapping and GIS (cont'd) (Victoria)
6:00	Dinner reception at the Grove Arcade		

Wednesday, November 5		
8:30	Protecting and Restoring Southern Appalachian Streams and Rivers (Salon A)	Dealing with Invasive Plants and Insects (Victoria)
10:00	Break	
10:30	Protecting and Restoring Southern Appalachian Streams and Rivers (cont'd) (Salon A)	Dealing with Invasive Plants and Insects (cont'd) (Victoria)
12:00	Lunch on your own or NEPA / Environmental Coordination Roundtable Luncheon (by registration) (Eagle)	
1:30	Environmental Monitoring by Communities and Citizens: The Public's Role in Research and Management (Salon A)	Air Quality: Understanding the Issues (Victoria)
3:00	Break	
3:30	Environmental Monitoring by Communities and Citizens (cont'd) (Salon A)	Break
4:00		Air Quality Improvements for the Great Smoky Mountains National Park: Hiker Health, Air Quality and Traffic Congestion (Victoria)
5:30	Poster Session with light hors d'oeuvres; SAMAB Awards (Salon A)	

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12:00	Lunch on your own			
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14th Annual SAMAB Fall Conference

Meeting the Challenges of a Changing Region

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Photo Credits for Cover Page:
(1) Rusty Rhea, USDA Forest Service
The tell-tale white fuzz of hemlock woolly adelgids marks this hemlock branch.
(2) Virginia Faust, NC Division of Community Assistance
The Division provides planning assistance to communities' downtown revitalization projects.
(3) Water Resources Research Center at the University of Tennessee
The Water Resources Research Center led this Love's Creek stream-bank stabilization project on the property of Holston Middle School. The project was carried out under a 319 project grant to the Southeast Water Quality Forum, with the partnership of the NRCS, the Knoxville CAC Americorp team, the city of Knoxville, TVA, Knox County Schools, and the Knox County Soil and Water Conservation District.
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14th Annual SAMAB Conference
Meeting the Challenges of a Changing Region

ABSTRACTS

(organized by session, in order of occurrence)

FACING THE THREAT OF THE HEMLOCK WOOLLY ADELGID

Tuesday, November 4, 2003
Session Chairperson: Carroll Schell, Great Smoky Mountains National Park

Past, Present, and Future of Hemlock Woolly Adelgid
Rusty Rhea, USDA Forest Service

Hemlock woolly adelgid, *Adelges tsugae*, an insect pest species native to Asia, was first identified in the eastern United States in the early 1950s near Richmond, Virginia. Eastern hemlock species, Carolina *Tsugae caroliniana*, and eastern *T. canadensis* in their natural settings occur on a multitude of sites. Eastern hemlock is found most often in riparian areas where it plays a vital and in many cases irreplaceable role. The adelgid has the potential to eliminate both hemlock species from their natural settings. Once infested by the hemlock woolly adelgid (HWA) it is eminent that the hemlock tree will succumb to the adelgid and die. It is agreed by anyone familiar with the hemlock woolly adelgid that it poses a significant threat to the hemlock resource as well as the ecosystem they help comprise throughout the east. This introduced pest is currently impacting hemlock resources in 15 states in the eastern United States. Since its introduction this insect pest has become well established in hemlock forests from New England into the southern Appalachian Mountains.

In the early 1990s, as the adelgid problem grew and the potential impacts were realized, concerned resource managers from many state and federal agencies, universities and special interest groups convened and formed the Hemlock Woolly Adelgid Working Group. This ad hoc working has for the past 10 years provided leadership and direction within all aspects of the HWA arena. The group serves a vital role and has helped make great strides within the HWA issue. This group has helped develop priorities and focus resources to effectively and efficiently deal with the HWA problem. To date the highest priority of the group has been to develop the area of biological control. This management strategy is possibly the only hope for the natural hemlock populations throughout the east. This work is progressing nicely and is the cornerstone within the management potentials for the adelgid.

The direction of many state and federal agencies along with universities has been to move forward with the establishment and propagation of the biological products, mainly predatory beetles, as resources become available. One of the limiting factors to date within biological control area is the limited number of facilities producing the predatory beetles. The production of predatory beetles is not an easy task and production potential has been limited. With this in mind specialists and resource managers agree that we need many more of the predatory beetles than the current labs can produce to be effective at controlling the adelgid. This is especially true in areas within the south with new and developing adelgid populations. Ideally introduction of the predatory beetles in these new and growing populations would have the greatest impact and ultimately limit damage to the resource.

Hemlock is an important ornamental and landscape tree as well as a keystone species in many unique forested ecosystems. Intervention and protection is possible for hemlocks in ornamental settings. This protection is achieved via chemical insecticides. An array of insecticide alternatives is available for treating hemlocks in these settings, including foliar sprays and systemic treatments. The keys to using chemicals to control adelgid infestations are early detection of the adelgid infestations and rigorous timely treatment programs. Unfortunately the majority of the hemlocks in the east are not candidates for chemical control. There are no feasible chemical treatment options for natural settings. This is due to many factors including accessibility, economics, and environmental constraints. Within these natural

areas we must rely on biological control. Through continued research and rigorous study scientists may find the means to control and manage the HWA and maintain this valuable hemlock resource.

The Save Our Hemlocks Action Team

Robb Turner[†] and Larry Hartmann[‡†]
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[‡]Great Smoky Mountains National Park and SAMAB

The Southern Appalachian Man and the Biosphere Cooperative is working to coordinate the region's response to the threat posed by hemlock woolly adelgids. Current activities are focused on public and land manager's awareness, planning for biocontrol, and environmental review. Activities and progress will be discussed. The Action Team's web site, at www.saveourhemlocks.org, provides more information.

The Economic Impacts of Hemlock Woolly Adelgid

Tom Holmes, USDA Forest Service

The hemlock woolly adelgid is an exotic insect pest that causes mortality to eastern and Carolina hemlocks. Eastern hemlock is an important species in riparian and other ecosystems and the loss of this species may drastically change ecosystem functions throughout the range of hemlocks in the eastern U.S. Calculating the economic impact associated with the loss of eastern and Carolina hemlocks can help natural resource managers prioritize investments in efforts aimed at mitigating and adapting to invasions of this exotic pest.

Scientists in the Southern Research Station, in cooperation with University collaborators, are currently investigating the magnitude of economic impacts caused by the hemlock woolly adelgid. The research program is being conducted in 3 general areas: (1) economic impacts on residential landscapes, (2) recreation and aesthetic economic impacts on publicly owned forested landscapes, and (3) impacts on timber and other economic values.

An overview of the research underway will be provided, as well as some preliminary results. A case study will be presented that demonstrates how the catastrophic loss of hemlock stands in a riparian ecosystem can impact nearby property values.

Responses of Southern Appalachian Ecosystems to Hemlock Woolly Adelgid at the Coweeta Watershed.

Sharon Lumpkin[†], Pauline Spaine[†], Mark Hunter[‡], Hunter Keys[‡]
[†]USDA Forest Service
[‡]University of Georgia

As Hemlock Woolly Adelgid, (*Adelges tsugae*), infestations move down the eastern coast of the United States, the long term prognosis to our terrestrial ecosystems is unclear. In the southern Appalachians, Hemlock species are a particularly important component of riparian zones. For example, it has been well established in the literature, that as stream temperatures rise, game fish, as well as other fish species are lost from the habitat.

The first report of Hemlock woolly adelgid (HWA) infestations at Coweeta Hydrological Lab in Franklin, North Carolina was in January 2003. More recent surveys have found that the primary infestations at this time are along roadways while, in the off road areas infestations remain light to absent.

To examine the effects of the growing infestation, 20 permanent plots, each 40 x 20 meters have been established this year. Ten of the plots have their majority of cover in Hemlock. The other ten plots have the majority of their vegetation types as mixed hardwoods.

These plots will be examined regularly for increased levels of HWA infestation, basal area growth of different forest tree species, and changes in the demography of under-story herbs. In addition, the population dynamics of sensitive species in these riparian areas will be evaluated including, endemic salamanders and other stream species.

Laricobius nigrinus, the Next Biological Control Agent to be Released for HWA
Scott Salom and L.T. Kok, Virginia Tech

Laricobius nigrinus, a derodontid beetle consistently found associated with HWA in western hemlock seed orchards in British Columbia, Canada has been studied at Virginia Tech since 1997. Laboratory and field experiments have shown that this predator is:

- host-specific,
- a voracious feeder,
- has a phenology that is highly synchronous with HWA,
- can survive the winter in Virginia,
- and is present and active when other predators are not.

This insect was released into the field for the first time in winter and spring 2003. We estimate that 12,000 eggs were laid by 144 females that were present in the stand for only part of the season. Establishment and recovery studies are ongoing. Progress in the development of mass rearing procedures has been slow but steady. Some details associated with recent improvements will be shared with the audience.

A concern that *L. nigrinus*, *Pseudoscymnus tsugae* and *Harmonia axyridus* may competitively interfere with each other is currently being investigated. First year lab and field studies indicates that the interaction between *L. nigrinus* and these other two predators will be minimal.

Future work will include additional releases at increasing rates. This will be accompanied by studies that evaluate different release and monitoring strategies as well as impact assessment of *L. nigrinus* on HWA populations.

The Invasion: Status of Eastern Hemlock vs. Hemlock Woolly Adelgid in Great Smoky Mountains National Park
Glenn Taylor, Great Smoky Mountains National Park

Since hemlock woolly adelgid (HWA) was discovered in Great Smoky Mountains National Park in 2002 the infestation has expanded to most areas of the park in 2003. More than 60 infested areas are now known with some areas coalescing to form one large infestation. Management strategies are still foliar spraying with insecticidal soap, soil injection with the systemic insecticide Imidacloprid, and biological control using a tiny beetle known as *Pseudoscymnus tsugae*. Follow up monitoring at 2002 *P. tsugae* release sites is encouraging and production of *P. tsugae* will start this year at the University of Tennessee.

Will Mass-releases of *Pseudoscymus tsugae* Suppress Hemlock Woolly Adelgid Populations?
Paris Lambdin, Jerome Grant, Lee Buck University of Tennessee

Upon discovery of the hemlock woolly adelgid on eastern hemlock in the Great Smoky Mountains National Park in 2002, the National Park Service implemented a program to control this exotic species with mass releases of the ladybeetle, *Pseudoscymnus tsugae*. These coccinellids were released onto infested hemlock trees at ten sites and monitored to determine if they were capable of surviving in the area. We sample for the coccinellids using beat sheets, evaluated the overall appearance of the infested trees, and sampled hemlock woolly adelgid populations from the release tree and 12 neighboring trees at the ten release sites.

Results infer the lady beetle can survive and develop as we found four adult specimens of the ladybeetle at three of the sites in the fall of 2002. The density of hemlock woolly adelgids on branches of infested trees 10 to 28m from the release tree averaged 211 (161-251) per site. Infested trees located 10m from the release tree averaged 183 (91-254), those infested trees up to 17m averaged 258 (186-382), and those up to 28m averaged 187 (167-213) adelgids.

Recovery of The Hemlock Forest at Bushkill Falls After Infestation by Hemlock Woolly Adelgid (Adelges Tsugae)
Richard C. Pais, Ecoscientific Solutions, LLC

Bushkill Falls is the most popular tourist attraction in the Pocono Mountains of northeastern Pennsylvania. The property is

approximately 400 acres and contains steep ravines, picnic areas, large waterfalls, and remote hiking trails. Most recreational areas and scenic overlooks are located within 50-acres of mature hemlock dominated forest. Scattered non-dominant hemlocks are also located throughout the site. Hemlocks on the site include specimen trees over 40 inches dbh and trees in steep inaccessible ravines. Hemlock woolly adelgid (*Adelges tsugae*) (HWA) was first observed on the property in 1992. Mortality of large trees was observed in 1999 and significant new growth had not been observed throughout the forest after 1996. An integrated pest management program was started in 2000. The program began with analysis of tree physiology and forest ecology. Parameters measured included: tree size, stand size, crown density, soil chemistry, soil compaction, depth of leaf litter, aspect, slope, visibility, accessibility for treatment, and disturbance. Representative trees were selected for study of foliar chemistry. Five hemlock habitats were defined and mapped. Unique treatment programs were developed and applied in each habitat. Treatments included insecticide injections (trunk and soil), irrigation, mulching, mass release of *Pseudoscymnus tsugae*, root fertilization, and the application of foliar micro-elements via helicopter. Inspection of representative trees and anecdotal observations in summer 2003 indicated three years of vigorous new growth and a return to normal hemlock needle color, leaf density, and leaf chemistry throughout all habitat types. HWA has been eradicated from large portions of the site.

SAMAB workshop on
MANAGING GROWTH AROUND PROTECTED AREAS
'EMPOWERMENT THROUGH COLLABORATION'

Tuesday, November 4, 2003

Workshop organizer and facilitator: John Peine, USGS Southern Appalachian Field Station

Growth management of human development has become a major concern throughout much of the United States. In the southern Appalachians, sprawl is of particular concern due to the proximity of metropolitan areas to national, state and local parks, forests and parkways. Knoxville, Tennessee, for instance, has been identified as one of the nation's top hotspots of sprawl. Uncontrolled growth is becoming a major problem in the region. The natural beauty of the landscape and culture heritage associated with the Appalachian highlands provides poignancy to societal resolve to respond positively to these environmental stewardship values. The good news is that there are numerous examples of 'sustainable' natural resource stewardship and 'sustainable' development practices in the region. The bad news is that these islands of enlightenment are just that and not widely adapted throughout the region. This workshop is centrally focused on discussing how best to follow these leaders in environmental stewardship and sustainable development.

The objectives of the workshop are

1. Review key growth management strategies applied in Tennessee and North Carolina.
2. Discuss the potential for greater collaboration between state and local planning agencies and non-government organizations dedicated to various dimensions in growth management. Discussion will address the goals and value of collaboration; types of collaboration that are most useful; topics for collaboration; and how collaboration should be facilitated.
3. Create a Web-based map of locations where growth management tools are in place in the southern Appalachian region.

Workshop speakers include Mary English (University of Tennessee's Energy, Environment and Resources Center); Bill McNeill (Director of the North Carolina Division of Community Assistance); and many representatives of efforts that contribute to sustainability in the region, with special focus on western North Carolina.

TRAVERSING THE LANDSCAPE: HIGHWAYS AND TRAILS

Tuesday, November 4, 2003
Session Chairperson: Scott Pearson, Mars Hill College

Topography, Transportation, and Dynamics of Forested Land Covers in the Southern Blue Ridge Province.
Scott M. Pearson, Mars Hill College

The rugged topography of the mountainous Southern Blue Ridge Province has long influenced the use of this landscape by human beings. A primary influence on the region's economy, and therefore the lifestyles of mountaineers, has been the difficulty of transporting people and materials. Railroad and highway construction since the late 1800s played a pivotal role in several transitions in the structure of the regional economy. These economic changes influenced the land use decisions by mountain residents and are reflected in changes in the spatial distribution and abundance of forests and early successional habitats. Maps of landscape change, compiled from remote imagery, show that forest cover has increased since 1950 in the region overall but is now declining around population centers. Using topography and landform to predict forest types, the change in abundance of forest types was measured at 20 yr intervals. Cove hardwood communities were the most dynamic, while ridgetop and high elevation forest changed the least. Fragmentation of forests declined with increasing forest cover. Factors correlated with the probability and degree of change include measures of terrain (e.g., slope and aspect) and proximity to roads and economic centers. The legacy of change has resulted in a mosaic of forest stands in which community composition and successional stage varies with abiotic gradients, landscape context, and disturbance history.

Interaction Between Roadways & Wildlife Ecology: Based on the NCHRP
Alex Levy, Federal Highway Administration

Roadway development choices made in response to population growth can affect many, if not all, forms of wildlife. Such effects include loss of wildlife habitat, fragmentation, mortality, and increased competition. The synthesis reviews and discusses regulatory context (laws, policies, and guidance); transportation planning and development processes; the types of effects, including habitat loss, fragmentation, and chemical and physical impacts; the scale and assessment of effects; analytical tools, including motorist safety studies and wildlife surveys; conservation measures and mitigation; maintenance; and funding sources and deficiencies.

This report from the National Academies' Transportation Research Board summarizes existing information related to roadway planning, design, construction, operation, and maintenance practices being used nationally and internationally, successfully and unsuccessfully, to accommodate wildlife ecology given the challenging background of rapid growth and diminishing natural resources.

It reviews the processes, effects, analytical tools, conservation and mitigation measures, maintenance, and funding involved in constructing an environmentally sustainable transportation system that acts in cooperation with the natural systems supporting modern civilization. Examples from the report will be included in the presentation, along with additional focus on measures being employed in some southeastern states and will also include coverage of the growing problem of deer/vehicle collision mitigation. The presentation will serve as both a census of current activities, as well as a toolbox of practices to help heal and preserve ecosystems fragmented by highway corridors.

The synthesis was developed using information assembled from numerous sources, including data obtained from survey responses of 35 state DOTs in addition to a research literature review. A topic panel of experts was established to guide the author's research in organizing and evaluating the collected data, and to review the final report.

A member of the topic panel, Federal Highway Administration Ecologist, Alex Levy, will make the presentation that may include a slide presentation and video. Relevant publications and media will be made available to conference participants. (Precluded by an early FY03 agency budget shortfall, this presentation was originally scheduled for delivery during the transportation session at the 2002 SAMAB Annual meeting in Gatlinburg, TN).

Southern Appalachians Initiative
Jeffrey Hunter, American Hiking Society

The Southern Appalachians Initiative is an exciting new joint project of the Silver Spring, Maryland based American Hiking Society, and the National Park Service's Rivers, Trails and Conservation Assistance Program. This project is the first regionally focused program of the American Hiking Society, and is based in Chattanooga, Tennessee.

This project seeks to build, promote, and protect a 5,000-mile interconnected network of hiking trails in the southeastern United States. At the core of the initiative is the Southeastern Foot Trails Coalition. This coalition is comprised of more than 20 hiking clubs from the southeast. Working cooperatively, these groups will seek to raise the visibility of hikers and hiking trails by pooling resources and constituents.

In addition to creating additional recreational opportunities in the southeast, this project hold great promise for increased economic opportunities in the communities adjacent to the trail network, as well as expanding conservation corridors in the Southern Appalachians and beyond. The project also seeks to reduce pressure on the much-loved and over-used Appalachian Trail by dispersing recreation onto other trails.

In this program, Southern Appalachians Initiative Director Jeffrey Hunter will introduce this ambitious project to conference attendees. In addition to discussing the various trails that comprise the initiative, Mr. Hunter will also discuss the partnership forged between the American Hiking Society and the National Park Service as a model for conservation initiatives in the region.

GPS-Based Mapping of Natural Resources Using Georeferenced Video
Adam Fiscor, Paul Ayers, Tammy Cheung
University of Tennessee

The new technologies involving Global Positioning Systems (GPS) and Geographic Information Systems (GIS) have revolutionized the data collection, storage, manipulation and display of features useful for natural resource management. Recently georeferenced images have allowed visual information to accompany the digital geographic information embedded in the GIS. This project involves the data collection procedure of georeferenced video for natural resource management. Satellite-based differential GPS information is collected on the audio track of a digital camcorder using the Red Hen VMS Professional. Georeferenced still images and video clips are captured and incorporated into the GIS to develop a database of natural resource management and recreation features. Applications include trail mapping of the Appalachian Trail in the Great Smokey National Parks and underwater video mapping in the Hiwassee and Conasauga River, Sams Creek and Thunderhead Prong. Captured features are determined for each application, for trail mapping including erosion control structures, campsite, signs, bridges, water sources and scenic views. Some of the captured features for underwater mapping include vegetation, typography, rock formations, and fish.

MAPPING AND GIS FOR PLANNING AND PROTECTION

Tuesday, November 4, 2003
Session Chairperson: Tom Tribble, NC CGIA

The National Map and NC One Map
Christopher Kannan[†] and Tom Tribble[‡]
[†]U.S. Geological Survey
[‡] North Carolina Center for Geographic Information and Analysis

The U.S. Geological Survey (USGS) is currently working on implementing *The National Map*. *The National Map* is a consistent framework for geographic knowledge needed by the Nation. It provides public access to high quality, geo-spatial data and information from multiple partners to help inform decision-making by resource managers and the public. *The National Map* enhances America's ability to access, integrate, and apply geo-spatial data at global, national, and local scales.

The North Carolina Geographic Information Coordinating Council (GICC) has adopted a vision for a comprehensive statewide geographic data resource, called NC OneMap. The NC Center for Geographic Information & Analysis (CGIA), which serves as staff to the GICC, is the state government agency responsible for implementing NC OneMap. In North Carolina, USGS and CGIA are cooperating with local and State partners to test technology and procedures for the integration of geo-spatial data common to both The National Map and NC OneMap. This presentation will provide background and activities related to The National Map and NC OneMap and discuss current collaboration and progress in North Carolina.

USDA Geospatial Data Gateway
Mike Hart, USDA - NRCS

The USDA Geospatial Data Gateway provides 'One Stop Shopping' for natural resources or environmental data at anytime, from anywhere, to anyone. The Gateway allows you to choose your area of interest, browse and select data from our catalog, customize the format, and have it downloaded or shipped on CD. It is part of the Geospatial Data Clearinghouse, which is a collection of over 250 spatial data servers. These serve digital geographic data primarily for use in Geographic Information Systems (GIS), image processing systems, and other modeling software. These data collections can be searched through a single interface based on their descriptions, or "metadata."

Introducing the NBII Appalachian Inventory & Monitoring Information Synthesis (AIMIS) Project
*Pamela J. Nabors[†], Brandon League[‡], Wolf Naegeli[‡], Jake Cseke[‡], Patty Day[‡], Robb Turner[‡], Franciel Azpurua[‡], Shelaine Curd-Hetrick[‡], Farial Shahnaz**
[†]TVA/SAIN
[‡]NBII-SAIN
**University of Tennessee*

The mission of the National Biological Information Infrastructure (NBII) is to provide increased access to data and information on our nation's biological resources. The NBII network is being developed through regional and thematic web-based 'nodes.' Our region is fortunate enough to have one of these regional nodes – namely the Southern Appalachian Information Node (SAIN). The NBII Southern Appalachian Information Node (SAIN) facilitates partnerships and creates applications that improve information exchange for research, education, and environmental decision-making in the Southern Appalachian region. (Visit *http://www.nbii.gov* for more information about NBII. Visit *http://sain.nbii.gov* for more information about SAIN.)

This presentation introduces a SAIN project, the goal of which is to synthesize,

integrate, and disseminate information from multiple inventory & monitoring activities in our Appalachian region. One of the purposes of this project is to bridge institutional and geographic boundaries for a much-needed demonstration of the benefits of data sharing and integration. Another is to examine means of documenting quality, including suitability for use, of data that were originally collected for different purposes. An invitation will be extended to join in this venture. A display of GIS and web-based information products created for one of our partners – the SAMAB Southern Appalachian Volunteer Environmental Monitoring (SAVEM) program – will also be highlighted.

Retrieving Little Tennessee Watershed Data for Conservation Use

*Shelaine Curd-Hetrick[†], PJ Nabors[†], Brandon League[†], Joe Henderson[†], Wolf Naegeli[†], Franciel Azpurua[†], Robb Turner[†], Bonnie Carroll[†], Jake Cseke[‡], Patty Day[‡], Farial Shahnaz[‡],Bill McLarney, Emile Elias**
[†]*NBII-SAIN*
[‡]*University of Tennessee*
***Little Tennessee Watershed Association*

The National Biological Information Infrastructure (NBII) www.nbii.gov is a broad, collaborative program to increase access to U.S. biological resources data and information. The NBII network has regional and thematic nodes including the Southern Appalachian Information Node (NBII-SAIN). SAIN encourages partnerships that improve information exchange for research, education, and environmental decision making. As part of the mission to improve environmental decision making, SAIN and its partners identify data for retrieval and assist in making that data accessible to the user. The SAMAB (Southern Appalachian Man and the Biosphere) Southern Appalachian Volunteer Environmental Monitoring (SAVEM) Program identified a continuing study on the Upper Little Tennessee River Watershed which encompasses portions of North Carolina and Georgia.

The Little Tennessee River Bio-monitoring Project was first administered through the Western North Carolina Alliance until 1999, when transferred to the Little Tennessee Watershed Association (LTWA). Under the direction of Dr. Bill McLarney, an aquatic conservation biologist, information has been collected at specified sampling locations to calculate an Index of Biotic Integrity (IBI).

An interactive map which shows (1) water quality and habitat quality from a biological perspective for stream stretches and (2) specific sampling points is currently available through the NBII-SAIN website. Currently, an online input tool to enable direct user access is being developed to smoothly and efficiently continue this work.

This work was produced collab-oratively through the hard work of many volunteers, Information International Associates (www.infointl.com), the Little Tennessee Watershed Association (www.ltwa.org), NBII-SAIN (http://sain. nbii.gov/), SAMAB (www.samab.org), Sunsite (http://sunsite.utk.edu/), TVA (www.tva.gov), University of Tennessee (www.utk.edu) and the Western Carolina Alliance (www.wnca.org).

Watershed-based Tool to Assess Land Use and Development Change

Mark Cantrell[†] and Neil Thomas[‡]
[†] *U.S.Fish and Wildlife Service*
[‡] *Resource Data, Inc.*

The Asheville Ecological Service Field Office of the United States Fish and Wildlife Service (USFWS), Resource Data, Inc. and the Environmental Leadership Center at Warren Wilson College are developing a watershed-based tool to measure and monitor land use and "development change" in western North Carolina. Various data fields from the county parcel data are summarized by (smaller than 14d HUNC) watersheds and by time period. Road centerline data and related attributes are included in the models to calculate road density and other road related characteristics.

Currently no regulatory agency is monitoring this change with data that is regularly updated, provides a very high spatial resolution, and has an historical component. From preliminary studies completed in Buncombe, Haywood, and Union Counties these methods have been successful in measuring and

illustrating development patterns temporally and spatially by 14-digit and smaller watersheds (HUNC). These methods were also used to project future development trends based on the historic data.

The models can support the development of storm water models refining impervious surface estimates that were based on satellite and aerial photo imagery. The models can be used for cumulative impacts analysis when linked to environmental gradients. The raw data can also be used to help update land use and land cover maps when new imagery is not available or the resolution of the imagery is coarse. The models will also help prioritize and target "watersheds of concern" and help the USFWS allocate financial resources for species/habitat management.

Using GIS to Explore the Pattern of Fire in the Southern Appalachians

Hugh Irwin, Southern Appalachian Forest Coalition

GIS has been a crucial tool for the Southern Appalachian Forest Coalition (SAFC) in its conservation work. SAFC initiated its GIS program eight years ago during its first year of being established. As a mapping tool GIS has enabled us to visualize and communicate conservation issues, and proposals to a wide audience. Analysis tools within GIS have allowed us to address questions and develop new data relevant to conservation issues. These efforts culminated last year in a conservation vision/proposal for the Southern Appalachians. Some of the GIS projects and products that went into SAFC's conservation vision and its continuing development will be discussed and displayed. I will also discuss some of the challenges and lessons learned for nonprofits setting up a GIS program on a limited budget.

PROTECTING AND RESTORING SOUTHERN APPALACHIAN STREAMS AND RIVERS

Wednesday, November 5, 2003
Session Chairperson: Phillip Gibson, RiverLink

The Needmore Tract Conservation Project
Sharon Fouts Taylor, The Land Trust for the Little Tennessee

The Needmore Tract is comprised of 4,500 acres in Swain and Macon Counties in Western North Carolina. It contains over 13 miles of biologically intact Little Tennessee River, 37 miles of tributary streams, dozens of wetland sites, and is the heart of a forested corridor connecting the Cowee and Nantahala Mountains. The Tract also contains significant cultural resources dating back over 1,500 years. Starting in the 1920s, the Tract was purchased by the local power company for construction of a hydroelectric project. The project never materialized and the property has been used by generations of local people for hunting, fishing, and farming. In 1999, Duke Energy transferred the tract to their real estate development and land management subsidiary, Crescent Resources. The Tract is now under contract to be purchased by the NC Chapter of the Nature Conservancy for the State of NC to be managed by the Wildlife Resource Commission's as part of their Game Lands Program.

The effort to protect this important segment of Southern Appalachian heritage has been a uniting theme for local people, local and state governments, as well as the conservation community. This effort provides an excellent example of a community pulling together to protect an ecologically significant river and it own sense of place.

Reducing Sedimentation and Improving Stream Habitat in the Brasstown Creek Watershed
Callie Dobson, Hiwassee River Watershed Coalition

Brasstown Creek begins in north Georgia within the southernmost part of the Southern Appalachian Mountains and flows generally northwest into the Hiwassee River in North Carolina. The creek has an 83 square mile drainage area with about 56 percent of its watershed in Georgia and 44 percent in North Carolina. In 1995, North Carolina rated Brasstown Creek as only "Partially Supporting" its designated uses and placed the stream on the State's Section 303(d) list. Sediment was listed as the cause of impairment. In 1998, the Hiawassee River Watershed Coalition (Coalition) submitted a grant proposal to the NC Clean Water Management Trust Fund (Trust Fund) for restoration work in the Brasstown Creek watershed. The Trust Fund awarded the Coalition a $2,100,000 grant for the work, effective May 1999 through October 2002. In 2002, an extension was granted until December 31, 2003. In March 2002, the Blue Ridge Mountain Soil & Water Conservation District received a Section 319(h) Grant for agricultural best management practices, effective until June 30, 2007.

The overall goal of the restoration work in the Brasstown Creek watershed was the removal of Brasstown Creek from North Carolina's Section 303(d) list. The Coalition's proposal to the Trust Fund outlined a watershed approach to address major sediment sources in Brasstown Creek. These include eroded or erodible streambanks, erosion from pastures, riparian areas with insufficient vegetation, and bare areas with proximity to streams. Specific goals as outlined in the proposal were to (1) restore

10,000 feet of eroded mainstem streambank and 10,000 feet of tributary streambank; (2) reestablish 10,000 feet of riparian buffer along the mainstem and tributaries; (3) restore 100 acres of bare, eroding areas within 300 feet of streams; and (4) restore 1,000 acres of pasture lands. The proposal also outlines plans to identify sites for future wetlands restoration and to develop a community education program highlighting the role that wetlands play in reducing peak flows and how wetlands restoration benefits wildlife and water quality.

To-date, 12 stream restoration projects involving nearly 30,000 linear feet of stream have been completed in the Brasstown Creek watershed. In addition, seven critical bare area projects restored more than 160 acres of eroding pastureland and 42 acres of riparian buffer have been established and protected. More than 30 landowners are involved and more than $1.1 million has been spent locally. Brasstown Creek was removed from North Carolina's Section 303(d) List in 2000.

The Coalition continues to work on watershed restoration projects in the Brasstown Creek watershed and others throughout the upper Hiwassee River basin in northern Georgia and southwestern North Carolina. The Coalition works closely with local agency personnel of the Natural Resources Conservation Service as well as local Soil & Water Conservation District staff. These professionals have already established good relationships with local landowners. By getting their buy-in on projects, the Coalition makes strong headway more quickly when an area is targeted for restoration. Strong partnerships are essential for successful watershed restoration and long-term protection of water quality.

Partners For Trout — Restoring and Enhancing Trout Habitat in the South Carolina Mountains

Wes Cooler, Foothills Resource Conversation and Development Council

While South Carolina has about 300 miles of trout streams in its three northwestern counties, many of these streams are of marginal quality due to a variety of factors, mostly related to human activity. Serving as the coordinating agency, the Foothills Resource Conservation and Development Council is working with a broad partnership of State and Federal agencies, conservation organizations, and private landowners to apply a broad variety of solutions to restore and enhance impacted habitat.

Because substantial public funding supports Partners for Trout, priority is given to projects that directly enhance public access or improve habitat in areas public access already exists.

Working with a team of biologists from the Natural Resources Conservation Service, the US Fish and Wildlife Service and the SC Department of Natural Resources, Partners for Trout has developed a prioritized plan of work designed to produce immediate and enduring improvements throughout the program's area of operations.

To date over $250,000 in Federal, State and private funding has been applied to over 20 individual projects ranging from installing cold-water outlets to lakes and ponds, to stabilizing stream banks and installing natural in-stream habitat. Additional projects totaling over $250,000 are currently in the final planning stages and a data collection and evaluation program is in place to document the success of the program and provide feedback for future improvements.

River Restoration Through Citizen Empowerment

Phillip Gibson, RiverLink, Inc.

RiverLink is a regional non-profit organization that has, since 1983, focused on the economic and environmental revitalization of the French Broad River as a place to work, live, and play. RiverLink's French Broad Riverkeeper program began July 2001 in response to the need for a regional ombudsman for the river system and its people. Over the past two years, the French Broad Riverkeeper has responded to citizen requests for guidance and technical assistance in resolving specific issues. Training programs have been developed for the development community and a media campaign has been launched for the general public. While most individual issues are resolved on a case-by-case

basis, it is obvious that the French Broad River watershed is in need of a watershed plan. This plan must involve citizens from both North Carolina and Tennessee. As a first step towards the development of this watershed plan, RiverLink's French Broad Riverkeeper is developing an interactive web-based mapping system that will serve as a community inventory of the watershed's assets and deficits. This interactive map will enable citizens to explore the history of their watershed, determine proximity of waste discharge sites to public swimming and boating areas, and determine regulations that can assist them in protecting their's and the environment's health. This community inventory is set to help the people of the watershed understand consequences in a number of social, economic, legal, ethical, and cultural contexts.

Pigeon River Restoration Project and the Blue Ridge Paper Company
Bob Williams, Blue Ridge Paper Products

Blue Ridge Paper Products (BRPP) operates the Canton Mill in Canton, North Carolina. BRPP was established in 1999 as a stand alone, employee owned business. Prior to the creation of BRPP, the mill was owned and operated by Champion International Corp., at the time, an international company headquartered in Stamford, Connecticut. The Canton Mill started up in 1908. The mill is located about 25 miles west of Asheville. The site was selected by the founders of the Champion Paper Company because of the availability of raw material and a good work force. The facility was built on the banks of the Pigeon River. The Pigeon provides the water to operate the mill and serves as the receiving stream. The mill was modernized in the 1990's but up until that time the mill's effluent had a harsh effect on the Pigeon River ecosystem. As a result of the modernization and the on-going environmental improvements taken by BRPP, Pigeon River water quality has been restored. The water quality improvements have been broad and a project is underway to reintroduce certain non-game fish. The Canton Mill success story is an example of how natural resources and biological resources can be restored while preserving economic vitality in a small community.

A Survey of Pigeon River Re-introduction Efforts
Joyce A. Coombs[†], Virginia Harrison[†], J. Larry Wilson[†], Jonathon Burr[$]
[†]University of Tennessee
[‡]Tennessee Department of Environment and Conservation

Since 2001, eight species totaling 3,223 individuals have been re-introduced into the Pigeon River, an Appalachian stream that once was so polluted North Carolina classified the best use of her waters to be for waste disposal. The river has historically suffered from the cumulative effects of years of pollution and hydrological alteration. In recent years, water quality improvements in the river have led state, federal, and private agencies to re-introduce several species into the river. To assess survival of relocated species, fluorescent visible implant elastomer (VIE) tags were employed. The first re-introductions, which were collected from area streams and tagged before release were blueside darters (*E. jessiae*), bluebreast darters (*E. camurum*), and gilt darters (*Percina evides*). Snorkeling surveys during the summer of 2002 revealed healthy gilt and bluebreast darters, but no blueside darters; observation of untagged gilts suggest reproduction. Subsequent re-introductions have included stargazing minnows (*Phenacobius uranops*), mountain madtoms (*Noturus eleutherus*), stripetail darters (*E. kennicotti*), American brook lampreys (*Lampetra appendix*), and mountain brook lampreys (*Ichthyomyzon greelyi*). Selected mollusks have also been re-introduced, including three genera of common snails (*Io*, *Leptoxis*, *Lithasia*) and five genera of common mussels (*Lampsilis, Cyclonaias, Alasmidonta, Elliptio, Villosa*). Significant reproduction in *Leptoxis* has been documented.

Stormwater Wetland Installation at The North Carolina Arboretum, Asheville, NC

Jon Calabria, North Carolina State University

In the summer of 2002, a stormwater wetland was installed at the Plant Professional Landscape Garden (PPLG) located at The North Carolina Arboretum (TNCA) in Asheville, NC. The stormwater wetland is an example of an end of the pipe, best management practice (BMP) retrofit. It treats pollutants carried in stormwater from a roof top, parking lot and lawn area and also reduces peak discharge, minimizing erosion downstream. This project was designed by the Water Quality Group at North Carolina State University (NCSU) and implemented by The North Carolina Arboretum Grounds Crew. Funding was provided by the Environmental Protection Agency s Section 319 grant program, which is administered through the North Carolina Department of Environment and Natural Resources.

Prior to the installation of the stormwater wetland, stormwater from a roof-top, parking lot and lawn area was released without treatment, causing erosion and degrading water quality. Stormwater was directed into a culvert, which was daylighted near the entrance of the Plant Professional Landscape Garden. Rip-rap had been placed to dissipate the velocity at the end of the culvert. After exiting the culvert, water recollected into an eroded swale, a portion of which was armored with river stone and geotextile fabric to minimize additional erosion. The stormwater flows into a small, jurisdictional wetland, into Bent Creek, and then to the French Broad River.

TNCA expressed a desire to address the unsightly culvert outfall at the entrance of the newly installed Plant Professional Landscape Garden (PPLG). The PPLG is a demonstration garden that also serves as a testing site for green industry professional training and certification. Design opportunities were sought to make the area attractive and improve water quality. Several design options were considered, including retrofitting BMP s higher in the watershed to minimize the erosive flows and armoring the existing swale up to the culvert outfall. However, a stormwater wetland was the most cost-effective option providing the maximum water quality benefit. The stormwater wetland would also serve as an aesthetically pleasing entrance to the PPLG and demonstrate the use of indigenous plant materials.

The stormwater wetland is designed to improve water quality by removing or reducing pollutants carried by stormwater. Pollutants such as sediment, phosphorous, nitrogen, heavy metals, and bacteria are carried by stormwater directly from rooftops, parking lots, and yards into swales or culverts, and eventually into streams and wetlands. These pollutants can have detrimental effects on aquatic habitat and wildlife. However, stormwater wetlands can reduce sediment, phosphorous, nitrogen, heavy metals, and bacteria in stormwater by slowing the stormwater down and allowing treatment by plants and soils. This stormwater wetland can lessen scour and erosion of receiving streams by reducing storm flow energy. Stormwater wetlands also create wildlife habitat and provide enjoyable gardening opportunities.

Since the project is highly visible, the site design included elements that reveal a sense of time and place by utilizing indigenous plants and local materials. A stacked stone headwall was built around the shortened culvert and several large boulders were placed for visual interest. Twelve indigenous plant species were planted at elevations according to their ability to remain saturated for long periods of time. For example, *Juncus effusus* (soft rush) and *Iris virginica* (blue iris) were placed at the lowest elevation, and *Sporobolus heterolepis* (dropseed) - - an upland species - -was placed around the rim at the highest elevation where it would be infrequently overtopped by water. Engineering considerations included determining the maximum footprint and volume. A stormwater routing model was used to predict the volume needed to detain the design storm for almost three days. The wetland was perched above the water table by compacting *in situ* clay.

The stormwater wetland installation began in August 2002 and lasted approximately two weeks. The Department of Corrections, TNCA's staff and volunteers and NCSU Extension provided the labor. The construction sequence included: installing erosion control practices, cutting the existing culvert back to increase the

footprint, clearing and grubbing, and rough grading which included the removal of approximately forty yards of soil. Grading equipment included a track hoe excavator, dump truck, and skid loader. Next, stacked stone walls were constructed around the headwall and boulders were placed. The existing clay soil was topdressed with a manufactured soil, composed of part compost and part saprolite, about two inches deep throughout the stormwater wetland. Biodegradable, erosion control fabric was placed on steeper slopes and then plants and mulch were installed. Hours after the stormwater wetland was finished, droughty weather conditions were reversed and it rained!

The French Broad Training Center (FBTC) was established in the spring of 2001 as a partnership between TNCA and NCSU to address water quality and quantity issues in Western North Carolina and to provide educational programming for landowners, concerned citizens, natural resource managers, and public officials in Western North Carolina. The training center is one of the four NCSU Soil and Water Environmental Technology Centers. Educational programs offered through the Training Center include topics such as environmental planning, conservation easements, agricultural and urban stormwater runoff management, and erosion control. In addition, technical assistance is provided for agricultural BMP s vegetated riparian buffers, streambank stabilization, natural channel design, livestock exclusion and watering systems, and pasture management. The Training Center is located at TNCA in Asheville, NC. TNCA is a 426-acre public garden located within the Bent Creek Research and Demonstration Forest of the Pisgah National Forest. A center for education, research, conservation and economic development, and garden demonstration, the Arboretum offers a wide range of activities for visitors of all ages. TNCA is a public institution -- integrating education, landscape, and research -- that elevates the aesthetic, cultural, and economic quality of life in North Carolina. The Arboretum, through conversion of the traditional values, environmental resourcefulness, and botanical mystique of the Southern Appalachian region, broadens contemporary expressions of landscape stewardship. For more information please refer to: http://www.ncsu.edu/waterquality/.

DEALING WITH INVASIVE PLANTS

Wednesday, November 5, 2003
Session Chairpersons: Jane Hargeaves, Asheville Weed Team; and
Jack Ranney, University of Tennessee

The Plant Invasion and the NC Exotic Pest Plant Council
Dick Bir, North Carolina State University

An invasion of plants that crowd out or prevent the existence of others is happening in Western North Carolina. These invasive plants can make floods and fires worse as well as smothering wildflowers and dramatically changing critical habitat for recreation and wildlife. NC-EPPC is a part of efforts to keep these invaders from hurting the local environment. Dick Bir will briefly talk about some of what is being done and what needs to be done in this area.

Asheville Weed Team: Small Projects, Grand Design
Jack Ranney, University of Tennessee
Asheville Weed Team Partners

The Asheville Weed Team (AWT) is a loosely coordinated group of organizations, volunteers, and agencies recently funded by the National Fish and Wildlife Service. A 10-minute introductory presentation summarizing the AWT will be followed by a series of questions posed to an AWT panel and the audience. Discussions will involve strategies, needs, and approaches evolving within the Asheville Weed Team and its participants. Responses to the questions are unrehearsed and should help direct the Team's future actions. Posed questions address the development of geographical and species-based strategies, getting important stakeholders involved, reconciling different stakeholder priorities, and funding if time permits.

Spotted Knapweed and Its Natural Enemies in Tennessee — A Model for Biological Control?
Greg Wiggins, Amy Kovach, Jerome Grant, Eugene Wofford, Paris Lambdin
University of Tennessee

Spotted knapweed, *Centaurea biebersteinii* DC, is an exotic invasive plant that is well established in areas of the northeastern and western United States. As with many exotic invasive plants, spotted knapweed can out-compete native plant species in disturbed areas, as well as displace native species, especially if harsh environmental conditions, such as drought, are experienced. In the southern Appalachians, spotted knapweed occurs in Virginia, West Virginia, North Carolina, and Tennessee.

Several insect species feed on spotted knapweed. Two seed-infesting fly species, *Urophora quadrifasciata* (Meigen) and *Urophora affinis* Fairfield, have been released in several areas of Canada and the United States as biological control agents of spotted knapweed. In addition, a herbivorous hemipteran species, *Megalanotus sabulicola* (Thompson), was documented to feed on spotted knapweed in New York and Pennsylvania. The only releases of these biological control agents in the Southern Appalachians have been in Virginia, where *U. affinis* was released in 1986.

In spring 2003, a research project was initiated to identify areas in eastern Tennessee infested with spotted knapweed and to investigate the prevalence of any insect biological control agents associated with spotted knapweed in these areas. Because no releases have been made in Tennessee, any biological control agents present may have dispersed into this area from release sites in other states. Twenty-three counties were examined for spotted knapweed populations. If spotted

knapweed was located, the area was sampled using sweep-net and beat-sheet sampling, as well as direct collection of insects, seed heads, and whole plants. Samples were taken to the laboratory for dissection and examination.

Of the 23 counties examined, 18 contained populations of spotted knapweed. Plants in three counties were damaged by mowing; thus, spotted knapweed was sampled in only 15 of the 18 counties. In 11 of the 15 counties, 864 (488 male and 376 female) adults of *U. quadrifasciata* were documented in the field. Additionally, parasitoid wasps, suspected to be parasitoids of *U. quadrifasciata*, were collected in the field and observed emerging from collected spotted knapweed seed heads in the laboratory. No *U. affinis* was identified from any collections. While *M. sabulicola* was documented from two counties, only eight adults were collected.

In theory, biological control agents are dependent mostly or solely upon their host, following fluctuations in population numbers and dispersing into areas where hosts have become established. The presence of biological control agents of spotted knapweed in Tennessee, where no releases have been made, demonstrates their ability to adapt to new areas, as well as their dependency upon the host plant. Unfortunately, the presence of parasitic wasps attacking the herbivorous natural enemies also demonstrates dispersal of higher trophic levels due to dependence of natural enemies, at all levels, upon their hosts. As a model for biological control, the natural movement and spread of these herbivorous natural enemies correlate with the movement and spread of spotted knapweed, suggesting that the biologies of these organisms are well synchronized. The coinciding incidence of natural enemies of these beneficial organisms serves as a reminder that organismal regulation occurs at all trophic levels. Despite the impact that these parasitoids may have on populations of *U. quadrifasciata*, the dispersal and establishment of biological control agents of spotted knapweed may have suppressed plant populations and slowed the spread of spotted knapweed in Tennessee. By evaluating insect/plant interactions, populations of exotic vegetation in new areas can be better understood and appropriate management plans can be developed.

Imported Fire Ants Are Coming: Are You Ready?

Elizabeth A. Long, University of Tennessee

A generic management plan was developed for gateway communities to use as a preparedness guide dealing with the establishment of the hybrid species of the Imported Fire Ant (IFA). The red species of IFA, *Solenopsis invicta* Buren, and the black species of IFA, *Solenopsis richteri* Forel, are located in southern Tennessee, but it appears that it is the hybrid species of their crossbreeding that is migrating into east Tennessee. The two species of IFA and their hybrid are moving north, both by natural migration and by being brought into the east Tennessee area on landscape plant materials and by the movement of infested soil and hay.

The red and black species seem to be less cold tolerant than the IFA species hybrid. It appears that the hybrid IFA is currently migrating into the Great Smoky Mountains National Park and new IFA mounds have been found from Fort Loudon Lake eastward along the Foothills Parkway, and east and south movement into the Great Smoky Mountains National Park has been noted by the Tennessee State Department of Agriculture and Park Service personnel, primarily along power line cuts and logging roads where the natural forest vegetation has been disturbed.

Due to the economic impact on tourism and human and animal health related problems that develop after the establishment of the IFA in a community, it was determined that it would be helpful to develop a management plan based on current pest control recommendations for the IFA and also to evaluate the recommended management practices that have been helpful in other southern states that have been infested with the IFA for several years.

Recommended management practices for established populations of IFA's include cultural (physical and mechanical), biological (natural enemies), organic (natural pesticides) and chemical (synthetic pesticides) control measures. These options were compiled from various

Extension publications, including Texas Cooperative Extension Regional publications on IFA and University of Tennessee publications and fact sheets.

This management plan was developed as a MS in Planning Thesis project at the University of Tennessee (2003).

Recent Mountain-Ash (*Sorbus americana* Marsh.) Stand Dynamics in the Great Smoky Mountains Spruce-Fir

Michael R. Mancusi and Niki Nicholas
Tennessee Valley Authority

American mountain-ash (*Sorbus americana* Marsh.), an eastern North American endemic, is a shrubby formed tree preferred by many wildlife species for its red berries and copious browse. In the southeastern United States it is limited to the higher elevations, often growing with red spruce (*Picea rubens* Sarg.) and Fraser fir (*Abies fraseri* (Pursh) Poir.). In 1926 a European defoliating insect, the mountain-ash sawfly (*Pristiphora geniculata* Hartig. Hymenoptera: Tenthredinidae), arrived in Canada, and has since spread to the entire range of mountain-ash in North America. Nicholas (1992) reported high amounts of mountain-ash annual mortality (11.7%) in the southern Appalachians in the late 1980s. In 1990 a study was initiated by the Great Smoky Mountains National Park to monitor the changes in the red spruce-Fraser fir forest, from the heavy negative impact of an invasive insect, the balsam woolly adelgid (*Adelges piceae* Ratz. Homoptera: Adelgidae). This study's results indicate that from 1990 to 2000 the yearly mortality rates of mountain-ash decreased to 0.8% since Nicholas's study in the 1980s. This presentation also discusses the changing attributes of the mountain-ash community in the Great Smoky Mountains over the last decade.

NEPA Roundtable: HWA NEPA Review Issues and Other Topics of Interest

Wednesday, November 5, 2003
Discussion leader: Harold Draper, TVA

Roundtable Synopsis:
Harold Draper, Chairperson of the SAMAB Environmental Coordination Committee, will lead a discussion of ongoing NEPA issues at participants' agencies. There will be special emphasis on the framework for environmental review of future HWA control activities.

ENVIRONMENTAL MONITORING BY COMMUNITIES AND CITIZENS: THE PUBLIC'S ROLE IN RESEARCH AND MANAGEMENT

Wednesday, November 5, 2003
Session Chairperson: Ina Warren

Monitoring the Effects of Ground Level Ozone on Plants Using Bio-monitoring Gardens
Susan Sachs, Great Smoky Mountains National Park

The Appalachian Highlands Science Learning Center in Great Smoky Mountains National Park facilitates research with a strong educational component. One of the largest projects are ozone bio-monitoring gardens that utilize students to collect data on the effects of ozone exposure on select plant species. Through a partnership between staff at the Smokies Learning Center, the US Forest Service's Cradle of Forestry in American and the North Carolina Arboretum, curriculum and teacher training workshops have been developed to involve students as primary data collectors. Starting in Grade 7, students estimate and collect data on the percentage of symptoms on the leaf surface. High school students go more in-depth, tracking the history of leaf exposure and symptoms. This summer, a teacher workshop was offered that instructed teachers on how they can get involved in developing schoolyard ozone monitoring gardens. An additional workshop was offered at the Western Carolina Nature Center last spring when teachers helped to plant an ozone garden at the nature center.

Since the project was started in Great Smoky Mountains National Park, genetic clones of those plants are used at the 10 additional gardens established in the past two years in Western North Carolina and Eastern Tennessee. These other locations allow the team of researchers studying the effects of ozone exposure to compare elevational differences. The data collected by students gives this team, which convenes each year in July, information that they can't collect otherwise since they aren't locally based. Currently, gardens exist in Great Smoky Mountains National Park (3 locations), Cradle of Forestry in America, Western North Carolina Nature Center, North Carolina Arboretum, and on school campuses in Buncombe, Haywood, & Graham Counties in North Carolina, Asheville and Greensboro City Schools in North Carolina and Monroe County, Tennessee.

Inventory and Monitoring by High School Student Interns in the Smokies: A Case Study
Jonathan Mays, Paul E. Super, Susan Sachs, Appalachian Highlands Science Learning Center, Great Smoky Mountains National Park

Twelve high school student interns worked within Great Smoky Mountains National Park in 2003 on an assortment of projects and activities. The purpose of these internships were to inspire and motivate students to pursue a career in science while they gathered real data and worked on real projects relevant to research in Great Smoky Mountains National Park. Each intern had a project they were responsible for (data collection and reporting) but they all helped each other and worked on special projects as the need presented itself. Intern projects included an ozone biomonitoring garden, a black-capped chickadee behavioral study, reptile monitoring, a mark-and-recapture study of stream salamanders, inventories of picture-wing flies, galls, moths, fungi, ferns, snails, and grasshoppers, and a study of the effects of fire on an invertebrate community. Interns also assisted with grassy bald restoration, beetle, lichen and water bear inventories, wild hog trapping, bird banding, and vesper sparrow territory mapping.

A total of 28 researchers, scientists, and park managers representing 18 different

organizations and 20 different research/ management topics were aided and/or interacted with the 2003 interns. Among many of their accomplishments the high school interns added 36+ new records to the All Taxa Biodiversity Inventory including 13 beetles, 3+ moths, and 20 gall maker species. All interns expressed an interest in considering science and/or natural resource management as a career. Additionally, several interns labeled as "at risk" of dropping out expressed a new commitment to earn their high school diploma and attend college.

The authors will discuss the organization of the internship program, which projects had the good results, which ones did not and why, and the impact of the opportunity on the students. The internships were made possible through a three-year grant from the Burroughs Wellcome Fund.

Citizens As Scientists: Lessons Learned From Two Lepidoptera Monitoring Programs
Michelle Prysby, Great Smoky Mountains Institute at Tremont

Citizens are a valuable resource for scientists and land managers engaged in >environmental monitoring and research. In this presentation, I draw on examples, data, and lessons learned from two research studies involving citizen scientists in the Southeast. The Monarch Larva Monitoring Project involves volunteers in the study of monarch butterfly breeding populations throughout the United States, and citizens have made particularly important contributions to our understanding of monarchs in this region of the country. The moth inventory and monitoring project in Great Smoky Mountains National Park involves students in the All Taxa Biodiversity Inventory. The results of these highly successful projects illustrate how citizens can gather data beyond the scope of what scientists are able to do, how citizens can make unexpected scientific discoveries, and how participating in research activities can raise community awareness about the environmental issue or ecological system at hand. These projects also illustrate some of the key ingredients of a successful citizen monitoring program, including strong communication, clear protocols, and opportunities for citizens to pursue their own research within the framework of a larger study.

A Volunteer-friendly Stream Monitoring Protocol and Stream Health Assessment Methodology
Jason Robinson, North Carolina State University

Volunteer effort comprises a large fraction of non-governmental stream monitoring programs in the United States. Some state environmental and resource agencies have worked with these groups maximize the quality and quantity of information derived from monitoring efforts. Many ideas have emerged from these collaborations; unfortunately many have yet to be fully implemented. I present here a tentative stream monitoring protocol that provides a familiar classification of 'stream health' or 'water quality' based upon taxa richness, as well as generalizations about the state of stream ecosystem processes and parameters. These data are generated by a rapid benthic bioassessment technique comparable to North Carolina DWQ 4 step EPT collection protocol, but include metrics derived from the relative abundance of individuals in five functional morphology classifications (predator, scraper, filter-feeder, shredder, collector). These data are nested within taxa classifications familiar to the users of Izaak Walton League protocols by dual purpose identification keys. The metrics are derived from raw worksheet scores and do not require intricate calculations by volunteers or non-specialists (an Excel macro provides automatic computation). The functional morphology component may increase the volunteer knowledge base about basic stream ecology concepts, provide a second opinion to stream ratings derived from mere taxa richness, and may yield additional information concerning the stresses experienced by populations of aquatic insect larvae in Southern Appalachian streams and low order rivers.

Accomplishments of the SAMAB-coordinated Southern Appalachian Volunteer Environmental Monitoring Program

Andy Brown, Equinox Environmental Consultation and Design; SAMAB

The goal of the SAMAB Southern Appalachian Volunteer Environmental Monitoring program is to develop the capacity of citizens in gateway communities of the national parks and forests in the Southern Appalachians to experience firsthand important environmental issues facing their communities so they can make better decisions about their own neighborhoods and backyards and can participate more effectively in the decision-making processes of their local governments, state government, and the federal land management agencies whose borders they share. SAMAB facilitates and participates in this constructive interaction by producing and disseminating data outputs for groups with whom we are engaged and bringing together these different stakeholders when appropriate. Accomplishments of this program are the focus of this presentation.

Currently, SAMAB is partnering with citizen groups in ten communities in the Southern Appalachians to monitor water quality and the threat of invasive exotic plants to significant natural heritage sites. In addition, we are exploring with the Forest Service and the non-profit environmental organization Appalachian Voices potential protocols and a program structure upon which to build a citizen monitoring program focused around forest health.

SAMAB provides technical support such as volunteer training, quality assurance of data collection, data graphics and GIS generated maps, and monitoring program design assistance to fit each community's unique local needs. While producing relevant information to serve a multitude of localities, SAMAB is uniquely positioned to construct a larger regional picture of the state of the environment in the entire southern Appalachians. This is highly useful as we all understand that environmental problems do not begin or stop at state borders. One of SAMAB's strengths to successfully implement a useful and credible monitoring program is its ability to draw upon the professional expertise of staff biologists, planners, and other natural resource professionals of its federal agency and other Cooperative members. Cooperative members who have assisted our monitoring efforts this year include the US Forest Service, National Park Service, and Tennessee Valley Authority (TVA).

Opportunities and Challenges associated with Sustainable Forests in the South: The Role of Regional and Community Decision Making in Successful Sustainable Management of Our Forests

Jennifer Crawford[†], Susan Fox[†], Charles Van Sickle[‡]
[†]USDA Forest Service
[‡]USDA Forest Service, Retired

For over a decade, national and international decision makers have been trying to identify and define measures of resource sustainability. Through multilateral processes, such as the Montreal Process, governments have defined measurable criteria and indicators to be used at the national level. Realizing that these processes are the cumulative in scale and designed to be national in scope, decision makers have begun to ask questions about the applicability of these measures to smaller scale models (regional, ecosystem, landscape level, community level or by forest). Managing these varying scales of forest resources for sustainability require much different approaches, most of which have yet to be determined. Are current national measures of sustainability applicable at finer scales? Is sustainability a concept that can even be addressed at a scale smaller than the national level? What roles will communities and regions play in the future of sustainability? These questions and many others are ones at the forefront of the forest resource management discussion. This project will begin a discussion and research and evaluate sustainability with diverse forest stakeholders, to come up with an assessment of trends for forest sustainability in the South, and ideally, develop methods to successfully measure these. This Southern multi-stakeholder process can collect information that can be compared with other regions of both our country and the world and can inform national

and international discussions towards better decision making with regards to sustainable forest resource management mechanisms.

Discussion: Agenda for a Citizen Environmental Monitoring Conference
Colin Donahue, Rural Action

No abstract

AIR QUALTITY: UNDERSTANDING THE ISSUES

Wednesday, November 5, 2003
Session Chairperson: Niki Nicholas, TVA

How Clean is the Air? Tennessee Valley Air Quality Trends
William J. Parkhurst, Tennessee Valley Authority

Contrary to the widely-held perception that air quality is bad and getting worse, with few exceptions, air quality is good and getting better. Clean air legislation and implementation has resulted in substantial emission reductions and significant improvements in regional air quality. Since 1979:

- Total suspended particulates, sulfur dioxide (SO_2), and carbon monoxide have improved dramatically with levels reduced more than 40%. All areas meet these standards.
- Particulate matter less than 10 microns in diameter (PM_{10}), lead, and nitrogen dioxide (NO_2) have improved significantly with levels improving between 20 and 30%. All areas meet PM_{10} and NO_2 standards, although two small lead nonattainment areas are found in eastern Missouri.
- Ozone was a challenge in 1979 and is a challenge today. There has been slight improvement in maximum 1-hour ozone levels (from 6 to 9 percent reduction) and no significant change in maximum 8-hour levels. Clearly, some ozone seasons are better than others. Two nearby areas (Atlanta, Georgia and Birmingham, Alabama) do not meet the 1-hour standard. The 8-hour standard is not yet used to determine clean air status but problem areas are expected.
- Fine particle air pollution–particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)–is a concern. The $PM_{2.5}$ standards are not yet used to determine clean air status but problem areas are expected.

There are a number of other air quality issues of ongoing concern that are not currently measured by traditional standards. Here are some highlights regarding several of these issues.

- Acidic deposition (i.e., acid rain) levels have improved as the emission of strong acid gases–SO2 and nitrogen oxides–decline. There is continuing concern about the effect of acidic deposition on sensitive, high-elevation forests and streams.
- Visibility impairment is a special problem for our National Parks and Wilderness Areas. The Great Smoky Mountains National Park is subject to periods of reduced visibility due to regional haze. Visibility should improve as SO2 and nitrogen oxide emissions decline.
- Persistent toxic pollutants, such as mercury, can be a concern because of their mobility, persistence, and ability to accumulate through the food chain. Clearly, better understanding is needed on the fate and effects of toxic air pollutants.
- Indoor air quality is a major public health concern. From a health perspective, indoor air quality is more important than outdoor air quality.

As scientific understanding improves, the issue of human-caused global climate change appears less theoretical and more "real." Global temperatures and greenhouse gas concentrations (carbon dioxide, methane, and nitrous oxides) are increasing. This issue is a global challenge.

Recent and Ongoing Air Quality Research in the Great Smoky Mountains
Stephen F. Mueller, Tennessee Valley Authority

The Tennessee Valley Authority (TVA), in partnership with the National Park Service, the Department of Energy, VISTAS and EPRI, is in the midst of a multiyear effort to measure and analyze air quality parameters associated with fine particles, trace gas precursors, visibility and

mercury deposition. This continues air quality research supported by TVA in the park since 1980. Recent results from the research will be described along with plans for work in 2004.

Fine particle measurements have been made for over 20 years in the western Great Smoky Mountains at a site called Look Rock. Visibility monitoring, following the sampling protocols of the IMPROVE network, has been active at Look Rock since 1988. TVA reactivated fine particle ($PM_{2.5}$) monitoring there in 1998 by installing a prototype of the Federal Reference Method (FRM) fine particle measurement system to determine total $PM_{2.5}$ mass and chemical composition.

Since 1998 TVA has conducted a series of intensive field studies and installed more sophisticated equipment to gain additional insight into the behavior of fine particles. Look Rock data have been used to detect the presence of semi-volatile organic aerosols. Data have been compared with those collected at other urban and rural sites to establish rural-urban differences in speciated $PM_{2.5}$. TVA has tested new instruments for making continuous measurements of $PM_{2.5}$ mass and chemical composition at Look Rock with high temporal resolution (1 hour or less). These data have revealed diurnal changes in fine particles that occur at a high elevation site. A series of analyses of carbon-14 in organic aerosols has produced estimates of the relative contributions from sources of fossil and modern carbon.

Beginning in the spring of 2003, TVA installed instruments for making continuous measurements of particulate sulfate, nitrate, and elemental and organic carbon for VISTAS, the regional planning organization representing southeastern states. Continuous trace gas measurements of ozone, nitrogen oxides, sulfur dioxide and carbon monoxide have been added to the research site to enable a more comprehensive picture of the origins of airmasses that impact and reduce visibility in the Great Smoky Mountains.

Measurements of mercury wet deposition were initiated at two sites in the park in 2002. Data reported to date indicate no significant elevation gradient in the composition of mercury in precipitation. Mercury levels are similar to those measured at neighboring sites. Deployment of additional mercury measurement technology is planned for the future.

Evidence for Recovery from Stream Water Acidification in Shenandoah National Park

Rick Webb, University of Virginia

The evidence for acidic deposition effects on streams in the central and southern Appalachian region is coherent and compelling. This region is exposed to some of the highest acidic deposition levels in the United States, and it includes some of the areas of the country most affected by acidic deposition. Within this region, the most-acidic and most-sensitive streams are associated with forested mountain watersheds, including some of our most highly valued public lands.

Sulfur is the primary determinant of precipitation acidity and sulfate is the dominant acid ion associated with most acidic surface waters. Sulfate concentrations in many central and southern Appalachian streams have increased dramatically as a consequence of acidic deposition, and sulfate has become the most-concentrated dissolved constituent in many streams—a major change in the chemical environment.

Despite recent and projected declines in U.S. sulfur emissions, full-recovery of central and southern Appalachian streams should not be expected. Emissions of sulfur, and therefore acidic deposition, continue to greatly exceed natural background levels. Although there is recent and encouraging evidence for a slight recovery or leveling-off of the acidification process in Shenandoah National Park streams, the degree of recovery is minor in relation to the magnitude of historic acidification and much less than observed in other regions of the country.

Visibility and Fine Particulate Mass in the Southeastern United States

Paul Muller[†] and Pat Brewer[‡]
[†]NC Division of Air Quality
[‡]VISTAS

The organization called Visibility Improvement – State and Tribal Association of the Southeast (VISTAS) is responsible for technical analyses and planning activities to support the 10 VISTAS states in the development of their individual State Implementation Plans for regional haze. These plans are due in December 2007. VISTAS has developed a conceptual description of regional haze and the contributions of components of fine particulate mass to haze in the southeastern United States, particularly on the 20% best and 20% worst visibility days. Sulfate fine particles are the primary contributors to fine particulate mass and to haze in the Class I national parks and wilderness areas in the Southeast. Organic carbon compounds are the second largest contributors to fine particulate mass and to haze. Nitrate, elemental carbon, and soils are smaller contributors to fine particulate mass and haze in Class I areas in the southeast. In urban areas, organic carbon, elemental carbon, and nitrate have comparatively larger contributions to fine particulate mass than in Class I areas. VISTAS's Data workgroup is supporting additional monitoring and analyses of components of fine particulate mass and haze. VISTAS' Technical Analysis workgroup is evaluating potential changes in fine particulate mass and visibility in response to emissions control strategies. Detailed emissions inventories are being developed with state and local agencies for 2002 (model base year) and for 2018 (model future year). VISTAS is currently evaluating performance of the air quality model for 3 episodes in July 1999, July 2001, and January 2002. Atmospheric modeling for the base year will begin in January 2004 and for the future year will begin in October 2004. VISTAS' Planning Workgroup is designing the assumptions for emissions controls by 2018 under current regulations and under alternative control strategies. For more information about VISTAS' projects and how to participate in the Data, Technical Analysis, and Planning workgroups, visit VISTAS' website, www.vistas-sesarm.org.

AIR QUALTITY IMPROVEMENTS FOR THE GREAT SMOKY MOUNTAINS NATIONAL PARK: HIKER PULMONARY HEALTH, AIR QUALITY AND TRAFFIC CONGESTION

Wednesday, November 5, 2003

Panel Organizer and Moderator: Greg Reed, University of Tennessee

This project was a joint effort of the University of Tennessee, Western Carolina University and Emory University. The presenters will be Wayne Davis, Kim Tramatore, Steven Girardot, and Terry Miller.

The air quality problems in Great Smoky Mountains National Park (GSMNP) and the nearby public lands are a highly visible example of the increasingly negative outcomes of the current air quality trends. Since GSMNP is the most visited national park (over 9 million visits per year), the impact of poor air quality is significant. While much is known about the impact of air pollution on the ecology and visibility declines in the GSMNP, research is needed to generate a decision-making tool by developing models to relate exposure to different air pollutants and its effects on human health (as measured by pulmonary function), with implications for economic, tourism and transportation development.

The data for this research program was collected over one ozone season to develop a comprehensive hiker pulmonary health impact assessment, to develop the corresponding air quality modeling for predictive purposes, and to evaluate and develop traffic models with congestion mitigation policy recommendations that have the largest impact to restore the air quality in and around GSMNP. The data collection from 1) 874 hikers for pulmonary effects versus air quality monitoring/modeling and 2) traffic patterns in and around GSMNP for traffic policy versus air quality modeling have been completed and the results to-date will be presented and discussed.

POSTER SESSION

Wednesday, November 5, 2003

Southern Appalachian Information Node — Immersive Technologies
Franciel Azpurua-Linares, Bonnie Carroll, Shelaine Curd-Hetrick, Robert Keller, *Brandon League, Pamela J. Nabors, J., Wolf Naegeli, Robert Turner*
NBII-SAIN

A great number of biological data and information about the Southern Appalachians is produced every year. With the latest sophistication if information technologies, organizations have been trying to answer the lingering question of "how do we provide long-term electronic access and storage of the enormous volume of data and information produced?" The Southern Appalachian Information Node (SAIN) of the National Biological Information Infrastructure (NBII) was created to answer that question. SAIN provides access to regional biological data and information for education and decision-making through the use of information technologies to students, teachers, researchers, community leaders and other decision-makers. To complement this activity, the Southern Appalachian Node is creating the necessary applications and tool to provide the required retrieval of such data and information. Some of these tools include maps and map services as well as models, immersive technologies, web tools in general.

Southwings: Conservation through Aviation
Taylor Barnhill, Southwings

No abstract

Mapping Change In Buncombe County
Paul J. Bartels, Warren Wilson College

Mapping Change in Buncombe County is a community planning resource developed by the ***APPLIED SERVICES*** branch of Warren Wilson College's Environmental Leadership Center and funded by the Community Foundation of Western North Carolina. It provides place-based descriptions of how Buncombe County has changed over the past ten years utilizing GIS maps with text summaries in key areas of interest to decision makers and planners from all sectors of Buncombe County including business, government, education, health, and housing.

Western North Carolina is one of the fastest growing regions in the state. Buncombe County has experienced a population increase of 18% over the past decade and a 39% increase in real median family income in the past 20 years. Understanding how and where the county is changing can help decision makers plan for positive change and respond to the negative effects of rapid growth.

A broad-based citizen advisory panel of 30 community leaders from business, government, education, housing, health, and the environment, representative of the diverse stakeholders in the county, identified five key issues facing Buncombe County decision makers. 49 maps were created to address these issues.

Mapping Change is available in hard copy or CD format by contacting Dr. Paul J. Bartels, Environmental Leadership Center CPO 6323, PO Box 9000, Asheville, NC 28815, 828-771-3781, pbartels@warren-wilson.edu.

Invasive Plant and Water Quality Data from Citizen Monitoring Efforts at Ten Locations in the Southern Appalachians

Andy Brown[†] and SAMAB Environmental Monitoring Volunteers
[†]Equinox Environmental Consultants and SAMAB

The goal of the SAMAB Southern Appalachian Volunteer Environmental Monitoring program is to develop the capacity of citizens in gateway communities of the national parks and forests in the Southern Appalachians to experience firsthand important environmental issues facing their communities so they can make better decisions about their own neighborhoods and backyards and can participate more effectively in the decision-making processes of their local governments, state government, and the federal land management agencies whose borders they share. SAMAB facilitates and participates in this constructive interaction by producing and disseminating data outputs for groups with whom we are engaged and bringing together these different stakeholders when appropriate. Accomplishments of this program are the focus of this presentation.

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SAMAB provides technical support such as volunteer training, quality assurance of data collection, data graphics and GIS generated maps, and monitoring program design assistance to fit each community's unique local needs. While producing relevant information to serve a multitude of localities, SAMAB is uniquely positioned to construct a larger regional picture of the state of the environment in the entire southern Appalachians. This is highly useful as we all understand that environmental problems do not begin or stop at state borders. One of SAMAB's strengths to successfully implement a useful and credible monitoring program is its ability to draw upon the professional expertise of staff biologists, planners, and other natural resource professionals of its federal agency and other Cooperative members. Cooperative members who have assisted our monitoring efforts this year include the US Forest Service, National Park Service, and Tennessee Valley Authority (TVA).

Eastern Hemlock: A Source of Food, Protection, and Shelter for Insect Species

Lee Buck, Paris Lambdin, Jerome Grant
University of Tennessee

Eastern hemlock, *Tsuga canadensis*, is an important component in the forests of eastern North America currently threaten by massive invasions of the exotic hemlock woolly adelgid, *Adelges tsugae*. The insect fauna was sampled at two sites with mature hemlocks and two sites with new growth hemlocks using sweep netting, handpicking, Malaise/pan traps, and pitfall traps.

We identified 240 species in 74 families representing eight orders. Coleoptera (113 species) and Diptera (72 species) comprised about 77% of all species collected. Many of these species are common with a wide distribution. More species were collected from the malaise traps (52%) than pitfall traps (22%) or direct sampling (12%), while 14% of the species were collected from multiple traps. Species numbers varied from 74 to 95 per site. The number of species identified specifically from either the new growth (146) or mature growth (154) was similar. Approximately 133 species were collected at the two lower elevation sites, while 125 species were collected at the two higher elevation sites. No significant difference occurred in species richness among the mature and new growth permanent sites.

The Mitigating Effects Of Forestland On Stream Water Quality In The Southern Appalachians

Barton D. Clinton and James M. Vose
USDA Forest Service Southern Research Station

In the southern Appalachians, National Forest lands often occupy the headwaters of major streams and rivers. Indeed, the protection of headwaters of navigable waterways was one of the basic premises for the establishment of the National Forest system. Under this setting, streams drain minimally disturbed watersheds and enter more developed landscapes sometimes resulting in reduced water quality due to both point and non-point sources of inputs from sedimentation, agricultural runoff, and urban development. In some cases the opposite occurs; streams originate in urban or suburban settings and flow into undisturbed forested landscapes downstream, such as the National Forest. In contrast to protecting headwaters, does the forested landscape also have the effect of improving stream water quality? The objective of this study was to examine the mitigating influence of a forested landscape on the quality of water in a stream originating from an urban landscape and flowing through National Forest lands.

Study sites included an urban stream above National Forest lands, a site on the same stream (forest stream) approximately 2 km downstream of the urban stream site, and a small undisturbed tributary that originates and flows into the Chattooga River, and that served as a reference stream. The forest stream travels approximately 1.6 km within the National Forest before reaching the downstream sampling site. The urban stream reflected the cumulative influences of housing developments, water impoundments, storm water runoff, roads, and a waste-water treatment facility. Stream water samples were collected weekly for 12 months from an automated stream sampler and analyzed for NO_3, NH_4, PO_4, Cl^-, K, Ca, Mg, SO_4, SiO_2, and pH. Both mineral and organic fractions of Total Suspended Solids (TSS) were determined for each water sample. Monthly stream water grab samples were taken along with stream water temperature for determination of the presence of fecal coliform, fecal streptococcus, and total coliform. In addition, sampling for bacteria took place during periods of high flow.

We found that most stream constituents were elevated in the urban setting relative to the downstream site or the reference stream. Concentrations during both base and storm flows were higher, as were fluxes. Similarly, TSS was higher on the urban site than either forested or reference site during both base and storm flow, as were stream bacterial counts. Based on our study results there appears to be a benefit, or ecosystem service, derived from the undisturbed forested landscape as it relates to improving stream water quality. Reductions in concentrations of major constituents were observed, as well as lower bacterial counts. These changes in stream biology and chemistry are likely the result of the combined effect of dilution and in-stream chemical transformations.

"Fern Forays": An Example of Partnerships in Biodiversity Research

Shelaine Curd-Hetrick[†], Jeanie Hilten[‡], Patricia B. Cox*, Keith Langdon**, Richard, Shultz&, Stephanie Osbourne[†*]
[†]*NBII-SAIN*
[‡]*Discover Life in America*
**University of Tennessee*
***Great Smoky Mountains National Park*
[†*]*Pellissippi State*

The Great Smoky Mountains National Park (GRSM) covers more than half a million acres of land and encompasses some of the richest diversity of life in the world. Discover Life in America (DLIA) is collaborating with GRSM on a comprehensive biological inventory, the All Taxa Biodiversity Inventory (ATBI). One of the many avenues to accomplish this immense task is to organize volunteers as citizen scientists on concentrated inventory efforts.

Volunteers received training and over the past three years many have devoted their time to the Fern Foray, which is an intensive, all-day survey of fern species conducted along as many trails as can be covered in a given period of time with the number of volunteers that participate that day. Fern species have been mapped on over 100 miles of 38 GRSM trails. This data collected has included geospatial information that is

incorporated into a database and provides information regarding spatial distribution and information to the public and management through the internet.

The above would not be possible without the work of volunteers and the partnerships of Discover Life in America, National Park Service–Great Smoky Mountains National Park, National Biological Information Infrastructure-Southern Appalachian Information Node, Southern Appalachian Man in the Biosphere, University of Tennessee, Tennessee Geographic Alliance, and the National Geographic Society Education Foundation.

The Upper Little Tennessee Watershed Biomonitoring Program: 1990 to 2003
Emile Elias and Bill McLarney
Little Tennessee River Watershed Association

Beginning in 1990, the Upper Little Tennessee River Watershed Biomonitoring Program, administered by the LTWA since 1999, has sampled fish and macroinvertebrates at 143 sites on 72 streams in the Little Tennessee watershed upstream of Fontana Reservoir. All samples are carried out with the assistance of community volunteers; some 1,600 individuals have participated over the history of the program. The data are used to calculate biotic indices, principally the Index of Biotic Integrity (IBI), and assign Bioclass Ratings, as shown on a color-coded map with conditions ranging from excellent to very poor. The information is used to highlight outstanding natural areas for protection (for example the Needmore Tract along the Little Tennessee) and also to pinpoint environmental problems to be addressed by The LTWA, local governments, landowners and others. The publication of the 'State of the Streams: 1990 - 2002' this fall represents the first document summarizing the health of the watershed based upon the Biomonitoring Program. The program receives financial support from the SAMAB Foundation through its grant from the National Forest Foundation, the Tennessee Valley Authority, and the National Fish and Wildlife Foundation.

Southern Appalachians Initiative
Jeffrey Hunter, American Hiking Society

The Southern Appalachians Initiative is an exciting new joint project of the Silver Spring, Maryland based American Hiking Society, and the National Park Service's Rivers, Trails and Conservation Assistance Program. This project is the first regionally focused program of the American Hiking Society, and is based in Chattanooga, Tennessee.

This project seeks to build, promote, and protect a 5,000-mile interconnected network of hiking trails in the southeastern United States. At the core of the initiative is the Southeastern Foot Trails Coalition. This coalition is comprised of more than 20 hiking clubs from the southeast. Working cooperatively, these groups will seek to raise the visibility of hikers and hiking trails by pooling resources and constituents.

In addition to creating additional recreational opportunities in the southeast, this project hold great promise for increased economic opportunities in the communities adjacent to the trail network, as well as expanding conservation corridors in the Southern Appalachians and beyond. The project also seeks to reduce pressure on the much-loved and over-used Appalachian Trail by dispersing recreation onto other trails.

In this presentation, Southern Appalachians Initiative Director Jeffrey Hunter will introduce this ambitious project to conference attendees. In addition to discussing the various trails that comprise the initiative, Mr. Hunter will also discuss the partnership forged between the American Hiking Society and the National Park Service as a model for conservation initiatives in the region.

The Pattern of Fire on the Landscape in the Southern Appalachians
Hugh Irwin, Southern Appalachian Forest Coalition

GIS has been a crucial tool for the Southern Appalachian Forest Coalition (SAFC) in its conservation work. SAFC initiated its GIS program eight years ago during its first year of

being established. As a mapping tool GIS has enabled us to visualize and communicate conservation issues, and proposals to a wide audience. Analysis tools within GIS have allowed us to address questions and develop new data relevant to conservation issues. These efforts culminated last year in a conservation vision/proposal for the Southern Appalachians. Some of the GIS projects and products that went into SAFC's conservation vision and its continuing development will be discussed and displayed. I will also discuss some of the challenges and lessons learned for nonprofits setting up a GIS program on a limited budget.

Nonnative Invasive Plants of the Southern Forests — A Field Guide for Identification and Control **by James H. Miller**
Charles K. McMahon, USDA Forest Service, Southern Research Station

The USDA Forest Service Southern Research Station (SRS) has published a new guide for identifying and controlling invasive plants in Southern forests. The guide was written and photographed by Dr. James H. Miller, research ecologist at the SRS Forest Vegetation Management unit in Auburn, AL. It provides a unique resource for individuals and agencies trying to identify and control the spread of the worst 33 nonnative invasive plants that are aggressively invading the Southern Region.

The identification section of the guide provides complete easy-to-read descriptions of each plant, its ecology, the plants it resembles, and history and use. Detailed photographs illustrate how the plant looks in different seasons of the year, including leaves, flowers, fruits, stems, and overall shape. The guide also includes maps showing states where infestations occur. Other invasive plants of major concern are also listed.

The book offers both general and specific prescriptions for effectively controlling the 33 worst invading plants. Illustrated directions are provided for applying herbicides to target nonnatives while avoiding damage to native plants. Other control tools for an integrated vegetation management approach are also included.

Miller stresses that actual invasive eradication is just one phase of an integrated approach that involves rehabilitation, restoration, and continuing surveillance. It is important to realize that eradication and rehabilitation of invasive plant infestations usually takes several years of treatment and many more years of surveillance and retreatment. The rehabilitation phase is extremely important. Native plants that can outcompete and outlast any surviving nonnative plants need to be promoted or reestablished.

This publication can be downloaded in pdf format or multiple copies ordered without charge at the Southern Research Stations website: www.srs.fs.usda.gov. Or e-mail pubrequest@srs.fs.usda.gov and ask for GTR-SRS-62. Related PowerPoint presentations are being made available at www.invasive.org. These presentations and the field guide book were part of the materials provided to approximately 300 attendees at the first Southern Regional Workshop "Terrestrial Plant Invasions in the Temperate South: the Problem, Consequences and Taking Control" held in Greenville, SC in June 2003. The 7,500 copies of the first edition of the field guide published in May 2003 were exhausted in three months and a second printing of 50,000 is now available for immediate distribution and use by federal, state and private institutions and agencies throughout the 13 states in the Forest Service Southern Region.

Vegetative Response Four Years After Fire Disturbance in a Southern Appalachian Oak Forest
W. Henry McNab, Tracy W. Roof, and Jacquelyn L. Adams
USDA Forest Service, Southern Research Station, Bent Creek Experimental Forest

Natural fire is an uncommon type of disturbance in oak-dominated forests of the humid eastern United States and little quantitative information is available on its effects on vegetation. In March 2000, fire escaped from a campfire in Bent Creek Experimental Forest and burned over 100 hectares of oak-dominated forest on mountainous topography, which included a tree

stand where sample plots had been installed before the fire. Fire characteristics resembled a low-intensity, prescribed burn (backing with low flames) in the area containing the sample plots. Measurement of the sample plots four years after the fire provided an opportunity to quantify fire effects on forest vegetation that ranged in size from small seedlings to large trees. The objectives of our study were to determine effects of fire on tree mortality by species and size classes, and develop a predictive model associating mortality with tree size and fire intensity. Using height of stem char as an estimate of intensity, flame heights varied from 0.1 to over 2 meters. Preliminary results of prefire and postfire inventory of sample plots revealed a reduction in numbers of seedlings and saplings, and increased number of basal sprouts in the burned area. Most trees larger than 10 cm in basal diameter survived the fire, but incurred partial cambial damage that may result in subsequent higher probability of stem decay and likely increased incidence of breakage. Logistic regression indicated that two variables, height of stem char and tree basal diameter, explained half of the variation in top-kill of trees. Red maple (Acer rubrum), a thin-barked species, was particularly susceptible to the fire, but almost all top-killed trees initiated new basal sprouts. Oriental bittersweet (Celastrus orbiculatus), an exotic invasive vine, was top-killed, but resprouted vigorously. Except for possible improvement of wildlife habitat by increasing sprouts for browse by deer, the fire had few beneficial silvicultural effects.

Role of Understory Vegetation in Biomass and Nutrient Cycling in a Southern Appalachian Spruce-Fir Forest

Patrick T. Moore†, Helga Van Miegroet†, Niki S. Nicholas‡
‡Utah State University
‡Tennessee Valley Authority

The high-elevation red spruce (Picea rubens Sarg.) Fraser fir (Abies fraseri (Pursh) Poir.) forests in the southern Appalachians have undergone significant structural changes in the last three decades, due to a combination of natural stand dynamics and the infestation by the balsam wooly adelgid (Adelges piceae (Ratz.)). Because of the heavy mortality of mature fir and presence of this exotic pest, it has been hypothesized that southern Appalachian spruce-fir forests will not return to their pre-adelgid condition. Though changes in overstory composition have been predicted by several, little has been suggested about the role of understory plant communities under new forest conditions. It is clear that forest biomass is being reallocated by changing forest dynamics and the regeneration of fir may be affected by the presence of specific plant communities. Understory vegetation may now play a larger role in the cycling of biomass and nutrients than in pre-adelgid forests. Understanding how the ecosystem will allocate biomass and nutrients among vegetation components and how this influences the ecosystem trajectory and will also aid in management of this sensitive forest type.

To quantify current ecosystem structure and assess trends in forest development, a total forest inventory was performed in Summer 2003 on 50 20 x 20 m plots located within the Noland Divide Watershed of Great Smoky Mountains National Park (5600-6270 ft). Within each plot, overstory trees, saplings and seedlings, shrubs, forbs, grasses and mosses were inventoried to determine the biomass and nutrient distribution among species and forest components. These estimates will be compared to earlier overstory measurements of the same plots taken in 1993 and 1998 and historical understory data to document shifts in biomass and nutrient allocation.

Investigating the Biogeography and Ecology of the Appalachian Yellow-bellied Sapsucker

Scott M. Pearson†, Jared Bailey†, John Gerwin‡
†Mars Hill College
‡NC Museum of Natural History

The Appalachian Yellow-bellied Sapsucker (AppYBSA) is a subspecies of the Yellow-bellied Sapsucker (*Sphyrapicus varius*) endemic to the southern mountains. It breeds in the Southern Blue Ridge Province of the Appalachians in the high mountains of southwestern Virginia, eastern Tennessee, western North Carolina and possibly in northern

Georgia. Since 2002, a group of scientists and resource managers in this region have sought more information on the status of this species. This poster will reports on on-going efforts to compile information on population size, breeding locations and habitats, and ecology of this species. Breeding records have been contributed by volunteers across the region and are being compiled into a common database. Investigations of foraging behavior and habitats are being conducted at three sites. In addition, taxonomic analyses are underway to examine the degree of genetic divergence between this subspecies and races breeding in the northern US. Information about AppYBSA and updates on research efforts are available from http://biology.mhc.edu/ybsa.

Effects of Prescribed Fire and Understory Removal on Bird Communities in a Southern Appalachian Forest

Aimee Livings Tomcho[†‡], Joseph D. Lanham[‡], Cathryn H. Greenberg[†], Thomas A. Waldrop[†‡]
[†]USDA Forest Service, Southern Research Station,
[‡] Clemson University

Fire suppression has contributed to increased fuel loads and potential for catastrophic fires in forested landscapes. In 1999, a national protocol to research the consequences of fuel reduction techniques was initiated with the National Fire and Fire Surrogate Study. The Green River Game Lands in Henderson and Polk Counties, NC, were chosen to represent the Southern Appalachian upland hardwood forest ecosystem. Mechanical understory removal treatments implemented in 2002 cut all *Rhododendron* and *Kalmia* and all trees >6 feet tall and <4 inches diameter (dbh). Both breeding bird and wintering bird communities were sampled using 50-meter fixed radius points. Preliminary results show no statistically significant differences in avian abundance or richness between the mechanical treatments and controls during the breeding season or winter. Results from prescribed burns conducted in March 2003 will be presented. Influences on bird community structure will be discussed.

Carbon Dynamics in a Southeastern High-Elevation Spruce-Fir Ecosystem

C. Tewksbury, H. Van Miegroet, P. Moore, Utah State University

It has been documented that commercial reforestations and plantations may constitute a net sink for atmospheric CO_2 in the Southern Appalachian region (Delcourt and Harris 1980). However, this net sink may be offset by the turnover of large pools of soil organic carbon (SOC) in the spruce-fir forests capping most high-elevation mountains and ridges in the region. This SOC is part of forests undergoing changes as a result of natural forest dynamics and disturbances and subject to high atmospheric deposition of sulfur (S) and nitrogen (N). The combined effect of climatic changes and increased N availability may cause shifts in the dynamics of these C pools, which may turn these ecosystems into net sources of CO_2. It is therefore important to understand what controls dynamics of SOC in these forests and how that may influence atmospheric CO_2 concentrations.

In the red spruce-Fraser fir [*Picea rubens* Sarg./ *Abies fraseri* (Pursh.) Poir] forest of the Great Smoky Mountains National Park we characterized C dynamics in relation to climatic drivers in 8 plots along an elevation gradient between 1525 and 1980 m. Carbon turnover in the organic and mineral soils was determined from litter decomposition rates, calculated mean residence time of the forest floor, and field measurements of soil respiration taken during summer and fall. Soil temperatures in the lower elevation plots were on average 3°C higher than in the higher elevation plots, resulting in spatial and temporal variations in CO_2 evolution and SOC turnover under corresponding plot microclimates.

High-elevation ecosystems are identified as susceptible to climatic change through several processes tightly connected to both the regional and global climate system. Establishing ecosystem C budgets for the southeastern U.S. is important for future ecosystem management decisions on regional and global scales.

Restoration of the Grassy Bald Plant Community at Craggy Gardens, North Carolina

Chris Ulrey, National Park Service, Blue Ridge Parkway

Unlike Heath Balds that are dominated by shrubs (mostly of the *Ericaceae* family), grassy balds are devoid of woody plants and consist of various grasses (*Danthonia compressa, Deschampsia flexuosa*) and sedge (*Carex pennsylvanica*) species. Located on high mountain summits, Grassy Balds are unique to the Southern Appalachians. Because of their uniqueness along with limited acreage world-wide, Grassy Balds are considered globally rare by The Nature Conservancy. Several rare plant species, including Gray's Lily (*Lilium grayi*), are found in Grassy Balds. The scientific community has produced numerous theories on the origins of Grassy Balds, a subject which remains controversial and which will probably never be resolved. Equally contentious among scientists are what mechanism(s) maintained these balds, thereby preventing their conversion into forests. It has been observed that if Grassy Balds are not managed, blackberry and other woody species will rapidly invade these sites. A popular notion suggests that native large mammals, such as bison and elk, were responsible for maintaining these balds; later early settlers grazed the same sites with domesticated livestock. The Craggy Mountains are one of the most significant natural resource sites along the Blue Ridge Parkway, a park with over a dozen federally listed species and over 60 state listed species. Currently, the grassy bald at this site is facing rapid encroachment by blackberry (*Rubus canadensis*), hawthorn (*Crataegus spp.*), and blueberry (*Vaccinium corymbosum*). It is estimated that less than 2% of the original grassy bald remains free of woody shrubs. Rare species known to occur primarily in grassy balds are present suggesting that this bald is by all accounts natural and not man-made. A project designed to restore the Grassy Bald community was begun during the field season of 2002. Using mechanical mowers, the strategy is to cut blackberry and other woody species in June followed by a repeat mowing in August; the plants energy reserves are therefore exhausted. This method has been shown to be effective for three years, when the process is repeated. The first and second year results of this restoration will be presented.

ECOSYSTEM RESTORATION

Thursday, November 6, 2003
Session Chairperson: Bambi Teague, Blue Ridge Parkway

The Pattern of Fire on the Landscape in the Southern Appalachians
Hugh Irwin, Southern Appalachian Forest Coalition

Fire is increasingly acknowledged as an important ingredient in natural ecosystems, and prescribed fire is increasingly used as a tool to restore the dynamics to fire dependent natural systems. Ecological studies have highlighted the role of fire in specific ecological communities in the Southern Appalachians, and there is strong evidence that some of these communities (e.g. table mountain pine, pitch pine) are fire dependent. However, there is strong evidence that some ecological communities (e.g. mixed mesophytic) are neither fire dependent or fire tolerant. The pattern of natural fire on the landscape of the Southern Appalachians is likely a complex mosaic of burned and unburned areas reflecting both physical conditions (slope position, aspect, moisture). This pattern of burns on the landscape would also both reflect and shape ecological communities. As prescribed fires are applied to the landscape the potential exists to both restore as well as harm ecological communities.

In order to apply prescribed fire appropriately and to reestablish natural fire regimes requires knowledge of the pattern of burns under natural conditions on the landscape. A GIS model will be described and displayed that predicts fire behavior on the landscape based on physical conditions and ecological communities. These predictions will be examined in the context of burn records from wildfires and prescribed fires.

Effects of Prescribed Fire and Understory Removal on Bird Communities in a Southern Appalachian Forest
Aimee Livings Tomcho[†‡], Joseph D. Lanham[‡], Cathryn H. Greenberg[†], Thomas A. Waldrop[†‡]
[†]USDA Forest Service, Southern Research Station,
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Fire suppression has contributed to increased fuel loads and potential for catastrophic fires in forested landscapes. In 1999, a national protocol to research the consequences of fuel reduction techniques was initiated with the National Fire and Fire Surrogate Study. The Green River Game Lands in Henderson and Polk Counties, NC, were chosen to represent the Southern Appalachian upland hardwood forest ecosystem. Mechanical understory removal treatments implemented in 2002 cut all *Rhododendron* and *Kalmia* and all trees >6 feet tall and <4 inches diameter (dbh). Both breeding bird and wintering bird communities were sampled using 50-meter fixed radius points. Preliminary results show no statistically significant differences in avian abundance or richness between the mechanical treatments and controls during the breeding season or winter. Results from prescribed burns conducted in March 2003 will be presented. Influences on bird community structure will be discussed.

Artificial Regeneration of Northern Red Oak: A Procedure for Establishing this Species in the Appalachian Mountains.
Paul P. Kormanik and Shi-Jean Susana Sung, USDA Forest Service Southern Research Station

Northern Red Oak (*Quercus rubra*) NRO is becoming a less common component on high

quality mesic Appalachian sites. Scientists have even speculated that unless new technologies for regenerating this species are developed, it may become endangered on many desirable sites.

There is no single factor that can account for this wide-spread decline in NRO populations. It is most likely that a series of maladies such as Oak Wilt (*Ceratocystis fagacearum*) (T.W. Bretz, J. Hunt), gypsy moth infestations (*Lymantria dispar*), aging of stands, and periodic droughts have all been involved in this decline during the past 50 years. In many stands, there are insufficient numbers of NRO capable of producing a large and consistent crop of acorns. Traditional shelterwood management systems do not provide sufficient sunlight to develop thrifty, competitive NRO seedlings to replace aging trees.

Various modifications of the shelterwood management system that do provide adequate sunlight may be hampered by slow development of NRO reproduction. This results in severe competition from more shade tolerant species that further restricts natural regeneration efforts. For this reason, it is doubtful adequate NRO regeneration will be possible without repeated herbicide treatments to control competitors during the regeneration period.

Artificial regeneration technology being developed at the USFS; Institute of Tree Root Biology, can overcome many of the problems associated with natural regeneration and will compliment it in many cases. Recent research findings suggest that NRO nursery grown seedlings that exceed specific morphological specifications for height, root collar diameter, and first-order lateral root numbers (FOLR) can readily be established in forest openings of various sizes and can become a dominant component in the newly developing crown canopy. Individual tree seedlings selected under these morphological criteria have produced abundant acorns in less than 10 years after planting in seed orchard and forest sites.

To attain this in newly developing stands, competing vegetation, particularly the faster growing shade tolerant tree species, and sprouts of any closely positioned stumps, as well as vines and nonwoody plants must be controlled. The most effective vegetative control procedure has been with specific herbicides. The intensity of the post planting vegetation control is dependent upon the effectiveness of the initial site preparation and the initial planting season growing conditions. If the oak protocol developed by the Institute of Tree Root Biology is followed, an average tree height of 3-6 M should be achieved by year five.

Summer Distribution and Status of the Endangered Indiana Bat, M*yotis sodalist*, in the Southern Appalachians of Tennessee and North Carolina

Michael J. Harvey, Tennessee Technological University

Prior to the summer of 1999, no Indiana bat summer colonies had been reported from south of Kentucky in the Southern Appalachians. Three Indiana bat maternity colonies were discovered during the summers of 1999, 2000, and 2001, in the Nantahala National Forest, North Carolina (1), and Great Smoky Mountains National Park, Tennessee (2). All three colonies, numbering 28, 23, and 81 individuals (largest exit counts), were located in conifer snags in dense, mature forest.

Approximately 6600 Indiana bats hibernate in four caves in or near Great Smoky Mountains National Park, Tennessee. Assuming all these bats remain during summer in the general vicinity of their hibernacula, several additional yet undiscovered maternity colonies, as well as numerous scattered males, are likely present during summer in the Southern Appalachians.

Restoration and Management of High Elevation Ecosystems: The Roan Massif

Paul Bradley[†] and Carolyn Wells[‡]
[†]U.S. Forest Service
[‡]U.S. Fish & Wildlife Service

Fish and Wildlife Service and Forest Service representatives will present a brief introduction of the history and significance of the Roan Massif, update participants on current management efforts that are being implemented to protect this high elevation ecosystem and share with participants the strategic plan that is being pursued by federal and state agencies and

cooperators. Actions on the horizon that will be discussed include 1) A symposium on high elevation ecosystem protection and management; 2) A site conservation plan for the Roan Massif, including the balds and spruce fir forest; 3) Funding opportunities for implementation of the strategic initiative.

APPALACHIAN HERITAGE AS AN ECONOMIC OPPORTUNITY

Thursday, November 6, 2003
Session Chairperson: Laura Rotegard, Blue Ridge Parkway

Appalachian Appropriate Technology
Paul Gallimore and Al Fritsch, Long Branch Environmental Education Center

This talk is a review of a number of earth-friendly appropriate technologies that have been applied and adapted within the Appalachian bioregion over the past quarter of a century. The goal of earth-friendly appropriate technologies is to use good design to conserve the region's natural resources, encourage greater community self-reliance, provide meaningful work opportunities for the region's inhabitants, and meet basic human needs without sacrificing the ecological heritage to meet the needs of future generations. Most of these approaches have roots in the heritage of the region and nation and are ways to save money, conserve resources, and include greater community involvement. The authors, who have directed environmental demonstration centers in North Carolina and Kentucky, have first hand experience with these technologies which deal with renewable energy applications, intensive gardening, water and waste-related conservation measures, and green building design and construction. They have shared their expertise through conducting environmental resource assessments for non-profit centers and farms in 33 states and Canada. Resource materials will be available at the time of the talks.

Ecotourism in Appalachia: Risks and Benefits
Albert J. Fritsch, Long Branch Environmental Education Center

This talk is based on insights found in a book by this speaker being published this autumn by the University Press of Kentucky and entitled *Ecotourism in Appalchia: Marketing the Mountains*. The vast expansion of tourism in this region, especially since 9/11, is well known. But that expanded tourism could bring economic progress to the region or it could seriously damage the environment. This challenge or peril hangs over the region unless proper planning is observed. While bread-and-breakfast establishments and a number of attractions could benefit the local economy by focusing on Appalachian heritage and culture, still risks are involved in unregulated recreational practices and so-called development projects. Ecotourism is one answer, for it is concerned about the welfare of the people and the environment, as well as a positive experience for the tourist coming to the region. A number of critical concerns will be raised in the course of this discussion.

How Will Visitation Change if Scenic Quality Changes? The Value of Blue Ridge Parkway Scenic Quality to Local Communities
*Susan Kask[†], Leah Greden Mathews[‡], Steven Stewart**
[†]Warren Wilson College
[‡]University of North Carolina - Asheville
University of Arizona

The majority of visitors to the Blue Ridge Parkway, a linear national park in the southern Appalachian region, make their trips in order to "see the views." Changes in the scenic quality along the Parkway are occurring, and an important question to Parkway managers and local communities is, *how will visitation change if scenic quality changes*? Communities along the Parkway are affected by these changes since Parkway visitors spend money in their communities, generating sales, tax revenue and other economic benefits.

The Blue Ridge Parkway Scenic Experience Project (BRPSEP) was designed to help investigate the effect of changes in scenic

quality on Parkway visitation. The research surveyed Parkway visitors in two sections of the park, southwest Virginia in 2000 and northern North Carolina in 2002. In addition to gathering information about the value of changes in scenic quality to visitors, the research estimates the changes in expenditures that local communities can expect as a result of scenic quality changes. Results from the southwest Virginia sample indicate that growth in expenditures will continue to grow as scenic quality declines in southwest Virginia but at a lower pace than would have otherwise occurred. Results from the North Carolina sample are pending and may be available for the presentation in November.

APPALACHIAN HERITAGE AS AN ECONOMIC OPPORTUNITY: PANEL DISCUSSION

Thursday, November 6, 2003

Panel Organizers: Geoffrey Willet, NC Division of Community Assistance; and Nann Guthrie, NC Department of Environment and Natural Resources

This panel brings together individuals who are interested and have experience/expertise in heritage-based tourism and development. The aim of the panel discussion is to explore whether SAMAB—as a proponent of community and resource sustainability—has a role in facilitating additional such development and the interaction of private activities and federal/state activities. The panel participants represent some of the more successful heritage preservation, tourism, and development activities in the region and will share their perspective and understanding of regional heritage tourism. Panelists are

Karen Cragnolin, RiverLink
Mark Owen, Advantage West
Betty Hurst, Handmade in America
Charles Maynard, International Storytelling Center

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