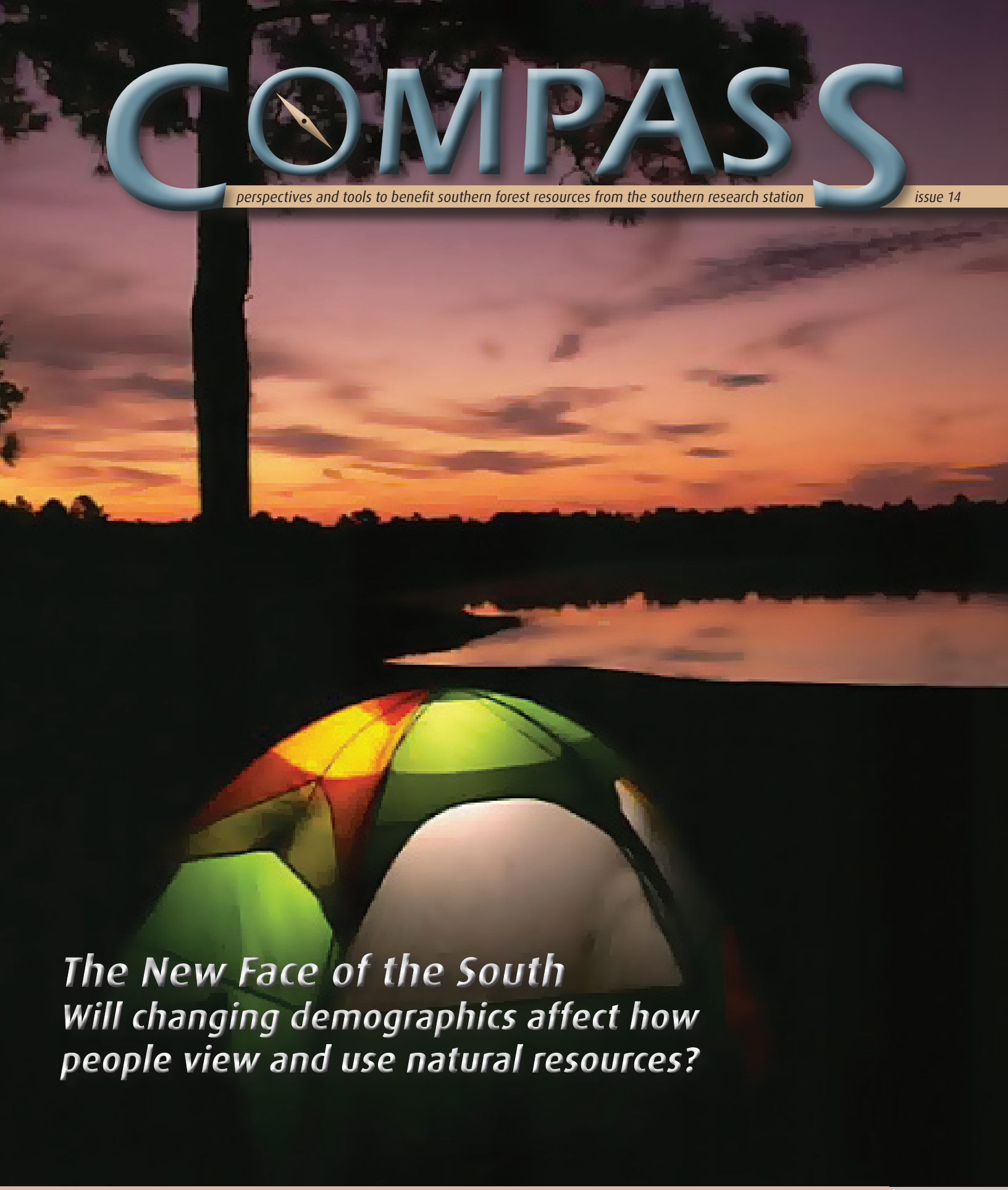
COMPASS

perspectives and tools to benefit southern forest resources from the southern research station

issue 14



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Cover photo: Recreational camping. (photo by Larry Korhnak, Interface South)

COMPASS

Science You Can Use!

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perspectives and tools to benefit southern forest resources

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The New Face of the South

How will changing demographics affect forest management?

by Zoë Hoyle

We've finally reached the point where more people in the United States live in urban than rural areas. In the South, an increasing number of people actually live in the wildland-urban interface, that unique area where woods meet houses and roads. And many of these people are relatively new to the area, people from various ethnic groups who bring their own perceptions of the outdoors, and ultimately, of how our natural resources should be managed in the future.

Clues from Recreation Trends

Ken Cordell grew up in the mountains of North Carolina. The first thing he did after school and chores was head off into the woods, either alone or with friends. Now an SRS pioneering scientist studying changes in the values people place on forests, Cordell is still an avid hiker and birdwatcher, continuing to carve out time from his busy career for precious hours in the wild.

As a new graduate student in forestry at North Carolina State University, Cordell expressed an interest in studying forest conservation. Lacking this opportunity, Cordell found himself studying outdoor recreation instead. Thus began his career-long interest in outdoor recreation and its relationship to natural resource values, planning, and management.

Cordell started surveying recreational trends almost four decades ago when the National Recreation Survey was first mandated by the U.S. Congress; the research group he leads in Athens, GA, has been involved in the survey since the 1980s. Since the mid-1990s, Cordell and his colleagues have been documenting national trends in outdoor recreation participation through the expanded **National Survey on Recreation and the Environment** (NSRE). The largest survey of its kind ever conducted, the NSRE not only identifies trends in outdoor activities, but also surveys perceptions and opinions, allowing a look into how America and the South are changing demographically—and how different groups use and value natural resources.

> *"Our research suggests that Americans' interest in nature and nature-based recreation, though changing, is not declining; rather, it is strong and growing."* —Ken Cordell

"After World War II, outdoor recreation started to become a major part of the American lifestyle," says Cordell. "The family vacation and summer trips became a significant part of the typical American's calendar." Recognizing a growing demand, the Federal government started studying recreation in the late 1950s and early 1960s; findings from these early studies set off legislative changes that ultimately resulted in Congressional acts that created the wilderness, water, and hiking resources that millions of people use every day.

In 1960, the recreation survey identified the most popular outdoor activities as (in order) driving for pleasure, swimming, walking, playing outdoor games or sports, sightseeing, picnicking, fishing, bicycling, attending outdoor sports events, boating, nature walks, and hunting. Recreation surveys in the 1980s found many of the same activities, but by 2000, when results from the expanded NSRE started to come in, recreation priorities for Americans had changed.

"In recent years, one of the most outstanding trends we've seen in outdoor recreation is a very strong change in what people choose to do," says Cordell. "More and more people are showing an interest in viewing, photographing, and learning about nature. One of the lead activities is birdwatching. That's a big change."

And more people than ever are outdoors. The NSRE found that between 2000 and 2007, the total number of people who participated in one or more outdoor activities grew by 4.4 percent, from an estimated 208 to 217 million. At the same time, the total number of days of participation increased by approximately 25 percent. Among activities, viewing,

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photographing, and studying nature showed strong growth.

"Our research suggests that Americans' interest in nature and nature-based recreation, though changing is not declining; rather, it is strong and growing," says Cordell. "The increase in observation and study of nature is, in my view, a very healthy trend that apparently reflects rising and widespread interest in the future of natural resources, conservation, and public lands."

New Folks in the South

For most of the four decades of recreation studies, the typical outdoor recreation participant has been white, male, able bodied, well educated, and earning above average income—but that demographic is definitely changing. In the South, population numbers for Hispanics are rapidly rising, and more Asian Americans are making the South their home. African-Americans, whose population is also increasing in the South, are participating in more outdoor activities than they have in previous generations. All of these population shifts—and those of the future—will affect how natural resources are managed in the South.

Research social scientist **Cassandra Johnson** grew up in urban Atlanta, where she recalls that no one in her neighborhood really went outdoors much. Johnson visited local parks with her friends, but had never visited a national forest until she began working with the Forest Service. Now based in Athens, GA, Johnson focuses part of her research for the **SRS Integrating Human and Natural Systems** unit on why, even in today's greening society, such a low percentage of African-Americans participate in nature-based outdoor recreation.

In one national study, Johnson found that only 2 to 3 percent of African-Americans in the South participate in outdoor recreation, compared to 20 to 25 percent of Hispanics in California. "Why do southern African-Americans not participate in population proportions at least equal to Hispanics?" asks Johnson. "Both populations have a long history in their respective regions, and each minority group is visible and prominent. When they do recreate, both tend to participate in large extended groups of family and friends. Why, then, is there such a disparity between the two groups?"

"Opportunities to engage in outdoor recreation might add a different dimension to the lives of urban minorities. Unfortunately, many urban minorities are not aware of the potential of wildland outdoor recreation to alleviate the effects of social ills." —*Cassandra Johnson*

One possible explanation may be rooted in the Forest Service itself, in differences in approaches to recreation and planning management, facility design, and communication strategies between the two regions. Johnson has just started a study of outdoor recreation management policies to identify possible disparities. But what if it's more about where you live than what ethnic group you belong to or how the forests near you are managed?

How Far to the Nearest Forest?

Mike Bowker, also a research social scientist in the SRS Athens unit, came to the Forest Service in the mid-1990s as a trained economist. Until he started working with Cordell, he had never had the occasion to study outdoor recreation economics. He applied what he knew from working in agricultural economics to this new area and has never looked back, expanding his work into this

Fishing can be a leisure activity, as well as providing food for the table. (U.S. Forest Service photo)

interesting question of minority participation in outdoor recreation.

Johnson and Bowker started looking at the relationship between access to recreational areas and minority status. Bowker, examining participation nationwide, notes that minorities do not generally live close to wildland recreation opportunities. Could lower participation rates be partially explained by location? Or can it be that the studies are skewed in some way?

"In the rural Black Belt region of the South, however, a large minority population does live in close proximity to undeveloped forest land," says Johnson. "Because African-American land ownership is relatively high in the Black Belt, could it be that African-American landowners use their own forest land for outdoor recreation that isn't documented in recreation studies?"

Bowker further notes that once a minority group member takes the first step to become involved in outdoor recreation, they usually continue participating. Race and ethnicity may be factors in constraining that first step, but they do not seem to constrain further participation.

Cordell, Johnson, and Bowker all stress that access to opportunities is critical to participation in outdoor recreation. "This can be as simple as where you live," says Bowker. "If opportunities are not close to one's home, then outdoor recreation participation will be lower." In the West, for example, whites, who have the highest levels of outdoor recreation participation, tend to live closer to national parks and forests than minorities.

Johnson's research about the attitudes and activities of urban minorities also shows that access is critical to both awareness and participation. "Opportunities to engage in outdoor recreation might add a different dimension to the lives of urban minorities," Johnson says. "Unfortunately, many urban minorities are not aware of the potential of wildland outdoor recreation to alleviate the effects of social ills."

Johnson also notes that a history of siting often noxious industries near minority communities has made positive association with nature difficult. She recently completed a study of Newton, GA, a community where decades of industrial pollution have made it unsafe for residents to grow gardens or spend much time outdoors.

"This is an extreme if not uncommon example of how access can affect outdoor recreation participation," says Johnson. "If children can't safely play outdoors, how will they ever develop positive attitudes toward nature, and how will they ever become outdoor recreation participants?"

Managing for the Majority

From a national perspective, Cordell underscores the important role of management in maintaining and improving outdoor recreation access. In recent decades, a plethora of new and specialized—sometimes extreme—outdoor activities have emerged. Activities such as rock climbing and snowboarding get a lot of coverage in outdoor magazines but are of intense interest to a relatively small number of participants. Because of safety and other issues, these activities often capture the attention of natural resource managers.

Cordell notes, however, that over the decades the majority of people, regardless of race and ethnicity, prefer a stable core of outdoor recreation activities that include walking, picnicking, swimming, riding bicycles, and viewing and learning about nature. "These activities are some of the easiest and least expensive to provide," says Cordell. "They also better address the needs of families, of an aging population, and of participants who are less able to engage in physically demanding activities. Access to these types of activities should remain a priority with natural resource managers."

User fees are another hotly debated issue for natural resource managers. Some feel that fees further restrict the access of citizens less able to pay, while others argue that user fees are low enough and provide needed funds for site maintenance. Bowker's research has uncovered two interesting twists to this debate. He found that users are willing to pay for outdoor recreation opportunities as long as they feel they are getting value for their money. Bowker's studies have also shown that minorities are less supportive of user fees. "In a study of recreation on the Florida Keys, we found that raising fees disproportionately reduced nonwhite visitation," says Bowker. "Managers should be aware of the disproportional impacts of user fees and other access-related issues."

Providing accessible information may be as important as providing physical access. Good communication is crucial to serving the outdoor recreation needs of citizens, regardless of race or ethnicity. "People are overwhelmed by choices," says Bowker. "Providing good information about what is available and possible will help people make better choices about their nature-based activities."

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SRS Greatest Good for the 21st Century: A Program for Pioneering Research on Changing Forest Values in the South and Nation unit: *www.srs.fs.usda.gov/trends/*

SRS Integrating Human and Natural Systems unit: *www.humanandnaturalsystems.org/*

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Recommended reading:

Cordell, H.K. 2008. **The latest on trends in nature-based outdoor recreation.** Forest History Today. (Spring): 4–10.

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Children enjoying nature activities. (photo by Cassandra Johnson, U.S. Forest Service)

Ken Cordell. (U.S. Forest Service photo)

Nature activities include swimming. (U.S. Forest Service photo)

The National Survey on Recreation and the Environment

The National Survey on Recreation and the Environment (NSRE) is the latest of eight national telephone surveys focusing on public outdoor recreation and environmental attitudes. Initiated in 1960, when the U.S. Congress created the Outdoor Recreation Resources Review Commission, the first **National Recreation Survey** (NRS) was a four-season, in-the-home survey of outdoor recreation participation in the United States. Five additional NRS surveys were conducted before the expanded NSRE was initiated in 1994. The most recent rounds of the NSRE were conducted between summer 2005 and spring 2009 as a long-term data collection effort that actually began in 1999.

The NSRE is conducted by the SRS research group led by pioneering scientist **Ken Cordell** in Athens, GA, with partners from the **University of Georgia** and the **University of Tennessee**. The Athens group has been collecting data and producing reports about the recreation activities, environmental attitudes, and natural resource values of Americans since the 1980s.

Findings from the most recent rounds of the NSRE showed that between 2000 and 2007, the total number of people in the United States who participated in one or more outdoor activities grew by 4.4 percent, from an estimated 208 to 217 million. "Nature-based" activities—those taking place in outdoor settings or directly involving elements of nature such as terrain, plants, wildlife, or water bodies—continued to grow. Prominent among growth activities were viewing and photographing natural scenery, flowers, trees, wildlife, birds, and fish.

Recommended reading:

Cordell, H.K. 2008. **The latest on trends in nature-based outdoor recreation.** Forest History Today. (Spring): 4–10.

SRS researchers are collecting baseline data about how much time children spend outdoors. (photo courtesy of the City of Albuquerque)

Are They in the Woods?

Results from the National Kids Survey

by Hannah Aleshnick

There is growing concern about the amount of time kids spend—or don't spend—outside. Some recent studies have found children and teens spending more time indoors on sedentary entertainment such as watching television or spending time online. Parents, educators, and others are concerned that a sedentary indoors life is leading to physically unhealthy children who aren't learning to connect with the natural world. Natural resource managers, policymakers, and those who love the outdoors are concerned that this lack of connection will affect how forests and other natural resources are valued by future generations.

There have been very few scientific studies on the outdoor activities of children and youth. The few that have been published are relatively small, surveying less than 500 individuals. In 2007, to address an important gap in information about kids and the outdoors, **Ken Cordell**, pioneering research scientist, and **Carter Betz**, outdoor recreation planner, both at the SRS Athens, GA, unit, and **Gary Green**, assistant professor at the University of Georgia in Athens, started the **National Kids Survey**.

"The purpose of this ongoing survey is to produce nationwide scientific data on a wide variety of outdoor activities in order to more accurately assess the current state of youth in the outdoors," says Cordell. "Our intention was to build a national baseline of data about kids' time and activities outdoors so we could take a more rigorous look at trends."

Conducted in conjunction with the **National Survey on Recreation and the Environment**, the kids study is a general population, random-digit-dialed household telephone survey. To avoid the appearance of exploiting children as research subjects (an ongoing conundrum in the world of research ethics), a proxy household member 20 years or older—such as a parent, guardian, grandparent, or older sibling—is interviewed about the activities of children in the household who are between 6 and 15 years old. Teens 16 to 19 years of age are interviewed directly. Data continues to be collected and is analyzed yearly. The sample size as of April 2009 was 1,201 individuals.

The kids survey report is made up of three parts. The first part simply records the amount of time youth spend outside, regardless of the activity, on a typical day during the week, over the weekend, and whether the interviewee felt the child spent less, about the same,

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In The Woods

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or more time outdoors than they did a year previously.

Part 2 of the survey report compares time spent in outdoor activities by age, gender, race, and household income. Part 3 looks at the types of activities children participate in while spending time outside.

Reason for Concern?

Results so far show that only about 15 percent of the youth surveyed spend *less* time outside than they did a year previously, while nearly 40 percent spend *more* time out-of-doors. About 61 percent spend two or more hours outside on weekdays, 77 percent on weekends. Genderwise, males of all ages are more likely to spend more time outdoors than females. The two oldest female groups are likely to spend the most time on indoor activities.

According to the survey, the primary reasons some children and teens don't spend as much time outside as they did a year ago include homework, school, weather, jobs, limited parental supervision, a busy schedule, no facilities nearby, family circumstances, and an increased interest in music and art.

For parents, teachers, natural resource managers, policymakers, and others, the question of what kids actually do outside is important. The results from the third part of the survey were perhaps not all that surprising. Passive, close-to-home activities are four of the top five most popular. Such activities include playing and just hanging out; biking, jogging, walking, or skateboarding; and listening to music, watching movies, or using electronic devices outdoors.

"Knowing what kids like to do outdoors can help enormously in outreach and outdoor program development," says Cordell.

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Recommended reading:

Cordell, H.K.; Betz, C.J.; Green, G.T. 2009. **National kids survey part I: how much time do kids spend outdoors?** Internet Research Information Series, National Resources, Recreation and Tourism. warnell.forestry.uga.edu/nrrt/nsre/IRISRec/IRISRec9rpt.pdf.

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Hannah Aleshnick is a writing student at Warren Wilson College in Swannanoa, NC.

More Kids in the Woods

The Forest Service (FS) launched the **More Kids in the Woods** cost-share award program in the spring of 2007 with support from the **American Recreation Coalition** and the **National Forest Foundation**. The purpose of the agency-wide program is to help close the gap between America's young people and nature, and to ensure that future generations remain active in caring for the Nation's natural resources.

The effort was fueled in part by public response to **Richard Louv**'s *Last Child in the Woods: Saving Our Children From Nature-Deficit Disorder*, which describes a generation so plugged into electronic diversions that it has lost its connection to the natural world. Louv argues that giving young people the opportunity to connect with nature is as important as any other conservation effort.

In October 2006, then FS Chief **Dale Bosworth** announced More Kids in the Woods as a pilot cost-share program and issued the first agency-wide call for proposals. Former FS Chief **Gail Kimbell** further contributed to the effort by expanding the Agency's partnerships with nature-based youth organizations. For each of the last 3 years, the Agency contributed $500,000 towards the internal cost-share award program, which provides field units with seed money to enhance partnerships aimed at connecting children with nature.

Field projects join FS units with local partners such as conservation education organizations to offer hands-on outdoor experiences for youngsters. Each year the awarded projects reach about 25,000 youth. The projects primarily offer first time experiences to urban and underserved youth and focus on recreational and environmental stewardship.

This year, two More Kids in the Woods proposals from the FS Southern Region received funding: **Earth Tomorrow** in Atlanta, GA, a program that fosters environmental stewardship in urban teens of color; and **Connecting Urban Youth in Louisville to Nature**, which will provide field trips and habitat restoration projects for fourth graders and their teachers in Louisville, KY.—*HA*

More Kids in the Woods:

www.fs.fed.us/emphasis/kids.shtml

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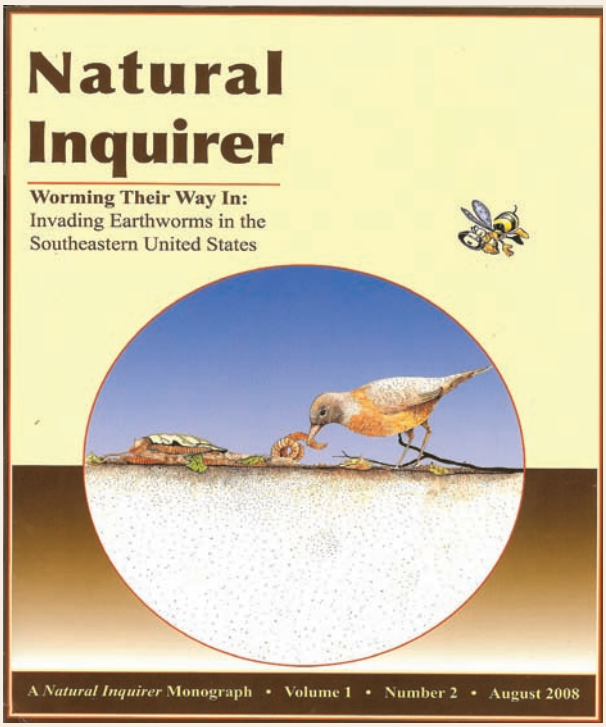
The Natural Inquirer Journal
Introducing kids to forests and forest science

Written and designed as a science education journal, the ***Natural Inquirer*** rekrafts Forest Service (FS) science articles for middle school audiences. Available in both Spanish and English, the journal encourages critical thinking, scientific inquiry, and investigation while learning about natural resources and the environment.

The publication includes a "meet the scientists" section, where students learn about FS researchers and how they conduct their studies. Students can also read about specific research projects in articles written in the same format as those in scientific journals—but at a more accessible level. "Reflection sections" are located throughout each article, and a hands-on activity for the classroom allows students to become further involved in the scientific process. The online version of the journal includes additional resources such as podcasts, slideshows, and glossaries.

The *Natural Inquirer*'s nonprofit partner is the **Cradle of Forestry Interpretive Association** located in Brevard, NC. The journal publishes a special monograph series in partnership with the association, presenting published science from SRS researchers in the same format and grade level as the *Natural Inquirer*. The latest monograph presented research on invasive earthworms, and an upcoming monograph investigates the relationship between hemlocks, water flow, and effects from the invading hemlock woolly adelgid.

Edited by social scientist, writer, and educator **Barbara McDonald**, the *Natural Inquirer* is distributed to approximately 700 classrooms per year; around 1.2 million copies of the magazines have been distributed in the 10 years of publication.



To access or order the *Natural Inquirer*, visit *www.naturalinquirer.org*. An upper elementary version is available at *www.scienceinvestigator.org*. All journals are available free of charge. —*HA*

Children participating in conservation education activities. (U.S. Forest Service photo)

Cultural Differences Can Impact How People Value Natural Resources

Cassandra Johnson focuses on cultural diversity and natural resource use

by Claire Payne

When she joined the Forest Service in 1990, **Cassandra Johnson** started exploring the work **Ken Cordell** and other scientists were doing on the preferences of visitors to public lands. The work fit well with her natural interest in different cultures.

"I think I have a fairly good angle on urban blacks in the South and how they engage with natural resources," says Johnson, research social scientist with the **SRS Integrating Human and Natural Systems** unit. "From a personal and professional place, this was a compelling research issue for me, because I never visited national forests or other wild places growing up."

Johnson earned her doctorate in sociology from the University of Georgia in 2001, and now seeks to apply social theory and methods to questions of natural resource use and perception. In the following answers, Johnson shares some of her research findings and perspectives.

How much does culture influence how people view natural resources?

Depending on the natural resource being investigated, Johnson, who is based in Athens, GA, says that many variations exist among racial and ethnic groups when it comes to perceptions, attitudes, and beliefs about forests and recreation. Perceptions vary significantly among African-Americans, Asians, and Latinos about wildland visitation. Also for immigrants, attitudes often depend on how long the person has been in this country.

How has the legacy of blacks in the South influenced their preferences?

Some research shows African-American environmental engagement to be distinct from other race and ethnic groups. African-Americans don't hike and camp a lot in the rural South. They don't usually go to wildland areas on publicly owned land. "In past decades, murders and other heinous acts were perpetuated against blacks in the woods. In some cases, these 'vicarious memories' are passed on to African-Americans as 'this is what happens if you're alone in the woods,' " Johnson explains.

Johnson also notes that blacks tend to go fishing frequently, especially in the South, where there is a higher incidence of black ownership of land than in other regions of the country. "With the agrarian/rural culture, fishing is an integral part of southern culture," Johnson explains. "It provides a means of contributing to the household livelihood—both culturally and for subsistence. It's hard to distinguish between the two."

Recent data from the **National Survey on Recreation and the Environment** indicates there are slightly higher percentages of African-Americans participating in outdoor recreation activities other than fishing than in the past. Percentages are on the rise, too, for other nonwhite groups' engagement in typical North American outdoor activities, especially among Asians and Latinos.

Cassandra Johnson at Yellowstone National Park in Wyoming. (photo courtesy of Cassandra Johnson)

How do cultural values about family influence the use of natural resources?

Johnson says African-Americans, Latinos, and Asians draw from collective culture, in which family members and extended family gather frequently in large groups. A wildland environment is not always conducive to these types of activities. For some groups, including African-Americans, the outdoors is more of a backdrop, a setting—chatter and camaraderie may be as important as interacting with the natural resource. Johnson thinks public land managers in the South would do well to realize the importance of providing facilities for large groups to gather.

For some, nature is a backdrop for family gatherings. Future natural resource planning should include providing facilities for large groups to gather. (U.S. Forest Service photo)

What do land managers need to know about culturally based preferences?

Johnson thinks it's important for people who manage public lands for recreation in the South to pay attention to changing demographics. Managers need to ask questions about what people want, and what they as managers could do to accommodate them. Latinos, now a significant presence in the South, are drawing more attention to their needs. With the large growth in the Latino population, it will become necessary for land managers to take notice. If managers don't place appropriate emphasis on the preferences of minorities, support for natural resource agendas in the South could decline.

"As a region, the South hasn't had the experience of minority-led grassroots recreation and environmental groups knocking on the doors of public land managers. More progress has been made in the Pacific region and the Southwest to design facilities conducive to minority recreation styles," says Johnson. "Land managers need to understand the changes in diversity. Groups relatively new to some parts of the South, such as Latinos, may not identify with the negative history that African-Americans associate with being in the woods. They don't feel the weight of 'These people don't look like me' or 'What are they doing in my space?' "

Can cultural values be a source of conflict among groups sharing natural resources?

Recreation visitors come to public lands during their leisure time, and conflicts can become personal. How can managers deal with these challenges? "When people are on public recreation lands, to some extent normative culture follows; oftentimes, people's culture is acted out on public lands," Johnson says. "Riparian areas are a big attraction for Latino groups. Some celebrate all-day worship services, enjoy picnics where they play music and have large meals. Traditional users in the South are not used to this—they have strong ideas about how the public areas ought to be used, especially areas they consider their own."

How are land managers going to deal with conflicts?

Johnson believes land managers need to pay more attention to the activity preferences of all visitors. "Go talk to users to find out what they want," she recommends. "Managers need to understand what would make an optimal recreation experience for different groups, then where practical, make site-specific recommendations based on their understanding of the visitor base, keeping in mind agency mission and purpose."

For more information:

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Who's Worried About Fire?

Ethnicity and perceptions about prescribed fire in the South

by Zoë Hoyle

Like other animals, humans are deeply wired to respond to the smell of smoke, for where there's smoke, there's usually danger. In the forest, wildfire moves fast, often too fast for us to outrun.

Until well into the second half of the 20th century, many forest managers and most of the American public believed that forest fires should be completely suppressed, every fire—no matter how remote—put out as soon as it could be reached.

Over the last 50 years, attitudes towards forest fire have changed. Resource managers have come to regard fire as a natural disturbance, and for some forests, as necessary to ecosystem health. Even more important for those who live in what's called the wildland-urban interface, managers have learned that periodic fires reduce the fuel loads that could lead to the catastrophic wildfires that can threaten homes and lives. The concept of prescribed fire, a "treatment" designed to contribute to forest health, is now widely accepted.

Forests cover more than 60 percent of most states in the South, one of the fastest growing areas in the United States in terms of population. This means that the wildland-urban interface, more prone to wildland fire than other land uses, makes up an increasing part of the southern landscape.

The South is also increasingly more diverse culturally. Hispanic, African-American, Asian, and other minority populations are growing rapidly, and by 2020, are projected to make up close to 40 percent of the population of the region. Studies have shown that different ethnic and cultural groups have different perceptions of how natural resources should be managed, but up until now there's been little work done to assess differences in perceptions about using prescribed fire as a management tool.

Concerned About Effects

SRS researchers **Mike Bowker**, **Cassandra Johnson**, and **Ken Cordell**, along with university collaborators **Siew Lim**, **Gary Green**, and **Sandra Rideout-Hanzak** (former SRS scientist) used data from a recent version of the **National Survey on Recreation and the Environment** to look at how culture affects perceptions and attitudes about fire and fire management in the South. When they analyzed the results, they found definite variations among respondents from the three most prominent ethnic groups in the South—African-Americans, Hispanics, and whites—about prescribed fire and its effects.

"The purpose of the southwide survey was to provide policymakers with a broad picture of public opinion on prescribed fire among major ethnic groups in the Southern United States," says Bowker, SRS research social scientist based in Athens, GA. "The goal is to enhance agency communications with the public and to gain acceptance of prescribed fire as a fuel control program."

Though overall most survey respondents agreed that public land managers and forest professionals can be trusted to choose the best methods for dealing with fire, African-American and Hispanic agreement was lower. African-Americans and Hispanics were also less likely to support prescribed fire as a management tool, and were more concerned about fire effects—harm to wildlife, reduced scenic quality, and smoke—than whites. Females across all groups also tended to be more concerned about the effects of prescribed fire than males. In addition, although level of education had no effect on preference for prescribed fire in general, concern over side effects diminished as education increased.

"Though we found that concern over the side effects of prescribed fire diminished as education level increased, it doesn't mean that more education leads to environmental knowledge," cautions Bowker. "The whole correlation between education and environmental knowledge needs to be more carefully examined."

One reason for differences among groups may have to do with ethnic environmental beliefs and backgrounds, an area that social environmental science has only started to explore. Another factor uncovered in the survey was local private forest land coverage. According to the survey data, as the presence of private forest land increases in the area a respondent lives in, so does distrust in the use of fire as a management tool. This result may indicate a lack of confidence in the expertise of private land owners or managers, distrust of state liability laws, or

a lack of communication between residents and private land managers.

"Our statistical evidence suggests that ethnicity does matter when it comes to prescribed fire," says Bowker. "To gain wide public support and trust, land managers and owners should be aware of these differences, and fuel control programs should be tailored with the concerns and preferences of the local community in mind."

For more information:

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For more about the wildland-urban interface in the South, see issue 7 of Compass, online at www.srs.fs.usda.gov/compass/issue7/.

Recommended reading:

Bowker, J.M.; Lim, S.H.; Cordell, H.K. [and others]. 2008. **Wildland fire, risk, and recovery: results of a national survey with regional and racial perspectives.** Journal of Forestry. 106(5): 268–276.

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Where There's Prescribed Fire, There's Smoke

by Stevin Westcott

Whether ignited by humans or naturally, fire has been a component of southern forest ecosystems for centuries. As more and more people migrate to the South, state and Federal foresters, natural resource managers, local leaders, and others face the challenge of how to reduce the loss of life, damage to property, and other adverse effects of fire on humans and, at the same time, maintain the benefits of fire in forests.

Fire promotes the health of forest ecosystems in a number of ways, but fire can also pose problems for urban and suburban areas. For example, smoke produced from fires reduces air quality and impacts human health. It also reduces visibility, which compromises ground and air transportation.

SRS meteorologist **Scott Goodrick** is leading a team of researchers who are working to help the South's foresters, health officials, and others better deal with the effects of smoke generated by wildfires and prescribed burns. Goodrick, whose atmospheric sciences team is part of the **SRS Center for Forest Disturbance Science** in Athens, GA, are using Google Earth computer software to display smoke model forecasts that can help southern communities determine the potential health risks caused by wildfires. These forecasts are useful for state and local health departments when deciding to issue warnings for people most affected by smoke, such as those with lung disease or asthma.

The forecasts combine smoke concentrations over a 3-day period with weather forecasts to predict the amount of smoke that will be produced and where the smoke will spread. The forecasts focus on particulate matter smaller than 2.5 microns in diameter, which is associated with respiratory problems and measured by the U.S. Environmental Protection Agency (EPA) as part of the National Ambient Air Quality Standards.

"Our goal is to post all of our modeling tools on the Internet for use by states and localities," says Goodrick. "At this stage, we're focused on perfecting how fire is represented in the models. A lot of air quality modeling has centered on industrial emissions. Forest fire is much different in terms of how it is dispersed in the atmosphere. So we're trying to fine tune how smoke behaves in our models through field work and other enhancements."

These new and improved smoke models will benefit foresters and other natural resource managers in the South who conduct prescribed burns to reduce heavy fuel loads that could cause catastrophic wildfires. Practitioners of prescribed burning also face tighter EPA standards, making the SRS models even more beneficial.

"In 2007, there were some prescribed burns in the South that exceeded EPA standards for a couple days," said Goodrick. "Prescribed fire is necessary, but the biggest challenge is to mitigate the adverse effects of smoke as much as possible. You have to decide whether you want a little smoke now from a prescribed fire or a lot later on from a wildfire." —*SW*

Forecasts can be accessed online at shrmc.ggy.uga.edu/ge/.

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The Southern Wildfire Risk Assessment

A powerful new tool for fighting fire in the South

by Zoë Hoyle

The South consistently has the highest number of wildfires per year. Population growth is pushing housing developments further into natural and forested areas where most of these wildfires occur. —*Fire in the South 2*

More than 5 million acres across the South are at high risk for fire, which places over 100,000 communities at risk of wildfire damage. (photo courtesy of the U.S. Fish and Wildlife Service)

The South is one of the fastest growing regions in the Nation, with an estimated population growth of 1.5 million people per year. With more than 88 million acres classified as wildland-urban interface, the South consistently has the highest number of wildfires per year. Across the region, more than 5 million acres are at high risk for fire, and 118,083 communities at risk of wildfire damage. Of these, more than 50,000 communities are at high to very high risk. It doesn't help that the South has a year-round fire season, unlike other areas such as the West where wildfires are mostly seasonal.

The above are a few of the key findings reported in *Fire in the South 2*, published in December 2008 by the **Southern Group of State Foresters** (SGSF), a nonprofit organization consisting of State Foresters from each of the 13 Southern states.

Authored by **Annie Hermansen-Báez**, technology transfer coordinator for the **SRS Integrating Human and Natural Systems** unit and **Anne Andreu**, former University of Florida research associate, the publication reports the main findings of the **Southern Wildfire Risk Assessment** (SWRA), a comprehensive and uniform wildfire risk assessment for the Southern states sponsored by SGSF in collaboration with the Forest Service and four other Federal agencies. When it was started in 2003, the main objectives of the SWRA were to identify areas most likely to have wildfires and those most susceptible to wildfire damage, prioritize fuel reduction treatment efforts, and help agencies work together to improve emergency response.

The SWRA team set out by analyzing key components of wildfire risk in the South, and in 2005 published *Fire in the South 1*, a comprehensive review describing cultural uses of fire in the region, landscape characteristics, and the impacts of fire on the forest economy. The report established a baseline for the larger SWRA project. The 2008 *Fire in the South 2* explains the objectives of the risk assessment, presents key findings, and demonstrates through case studies its practical applications.

A Powerful New Tool

The SWRA is the first comprehensive regionwide fire risk assessment of its kind in the Nation. The Southern states and Federal agencies including the Forest Service pooled their resources in a huge data collection effort that, for the first time, mapped surface fuels consistently for each of the 13 Southern states. SGSF contracted with Sanborn, a company

which offers Geographic Information Systems (GIS) mapping services, to develop a software framework for viewing, modeling, and creating wildfire risk assessment maps.

The SWRA consists of a series of GIS layers that can be used separately or in combination to produce graphic images of wildfire risk and occurrence. Data layers include fuels, wildfire history, and initial fire dispatch locations, as well as weather, topography, soils, land ownership, land use, and transportation infrastructure. The SWRA also enables managers to identify areas where fuels may need to be reduced through thinning, mowing, herbicide, or prescribed burning.

"Unlike other risk assessments that simply combine GIS layers, the risk assessment applies published fire science along with GIS modeling techniques and assigns numerical values to data inputs," says **David Frederick**, SGSF fire representative. "Because outputs are based on numerical calculations, users can change inputs and rerun calculations to determine their impact on overall wildfire risk."

Fuel models can be changed, for example, to look at how planned fuel treatments will affect wildfire risk in a specific area. Structures such as new developments can be added to maps, as well as additional firefighting resources. The risk assessment can then be run again to show the effect such changes will have on overall wildfire risk.

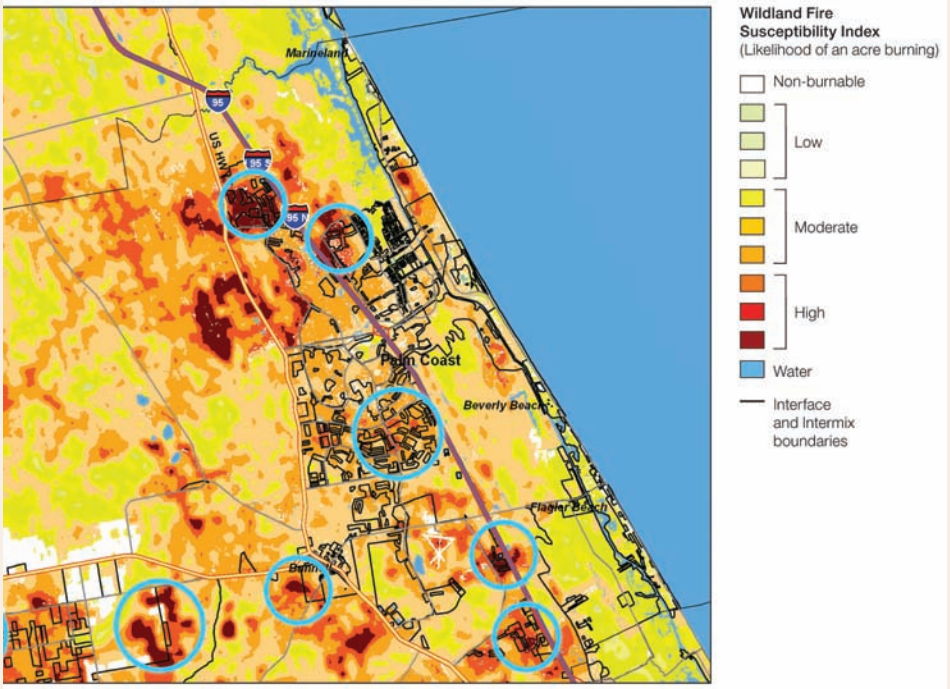
> *"In the fire-adapted ecosystems of the South, the issue is not whether an area will burn but when it will burn and at what intensity."*
>
> —*Fire in the South 2*

Planners and managers at various levels—state, Federal, and local—are using the SWRA to support both planning and protection efforts. The system gives fire prevention specialists access to maps that show communities at risk, historical fire occurrence, and fire potential, allowing them to target at-risk communities with mitigation strategies. When a fire actually breaks out, incident commanders can generate maps to help decide where to deploy firefighting resources first, the best way to reach the location of a fire, and the optimal locations to deploy ground- and air-based equipment.

The assessment can also be used to raise public awareness about fire and fire management issues in the South, to increase support for wildfire protection planning, and to help prioritize areas in need of community wildfire protection plans, which help communities to identify strategic sites and methods to reduce risk for wildfire damage, and get funding for fuel treatments from the National Fire Plan.

"Wildfire risk is not simply the risk of an area burning, but also includes potential damage to roads, homes, and other assets of value," says Hermansen-Báez. "Because the risk assessment process considered so many factors—from historical weather data to the current location of fire response dispatches—it can be readily used for planning wildfire protection."

An image produced from the SWRA of the wildland-urban interface in Palm Coast, FL, showing the probability of wildfire. The areas circled in blue are highly likely to burn, and can be targeted for fuel reduction treatments. (from Fire in the South 2)



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David Frederick at 334–590–6711 or firerepsgsf@charter.net

The Southern Wildfire Risk Assessment project was funded by the National Fire Plan. Major Federal partners include the Forest Service, U.S. Fish and Wildlife Service, National Park Service, Bureau of Indian Affairs, and Department of Defense.

Southern Group of State Foresters: *www.southernforests.org*

Recommended reading:

Andreu, A.; Hermansen-Báez, L.A. 2008. **Fire in the South 2: the southern wildfire risk assessment.** Atlanta: Southern Group of State Foresters. 32 p. Available online at: *www.southernwildfirerisk.com/reports/FireInTheSouth.html.*

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My perspective on...

Greening the City, Connecting Urbanites to Nature

by Viniece Jennings

Urban park in Asheville, NC. (photo by Rodney Kindlund, U.S. Forest Service)

Urban dwellers do not readily make a connection between themselves and the "nature" that surrounds them in a city. I experienced this disconnect first-hand growing up in metropolitan Atlanta. In high school I became interested in environmental science, particularly related to social and health issues, and I eventually chose environmental science as my undergraduate major.

During the end of my senior year of high school, I was accepted into the **USDA/1890 Scholars Program** with the Forest Service. Initially, I asked myself, "Forest Service? What can I possibly contribute to this agency?" At that time, the connection between the Forest Service and my career interests was unclear. Some relatives jokingly referred to me as a tree hugger and a potential candidate for the next Smokey the Bear audition (no offense, Smokey), while others had no idea of what kind of work I could find with my degree. This lack of understanding about my chosen career path is a further reminder that the closest connection that some urbanites have with nature is an image of a forest on their computer screen saver.

For decades, ecological research has focused on rural areas, while urban environments were marginally explored. Due to increased population growth and concerns about the global environment and the sustainability of nonrenewable natural resources, more investments in connecting urban residents to the environment are being made. The benefits of urban forests for improving water quality, human health, and carbon sequestration are being recognized. In response to these societal needs, SRS created a new research unit—**Integrating Human and Natural Systems**—to address urban and wildland-urban interface issues. The unit consists of both social and ecological scientists as well as technology transfer specialists, with employees based in Athens, GA, and Gainesville, FL.

Building the Bridge between Urban Residents and Nature

A recent project conducted by SRS researchers **Cassandra Johnson**, **Dudley Hartel**, and **Eric Kuehler**, as well as **Stephen Holloway** and **Nic Goodson** from the University of Georgia, explored the interaction of Latinos with urban green spaces. Results from this study elaborated on the relationship between social dynamics, (e.g., housing category, residency status), and a population's access and attachment to urban green spaces. Findings about access and interaction with green spaces reflect the degree that Latinos (and other populations) benefit from services provided by urban green spaces. As an individual's culture influences their perceptions and regard for natural resources, considering diverse cultures in urban forestry research improves our understanding of interactions and response to changes within the urban environment.

Another project conducted by Johnson in collaboration with

faculty at Florida A&M University investigated the cultural dimensions of landscape change. This project is part of a larger study that evaluates how sociocultural, ecological, and economic attributes in the Florida Panhandle are affected by rapid land use changes. Specifically, the study used survey feedback to assess how development impacts the respondent's livelihood and traditional way of life.

To complement **SRS Forest and Inventory Analysis** urban inventory work, the human and natural systems unit, in partnership with **Francisco Escobedo** of the University of Florida, has started urban forest inventories in five Florida cities—Gainesville, Miami, Orlando, Pensacola, and Tampa. This project monitors changes in the urban forest to determine how factors such as species composition, tree health, and the distribution of native and nonnative species vary over time.

For my own project, I am using the inventory data from the Florida study to examine how the presence or absence of urban forest influences human health. In the late 1980s, some pioneering studies showed that green spaces outside of hospital rooms may actually promote patient recovery by reducing stress and other psychological concerns. That study led to additional research that explored the connection between vegetation and health. My focus is on the relationship between tree cover and human health outcome statistics, exploring whether the health of urban residents is directly affected by access to urban forest.

To read more about Latinos and urban green space, see issue 4 of *Leaves of Change: www.interfacesouth.org/products/leaves.php*.

SRS Integrating Human and Natural Systems unit: *www.humanandnaturalsystems.org/*

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Viniece Jennings is a biological scientist student trainee based at the SRS Human and Natural Systems unit in Gainesville, FL.

SRS Integrating Human and Natural Systems Unit

The SRS Integrating Human and Natural Systems unit, which is split between Athens, GA, and Gainesville, FL, focuses on improving the understanding of how people living in urban and urbanizing landscapes both influence and are influenced by natural environments. The technology transfer centers associated with the unit, collectively called the **Centers for Urban and Interface Forestry**, develop and communicate guidelines, models, and tools for natural resource professionals, policymakers, planners, and citizens.

For more information:

www.humanandnaturalsystems.org
www.interfacesouth.org
www.urbanforestrysouth.org

Jennings Wins Research Discussion Contest Award

Viniece Jennings, a Forest Service Student Career Employment Program employee based at the **SRS Integrating Human and Natural Systems** unit in Gainesville, FL, recently won first place in a research discussion contest at the annual meeting for **Minorities in Agriculture, Natural Resources, and Related Sciences** (MANRRS) in Indianapolis, IN. MANRRS is a national nonprofit organization formed to foster and promote the inclusion, achievement, and advancement of ethnic minorities in the agricultural sciences and related fields. The Forest Service was a major sponsor of the 2009 conference.

Jennings is pursuing her Ph.D. in environmental science at Florida A&M University (FAMU). Her working dissertation project focuses on the impact of urban tree cover on human health. She recently completed her tenure as president of the FAMU Environmental Science Students Organization and was recognized as a Southeastern fellow of the university's Environmental Leadership Program.

Viniece Jennings.

What Trees Can Do for People Who Live in Cities

Urban parks and forests may be the only "nature" that many Americans experience, especially when they are young. Appreciating urban trees and the ecosystems they shelter can be the first step towards a hike in a national forest. And there's more to appreciate about urban trees than meets the eye:

- Trees improve air quality by removing or trapping dust, ash, and pollen as well as providing shade. One acre of trees produces enough oxygen in a day to support 18 people. Forests in Atlanta have been estimated to remove almost 10,000 tons of air pollutants a year.
- Trees clean water by slowing the flow of stormwater, which often includes sediment and pollutants washed from impervious surfaces such as roads and driveways. During a heavy rain, a healthy forest can absorb as much as 20,000 gallons of water an hour.
- Trees reduce noise in urban environments by absorbing sound.
- Urban forests provide habitat for numerous species of wildlife.
- Wooded areas near work and retail areas encourage people to walk during breaks; studies have shown that the availability of outside walking space can reduce work stress.
- Studies have found a correlation between access to community forests and physical activity. People are more likely to get out and exercise when they live near green space. Urban forests and parks are increasingly popular as places to walk, run, bike, and hike.
- Studies have shown that people who live near green common spaces are also more likely to interact with their neighbors.

Adapted from an online article about tree benefits by the Georgia Forestry Commission: www.gfc.state.ga.us/CommunityForests/TreeBenefits.cfm

Urban park in Asheville, NC. (photo by Rodney Kindlund, U.S. Forest Service)

Urban Parks Provide Bats Needed Refuge

by Zoë Hoyle

Though slowed by the recession, development in the Southeast continues at an unprecedented rate, with areas in the region projected to have some of the highest population increases in the United States over the next few decades. As forests fall and fields are paved, habitat loss and fragmentation put the pressure on wildlife species. As roads slice the landscape into smaller and smaller pieces, the car takes over as the system's top predator.

Some wildlife species—squirrels, Canada geese, deer, and coyotes—thrive in urban and suburban areas, may even seem a nuisance. For other animals such as bats, urbanization and the loss of forests and wetlands can mean decline and local extinction.

Bats at a Loss

Worldwide, almost a quarter of all bat species are threatened with extinction, with even common species starting to disappear. As with other wildlife, declines in bat populations are tied to habitat loss due to human development.

"In addition to loss of forest and wetland habitat, other factors related to urbanization impact bats," says **Susan Loeb**, SRS research wildlife biologist based in Clemson, SC. "Urban areas have less snags and hollow trees for bats to roost in and fewer of the insects they eat."

Parks and preserves are increasingly recognized as important for conserving biodiversity as pressures from development, introduced species,

(continued on page 18)

Large and adaptable, big brown bats tend to dominate urban bat communities; in the eastern United States; increasing proportions of big brown bats in mist-net captures may be a good indicator of encroaching urbanization. (photo by Susan Loeb)

Bats

(continued from page 17)

and climate change increase. Though large national parks and forests are assumed to provide the greatest conservation value, smaller parks often contain a large number of unique wildlife species, and serve as refuges for creatures that don't move very far during their lives as well as rest stops for migrating species.

"Around 2000, bat researchers started to realize that parks in urban and suburban areas might play a particularly important part in bat conservation, but we didn't really have the studies to back that up," says Loeb.

Though bat inventories had been taken for some American cities, there hadn't been any surveys of bats specific to urban and suburban parks. In 2004, the National Park Service contacted Loeb about surveying bats in some of the Coastal Plain parks in South Carolina and Georgia as part of a larger national resource inventory. What started out as a coastal inventory turned into a broader study of parks in a number of different types of regions.

From 2004 through 2007, Loeb and technicians, some led by now-retired wildlife biological technician **Chuck Dachelet**, (who was well seasoned in mist-netting bats that ranged from the tremulous Indiana bat to the combative big brown bat) surveyed 10 National Park units in the Piedmont and Coastal Plains of North Carolina, South Carolina, and Georgia. Parks ranged from the highly urban Chattahoochee River National Recreation Area in Atlanta, GA, to the relatively rural—and mostly wetland—Congaree National Park in the Upper Coastal Plain of South Carolina.

Loeb and her team used mist nets and acoustic detectors to identify and count bats, recording both species richness (total number of different species present) and diversity (numbers of individuals of each species present). Loeb and her fellow researchers were used to working through the night in dark forests but the park survey offered a different experience. "We actually caught a couple of bikers in our mist nets," says Loeb. "There were a lot of people out there, running and walking. It was a good opportunity to tell people about bats and our research."

The researchers had predicted that species richness would increase with park size and that both species richness and diversity would decrease with development. What they found was more complicated.

"Contrary to our prediction, species richness was not related to park size and did not decrease with development," says Loeb. "Species richness in urban parks was as high, sometimes higher than in rural parks, with some of the urban and suburban parks containing rare and sensitive species such as the Rafinesque's big-eared bat and the small-footed bat." (Loeb cautions that since most of the parks in the study were over 250 acres in size, the lower threshold at which the size of the area studied becomes a factor might not have been reached.)

Big Browns Take Over

Though species richness was relatively high in urban parks, species diversity was low. As the researchers expected, the higher the human population density and percent developed land in an area, the lower the species diversity for bats. But these results were not only due to reduced habitat, but also to the increased dominance of big brown bats.

"Declining species diversity in relation to urbanization can be traced to the dominance of big brown bats in the urban parks we studied," says Loeb. "We found that numbers of big brown captures were positively correlated to human population density and developed land."

Big brown bats have been shown to dominate all the urban bat communities studied in the United States to date. Loeb speculates that the urban environment might actually be favorable for species such as big brown bats because they readily roost in buildings and bridges, and, with their large body size and long wing span, can fly longer and farther to forage than smaller species.

But smaller and more sensitive species are still present, even in highly urbanized settings. Loeb and fellow researchers found Rafinesque's big-eared bats, a species of concern, in the highly urban Ocmulgee National Monument in Macon, GA.

"Though our results show that urban parks may serve as important refuges for some bat species, the low numbers of individuals suggest that some species in these areas may be vulnerable to local population extinction," cautions Loeb. "Management of urban as well as rural parks should strive to conserve as much bat roosting and foraging habitat as possible."

For more information:

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Recommended reading:

Loeb, S.C.; Post, C.J.; Hall, S.T. 2009. **Relationship between urbanization and bat community structure in national parks of the Southeastern U.S.** Urban Ecosystems. 12: 197–214.

Making the Shade in Georgia

by Zoë Hoyle

Before the invention of air conditioning, shade trees were an absolute necessity for living through the heat of a southern summer. Into the 1960s, old shade trees often surrounded school playgrounds, but as new schools were built across the South to accommodate growing populations, these veteran trees were cut down, victims of cost-effective construction practices and safety concerns. Today, many southern schoolyards literally bake in sun.

In late spring and summer in the South, surfaces of schoolyards and playground equipment can get hot enough to literally burn skin. "Surface temperatures on playground equipment can easily reach anywhere from 120 to 140 °F, which can burn a child's skin in only 3 seconds," says **Larry Morris**, who manages the **Sustainable Community Forestry Program** (SCFP) for the **Georgia Forestry Commission**. "In addition, a child's skin can become overexposed to the sun's ultraviolet radiation in only 15 minutes out in the open, which can lead to sun damage and ultimately to skin cancer."

Air quality is another concern. Ground-level ozone, an air pollutant, is the result of a series of complex chemical interactions that increase in the spring and summer when there is more sunlight and temperatures are higher. Ground-level ozone levels are often at their peaks during midday when children are outside for recess.

"The pollution children inhale can lead to lung-related problems such as asthma," says Morris. "Reestablishing shade on playgrounds can help reduce respiratory-related illnesses by lowering ground-level temperatures and sun exposure."

Morris is one of the architects of **Making the Shade**, a program designed specifically to improve the health of school children by strategically planting shade trees on school playground areas across Georgia. In 2005, in cooperation with the Forest Service, SCFP created Making the Shade as a pilot program; since its beginning, 14 elementary schools across the state have started programs to reestablish shade on playgrounds, with 6 more locations scheduled for this year. More than 500 shade trees have been planted, and more than 8,825 students impacted.

Each year, SCFP sends out requests for proposals for grants of up to $10,000 to elementary schools and associated groups interested in starting Making the Shade programs. To participate, schools must have strong local partnerships with a tree board or nonprofit, a volunteer landscape architect, a nursery, and a city/county representative. Applicants must also match the grant dollar for dollar through a corporate sponsor or monetary match, have a maintenance plan in place, and secure the participation of the local SCFP forester and county ranger.

SCFP foresters coordinate individual projects with the local school board and school system officials, parent-teacher groups, tree suppliers, and volunteers. Assistance includes developing planting plans; selecting and scheduling shipment of trees, mulch, and other materials; and onsite planting with volunteers. SCFP foresters also use classroom lessons to increase student awareness of the important roles trees play in their lives.

"Our goal is not just to increase trees on elementary school playgrounds today, but to influence future planning towards the proper placement of trees for healthy shade rather than just landscaping for aesthetics," says Morris. "The proper placement of trees can help reduce surface temperatures by 30 degrees and block 80 percent of the ultraviolet rays that cause skin cancer."

May Howard Elementary School in Savannah, GA. (photo by Daniel Westcot)

Making the Shade receives funding from the **Forest Service**, **Urban and Community Forestry Grant Assistance Program** and from **Milliken & Company**, a textile and chemical manufacturing company with a design center located in LaGrange, GA. Milliken & Company provides funding to selected schools in communities where there are Milliken facilities.

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Sustainable Community Forestry Program: *www.gfc.state.ga.us/CommunityForests/SustainableCommunity.cfm*

Forest Service Urban and Community Forestry: *www.fs.fed.us/ucf/*

The **Making the Shade** *program is designed to create healthier, shaded playground areas on elementary school campuses throughout Georgia.*

How Tree Shade Benefits Schools

- *Helps lower surface temperatures on schoolyards and playground equipment*
- *Prevents skin damage due to overexposure to ultraviolet radiation*
- *Increases air quality and lowers exposure to ground-level ozone*
- *Increases opportunities for outdoor activities in spring and summer*
- *Reduces energy consumption by shading air conditioning equipment, windows, and buildings*

Top left: Cheatham Hill Elementary School in Marietta, GA. (photo courtesy of the Georgia Forestry Commission)
Top right: Gaines Elementary School in Athens, GA. (photo courtesy of the Georgia Forestry Commission)
Lower left: May Howard Elementary School in Savannah, GA. (photo by Daniel Westcot)

Cogongrass Invades the South

by Stephanie Worley Firley

It grows on every continent except Antarctica and has earned a reputation as one of the worst weeds on earth. Now, according to **Jim Miller**, cogongrass (*Imperata cylindrica*) is one of the most threatening invasive species in the South.

Native to Southeast Asia, cogongrass was accidentally introduced into the United States as packing material in an orange crate that arrived in Grand Bay, AL, in 1912. A few years later, it was intentionally planted as a potential forage crop in Mississippi and as a soil stabilizer in Florida.

And then it began to spread.

SRS Forest Inventory and Analysis data indicate that cogongrass currently grows on over 46,000 forested acres—and counting—throughout the Southern United States. "This does not take into account the thousands of unsurveyed acres occupied by cogongrass in nonforested settings," says Miller, an ecologist with the **SRS Insects, Diseases, and Invasives Plants** unit in Auburn, AL. "Because cogongrass is a fast moving and destructive plant that can thrive almost anywhere, the entire Southeast is at risk for invasion."

Each cogongrass plant can produce as many as 3,000 wind-dispersed seeds that can germinate on disturbed soil. Cogongrass also spreads by underground stems known as rhizomes that form dense mats reaching deep into the soil. The rhizomes have pointed tips—sharp enough to pierce the roots of nearby plants—that send out shoots and branches that multiply and grow, expanding into colonies that can completely exclude other vegetation, even kudzu.

"The rapid spread of cogongrass can primarily be attributed to seeds and rhizomes that hitchhike on mowers, equipment, hay, fill dirt, and rocks being transported out of infested zones," says Miller.

Cogongrass can apparently tolerate all light and soil conditions except dense shade and permanently wet soil, so most habitats in the South are fair game. Once established, it is extremely difficult to control.

Fire doesn't slow down the invader; cogongrass itself is a fire hazard to be taken seriously. The plant burns readily, even when green and especially when plant tops have browned and dried in the winter. Homes and structures in the wildland-urban interface and in suburban areas are increasingly at risk due to the unnaturally hot and fast wildfires produced by ignited cogongrass. Following a fire, the surviving rhizome system allows cogongrass to quickly regenerate and continue spreading.

The spread of cogongrass has so far been limited to temperate areas with relatively mild winters, but that could change.

Red Baron or Japanese blood grass, an ornamental variety of cogongrass used in landscape

(continued on page 22)

Red Baron cultivar of cogongrass may allow the plant to invade further north. (photo by Charles T. Bryson, www.bugwood.org)

Cogongrass

(continued from page 21)

plantings, is cold hardy. As of yet, the cultivar does not produce viable seed, but its pollen is viable.

"There is real potential for the cold hardiness that has been bred into the red varieties to be imparted to invasive cogongrass populations through pollen," says Miller. "If this occurs, the whole United States and southern Canada would be open for invasion." This concern has prompted several Southern states to prohibit the sale and distribution of the cogongrass cultivar.

Proactive control and eradication of cogongrass and, ultimately, rehabilitation of infested lands in the South is an ongoing challenge. "Cooperation and education on a grand scale are needed to rid the South of cogongrass," says Miller. "But preventing cogongrass from becoming established in the first place will be the best—and least costly—solution to this problem."

For more information:

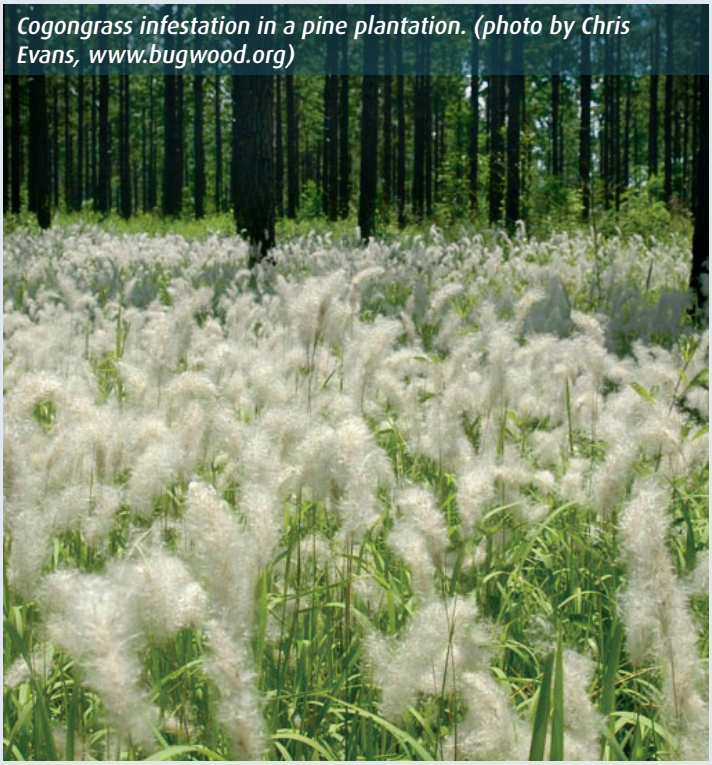
Jim Miller at 334–826–8700, x36 or jmiller01@fs.fed.us

Recommended reading:

Loewenstein, N.J.; Miller, J.H., eds. 2007. **Proceedings of the regional cogongrass conference: a cogongrass management guide.** Auburn University, AL: Alabama Cooperative Extension System. 77 p.

Stephanie Worley Firley is a biological science information specialist with the SRS Eastern Forest Environmental Threat Assessment Center in Asheville, NC.

Cogongrass rhizomes. (photo by Jim Miller, www.bugwood.org)



Cogongrass infestation in a pine plantation. (photo by Chris Evans, www.bugwood.org)

Field infested with cogongrass. Once established, it is extremely difficult to control. (photo by Nancy Loewenstein, www.bugwood.org)

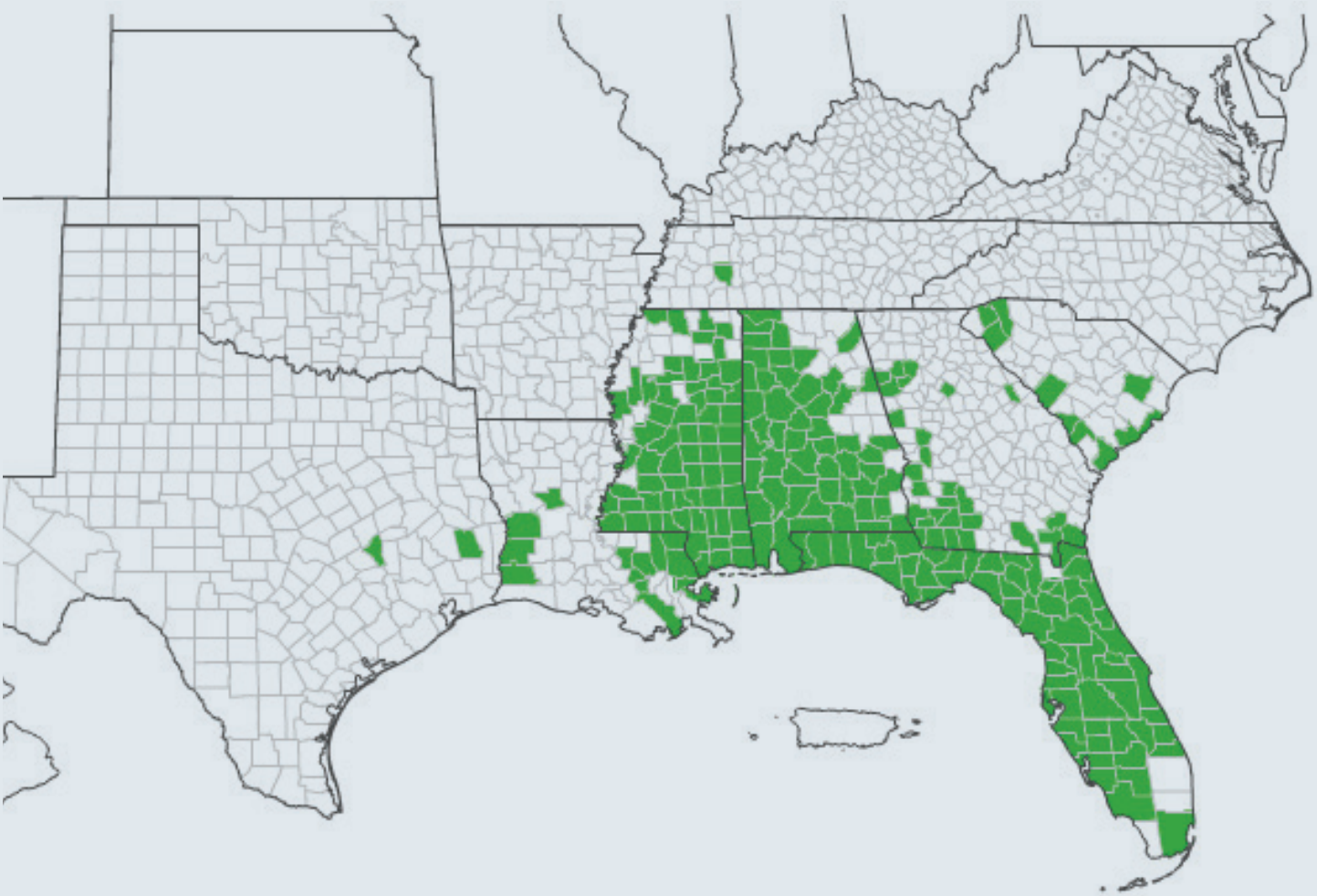
When Cogongrass Invades, Southern States Fight Back

The urgent need to address the cogongrass crisis in the South has led to the establishment of a Memorandum of Understanding (MOU) among seven states: Alabama, Georgia, Mississippi, Louisiana, Florida, South Carolina, and North Carolina.

By signing the MOU in October 2008, the states agreed to coordinate efforts and leverage expertise and resources to control the invasive. Cogongrass task forces are being formed in support of an integrated strategic plan for cogongrass eradication. Together, state forestry agencies will organize outreach programs to help landowners and organizations identify and prevent the spread of cogongrass.

Prior to the MOU, the states most impacted by cogongrass infestations to date—Mississippi, Alabama, Georgia, and South Carolina—joined forces to control the plant, map its distribution, and provide educational resources through a 3-year grant from **Forest Service State and Private Forestry** (S&PF).

Mississippi, Alabama, and Georgia will receive over $8 million on behalf of S&PF as part of the **American Recovery and Reinvestment Act** (ARRA). The ARRA funds will be released to the states in late 2009 and will be used to create jobs related to the treatment of cogongrass-infested lands. *—SWF*



Current cogongrass distribution. (from www.cogongrass.org)

science

You Can Use!

Controlling cogongrass on your land

Has cogongrass invaded your land? The first step—and the easiest—is identification.

Cogongrass has some features that make it fairly easy to identify. Compared to the deep green hues of other grasses typically found in the South, the leaves of cogongrass appear yellowish green, and the white upper midrib of the leaves tends to be slightly off center. The short nondistinct stems and the leaves appear to arise directly from the soil.

Cogongrass flowers in the spring—earlier than most other grasses—in a striking display of fluffy silvery-white seed heads. Also distinctive is the pattern of spread: patches of cogongrass often radiate outward in circular patterns, which remain obvious even when plants turn brown in winter.

If you suspect cogongrass is growing on your land, contact your local forestry commission or county extension office as soon as possible for positive identification and to develop an eradication strategy. Since cogongrass is a federally listed noxious weed and is also listed as such by most Southern states, control and eradication are often assisted or carried out by state forestry and agriculture agencies. Prescribed burns should not be attempted without first consulting these personnel.

Some tips for controlling cogongrass:

- Minimize disturbance within miles of where cogongrass occurs. Anticipate spread.
- Treat cogongrass infestations as soon as possible. Young infestations are much easier to control than those that are older and well established.
- Effective and safe herbicides are available for cogongrass control. Remember that it is possible to kill or injure nontarget plants when using herbicides.
- Burning and mowing can improve the efficiency of herbicide treatments. However, burning can kill native shrubs and trees that constrain spread and may actually *cause* cogongrass infestations to expand more rapidly.
- Mowing, burning, or treating cogongrass with herbicides in early growth stages, during early flowering, or even shortly before flowering can stop seed production. However, these treatments may also *cause* flowering and seeding.
- Thoroughly clean all equipment and personnel to remove cogongrass seeds and rhizomes before leaving the site after working in an infested area.
- Do not plant the ornamental cogongrass cultivars (Japanese blood grass and Red Baron). If a cultivar has been planted, remove the plantings, and control sprouts and seedlings.
- Repeated cultivation and planting of aggressive grasses or herbicide resistant crops can restore pastures and croplands impacted by cogongrass infestation.

More information on herbicide treatments and specific application instructions can be found at: *www.srs.fs.usda.gov/factsheet/400*. See *www.cogongrass.org* for much more information about cogongrass in the South. *—SWF*

Has cogongrass invaded your land? (photo by Jeffrey W. Lotz, www.bugwood.org)

around the STATION...

Experimental Forests

1	Bent Creek	NC
2	Blue Valley	NC
3	Coweeta	NC
4	John C. Calhoun	SC
5	Santee	SC
6	Scull Shoals	GA
7	Hitchiti	GA
8	Olustee	FL
9	Chipola	FL
10	Escambia	AL
11	Tallahatchee	MS
12	Delta	MS
13	Harrison	MS
14	Palustris	LA
15	Stephen F. Austin	TX
16	Crossett	AR
17	Alum Creek	AR
18	Sylamore	AR
19	Henry F. Koen	AR

Breaking Ground for New LEED® Certified Conference Center

On June 8, U.S. Representative **Heath Shuler** (NC–11) and other local leaders and partners joined SRS Director **Jim Reaves** and SRS employees for a groundbreaking ceremony on the site of the new Leadership in Energy and Environmental Design (LEED®) certified conference center to be built at the **Bent Creek Experimental Forest** near Asheville, NC.

The LEED® Green Building Rating System is a third-party certification program administered by the U.S. Green Building Council for the design, construction, and operation of high performance, sustainable buildings.

The conference center, which will provide office space for five Forest Service employees as well as conference space for up to 50 people, will comply with all five aspects of "green" construction, including highly efficient HVAC systems, erosion control around the building, and the reuse or recycling of at least 75 percent of waste during construction. In addition, clearing around the building, parking areas, and roads will be restricted to minimize disturbance. The handicapped-accessible building will also include operable windows, allowing employees fresh air and a healthier work environment.

The conference center will be used primarily for research and training purposes, but will also serve as a new space for communicating with landowners, natural resource

(continued on page 26)

U.S. Representative Heath Shuler, SRS upland hardwoods unit Project Leader Cathryn Greenberg, and SRS Director Jim Reaves break ground at the site for the new LEED certified conference center. (photo by Rodney Kindlund, U.S. Forest Service)

Breaking Ground

(continued from page 25)

managers, and others about science-based land and habitat management. The building will cost an estimated $1 million to construct, and is expected to be completed within a year.

Mark McDonough, SRS station engineer for the new conference center, recently received news that the **Savannah River Forestry Sciences Laboratory** project (featured in issue 12 of *Compass*), which recently received LEED® certification, has been selected to win a "Green Building of America" award and will be featured in the Green Success Stories edition of the *Southeast Real Estate and Construction Review*.

SRS has also received **American Recovery and Reinvestment Act** funds for a LEED® retrofit on the **G.W. Andrews Forestry Sciences Laboratory** in Auburn, AL. The project, which is already 80 percent complete, will enable the laboratory to become the first LEED® existing building certified project in the Forest Service. Six companies have been involved in the project and have provided much needed employment opportunities in the region.

Escambia Experimental Forest Celebrates 60 Years

SRS joined research partners on May 12th to celebrate the 60th anniversary of the **Escambia Experimental Forest** (Escambia) and the establishment of the Farm 40 study. For six decades the experimental forest, located near Brewton, AL, has served as a primary means of communicating with landowners about establishing and growing longleaf pine trees.

Research on the site has focused on the natural regeneration of the longleaf pine forests that once covered an estimated 92 million acres across the South. With only 6.2 million acres of second-growth longleaf pine forest remaining by the middle of the 20th century, researchers were looking for ways to encourage landowners to reestablish longleaf pine trees on their properties.

The purpose of the Farm 40 study at the Escambia was to demonstrate longleaf pine forest management for the small-scale private forest landowner, with the initial management goal of producing high-quality poles and logs on a 60-year rotation. The annual field day showcased all the products—including poles, sawtimber, turpentine, and gum—that could be harvested from a 40-acre woodlot in 1 year.

The 60th anniversary celebration of the experimental forest included tours and talks by SRS scientists, university researchers, and industry specialists. Topics included forestry management options, longleaf pine products, agroforestry, and research history.

New SRS Project Leader

Doug Streett took on the position of the new project leader for the **SRS Insects, Diseases, and Invasive Plants** unit in Pineville, LA, on July 19. Research entomologist and research leader with USDA Agricultural Research Service in Stoneville, MS, since 2001, Streett has significant experience in building a diverse and extensive research project at multiple locations, and a strong record of accomplishment in the area of biological control of insect pests.

Research Honors and Awards

James Barnett, emeritus scientist at the **SRS Southern Pine Ecology** unit, received notice on June 8th that he will receive the Society of American Foresters Barrington Moore Memorial award for outstanding accomplishments in biological sciences.

Wendell Haag, fisheries research biologist with the **SRS Center for Bottomland Hardwoods Research** unit, was presented the Presidential Early Career Award for Scientists and Engineers at the White House on December 19, 2008, by President George W. Bush. The award honored Haag's innovative research on the freshwater mussel populations of the South. The Presidential Early Career Award is the highest honor a young scientist or engineer can receive in the United States.

Wendell Haag wins prestigious Early Career Award for Scientists and Engineers. (U.S. Forest Service photo)

David Loftis, research forester at the **SRS Upland Hardwood Ecology and Management** unit, was recognized June 8th for his significant contributions to the management of experimental forests and ranges (EFRs) nationwide. The Forest Service Washington Office presented the award, as part of the Agency's centennial celebration of EFRs across the United States. Loftis has been a research forester at the **Bent Creek Experimental Forest** since 1976, and from 1990 to 2007, served as project leader for the upland hardwoods unit.

On June 17, **Henry McNab**, research forester at the **SRS Upland Hardwood Ecology and Management** unit, received a National Silviculture Workshop award from the Forest Service Washington Office for "outstanding research contributions in the field of silviculture" at the 2009 National Silviculture Workshop in Boise, ID.

Mississippi Governor Haley Barbour presented **Jim Perdue**, SRS biomass and bioenergy liaison and senior biological scientist, and **Tim Young**, forestry technician at the **SRS Insects, Diseases, and Invasive Plants** unit and associate professor in the Forest Products Center at the University of Tennessee, with the "Innovator" award for the state of Tennessee at the Southern Energy: Abundant, Affordable, and American conference. The award acknowledged the Biomass Site Assessment Tools project—a partnership to provide research, policy, and business practitioners with innovative biomass to energy research.

SRS research economist **David Wear** received the Forest Service Deputy Chief's 2008 Distinguished Science award. Wear has been the project leader for the **SRS Forest Economics and Policy** unit since 1995. His most recent work focuses on forecasting the future conditions of forests nationwide, especially in the South, through the **Southern Forest Futures** project. He has served as editor for several distinguished journals in his 21 years with the Forest Service, and has published more than 110 scientific articles.

Science Delivery Awards

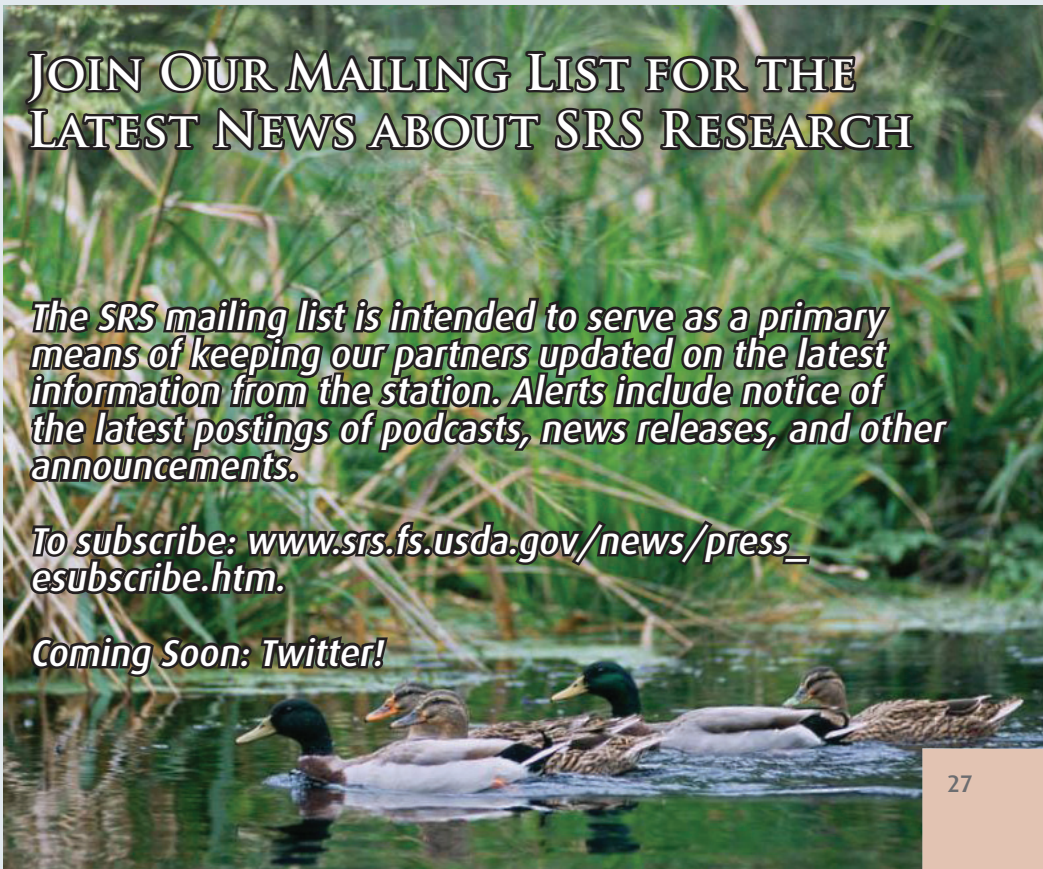
Gary Bentrup, research landscape planner at the **SRS National Agroforestry Center**, and **Rodney Kindlund**, art director for the **SRS Science Delivery Group** (SDG), received a gold award for the publication *Conservation Buffers: Design Guidelines for Buffers, Corridors and Greenways* in the technical publications category of the 2009 Association for Communication Excellence Critique and Awards Program.

Compass magazine won an award of excellence in the 2008 Society for Technical Communications (STC) International Technical Publications competition. The international award, which was confirmed on June 1, was awarded in the category of periodicals to writer/editor **Zoë Hoyle**, art director **Rodney Kindlund**, and technical information specialist **Claire Payne**, all with SDG.

Forest Science in the South (2007), the annual report of SRS accomplishments produced every year by SDG, won an award of excellence for graphic design in the 2008 STC International Technical Publications competition, as well as a second place overall Blue Pencil/Gold Screen award from the National Association of Government Communicators in the graphic design category. Art director **Rodney Kindlund** and **Carol Whitlock**, retired SDG group leader, were named recipients of the awards.

Acquisitions Management Awards

The Forest Service Small Business Special Achievement award for 2009 was awarded to the **SRS Acquisitions Management** (AQM) team based in Asheville, NC, and led by **Bruce Hall**. The AQM team also received the Forest Service Deputy Chief's award for "excellence in providing business operations support."



Southern Research Station headquarters in spring 2007. (photo by Rodney Kindlund, U.S. Forest Service)

NEW PRODUCTS *from the Southern Research Station...*

Natural Resources Inventory and Monitoring

1 Brandeis, Thomas J.; Woodall, Christopher W. 2008. **Assessment of forest fuel loadings in Puerto Rico and the U.S. Virgin Islands.** Ambio. 37(7-8): 557-562.

Quantifying the downed woody materials that comprise forest fuels has gained importance in Caribbean forests due to the increasing incidence and severity of wildfire on island ecosystems. Forest fuels were assessed at U.S. Forest Service inventory plots on Puerto Rico and the U.S. Virgin Islands. Trends in Caribbean forest fuel loadings are dynamic and episodic, with high coarse woody debris fuel loads after hurricanes. Fine woody debris fuel loads decrease quickly and take years to reach pre-disturbance levels. Resource managers and agencies charged with fire protection will have to assess downed fuels pulses and their attendant wildfire risks to plan effectively.

2 Harper, Richard A.; McClure, Nathan D.; Johnson, Tony G. [and others]. 2009. **Georgia's forests, 2004.** Resour. Bull. SRS–149. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 78 p. [Editor's note: Southern Research Station scientists James L. Chamberlain, KaDonna C. Randolph, and Sonja N. Oswalt co-authored this publication.]

For the last 50 years, Georgia's forest land area has remained stable, averaging 24.7 million acres, about 67 percent of the land area. Estimates show timberland area was converted to nonforest area at a rate of almost 92,000 acres per year over the last seven years. However, nonforest area was converted to timberland at a rate of about 156,000 acres per year over the same time period—mostly from agricultural land. Since the 1953 inventory, both hardwood and softwood live tree volume has reached its highest levels and increased 16.0 billion cubic feet or 78 percent. The report also discusses growth/removals/mortality, forest disturbance, family forest ownership, forest products and the

economy, nontimber forest products, best management practices, and forest health.

3 Hartsell, Andrew J.; Johnson, Tony G. 2009. **Alabama's forests, 2000.** Resour. Bull. SRS–143. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 49 p.

The principal findings of the seventh forest survey of Alabama (2000) and changes that have occurred since the previous surveys are presented. Topics examined include forest area, ownership, forest-type groups, stand structure, basal area, timber volume, growth, removals, and mortality.

4 Hartsell, Andrew J.; Johnson, Tony G. 2009. **Alabama's forests, 2005.** Resour. Bull. SRS–146. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 42 p.

The principal findings of the eighth forest survey of Alabama (2005) and changes that have occurred since the previous surveys are presented. Topics examined include forest area, ownership, forest-type groups, stand structure, basal area, timber volume, growth removals, and mortality.

5 Johnson, Tony G.; Steppleton, Carolyn D.; Bentley, James W. 2009. **Southern pulpwood production, 2007.** Resour. Bull. SRS–145. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 44 p.

Pulpmills and the production of paper and paperboard products are a major part of the forest industry in the South. In 2007, 87 pulpmills were operating and drawing wood from the 13 southern states. Pulping capacity of southern mills amounted to 125,565 tons per day, and accounted for more than 70 percent of the nation's pulping capacity. Pulpwood production in the South is comprised of two components: wood chips from roundwood derived from forest land and wood chips from mill residue, a byproduct of sawmilling and veneer mill operations. For additional information about the Southern Pulpwood reports contact Tony Johnson in Knoxville, TN at 865-862-2042.

6 Oswalt, Christopher M.; Turner, Jeffrey A. 2009. **Status of hardwood forest resources in the Appalachian Region, including estimates of growth and removals.** Resour. Bull. SRS-142. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 16 p.

The Appalachian Hardwood Region (AHR) is an important wood producing area of the Eastern United States and is near a large portion of the U.S. population that is growing considerably. We present results from an investigation into the forest resources of the AHR, with particular emphasis on the growth and removals of hardwood timber volume in the region. According to estimates of growth-to-removals ratios, while removals are increasing, growth continues to outpace removals at almost 2 to 1. This study provides an important assessment of the current status and recent utilization of hardwood species in the Appalachians. In addition, it provides a framework in which to continue to monitor the resources of the AHR.

7 Oswalt, Sonja N.; Johnson, Tony G.; Coulston, John W.; Oswalt, Christopher M. **Mississippi's forests, 2006.** Resour. Bull. SRS–147. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 78 p.

Forest land covers 19.6 million acres in Mississippi, or about 65 percent of the land area. The majority of forests are classed as timberland. One hundred and thirty-seven tree species were measured on Mississippi forests in the 2006 inventory. Thirty-six percent of Mississippi's forest land is classified as loblolly-shortleaf pine forest, 27 percent is classified as upland oak-hickory forest, and 19 percent is composed of bottomland hardwoods. Weather-related events were the largest component of average annual disturbance (204,000 acres yearly) on Mississippi forest land since the previous inventory. About 4 percent of live trees on Mississippi's forest land experienced some degree of damage due to Hurricane Katrina.

8 Oswalt, Sonja N.; Johnson, Tony G.; Howell, Mike; Bentley, James W. 2009. **Fluctuations in national forest timber harvest and removals: the southern regional perspective.** Resour. Bull. SRS–148. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 30 p.

Here, we examine fluctuations in timber harvest and removals on National Forest System (NFS) lands of the southern region in light of changing societal values and administrative policies. We also present timber product utilization information based on multiple data sources, examine NFS removals in the context of standing volume, and compare NFS removals with removals on other ownerships. Additionally, we compare the estimates generated using the Forest Inventory and Analysis inventory with data collected and reported in the NFS Timber Cut and Sold reports. Data presented in this bulletin will enable NFS managers in the southern region to take a more indepth look at amounts of logging residue left on the ground versus merchantable material leaving the forest.

9 Randolph, KaDonna; Moser, Keith W. 2009. **Tree crown condition in Missouri, 2000-2003.** Gen. Tech. Rep. SRS–113. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 11 p.

Trees with full, vigorous crowns generally are associated with higher growth rates due to their increased capacity for photosynthesis. Crown characteristics that are less than optimal may indicate one or more underlying stressors and, if severe enough, may result in tree mortality. Tree crown conditions assessed in Missouri between 2000 and 2003 were biologically reasonable given the species composition of the state. This crown condition summary was the first of its kind in Missouri and will serve as a baseline against which to compare future assessments. Upon remeasurement, calculation of changes in crown condition will indicate whether crown condition—and by extension, forest health—is stable, improving, or declining.

10 Rudis, Victor A.; Carraway, Burl; Sheffield, Raymond M. [and others]. 2008. **East Texas forests, 2003.** Resour. Bull. SRS–137. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 145 p. [Editor's note: Southern Research Station scientists Sonja N. Oswalt and James L. Chamberlain co-authored this publication.]

Forest land covers 12.1 million acres in east Texas, or about 57 percent of the land area. The majority of forests, 11.9 million acres, are classed as timberland. The 2003 timberland area is the highest recorded since 1975. Forests classed as softwood forest types were found on 5.2 million acres of the timberland; almost one-half of the softwood forests are pine plantations. More than 80 tree species were recorded during the inventory. These species account for 17.2 billion cubic feet of merchantable volume. Softwood and hardwood volumes have increased since the previous inventory in 1992. During the 1992 to 2003 period, net annual growth averaged 796 million cubic feet, whereas annual removals averaged 736 million cubic feet.

11 Schiller, James R.; Hendricks, Brian. 2009. **Alabama's timber industry—an assessment of timber product output and use, 2007.** Resour. Bull. SRS–151. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 33 p.

In 2007, roundwood output from Alabama's forests totaled 1.10 billion cubic feet. Mill byproducts generated from primary manufacturers amounted to 379 million cubic feet. Almost all plant residues were used primarily for fuel and fiber products. Pulpwood was the leading roundwood product at 574 million cubic feet; saw logs ranked second at 413 million cubic feet; veneer logs were third at 75 million cubic feet. The number of primary processing plants was 144. Total receipts amounted to 1.12 billion cubic feet.

12 Woodall, C.W.; Oswalt, C.M.; Westfall, J.A. [and others]. 2009. **An indicator of tree migration in forests of the Eastern United States.** Forest Ecology and Management. 257: 1434–1444.

In a first-of-its-kind study, scientists from the Forest Service, U.S. Department of Agriculture Northern and Southern Research Stations and Michigan State University have confirmed that tree species distributions are already shifting northward as a potential result of climate change. Their recent Forest Ecology and Management article compares the current geographic distributions of tree seedlings to tree biomass for species in the Eastern United States. The results of this study suggest that the process of northward tree migration in the Eastern United States is currently underway for numerous species, with rates approaching 100 km (62.1 miles) per century. The researchers also hypothesized that as northern and southern tree species together move northward due to greater regeneration success at higher latitudes, generalized species (e.g., red maple) may fill their vacated niches in southern locations.

Forest Ecosystem Restoration and Management

13 Bennett, Frances M.; Loeb, Susan C.; Bunch, Mary S.; Bowerman, William W. 2008. **Use and selection of bridges as day roosts by Rafinesque's big-eared bats.** American Midland Naturalist. 160: 386–399.

Rafinesque's big-eared bats (*Corynorhinus rafinesquii*) are a rare and sensitive species found throughout the Southeastern United States. Biologists are concerned about their conservation status due to loss of their natural roost sites, particularly large hollow trees. We surveyed >1,130 bridges across South Carolina to determine the distribution of big-eared bats in the state and determined factors associated with their use and selection of bridges. Bats were located under 73 bridges, primarily in the Coastal Plains region, and selected large, concrete, girder bridges. Both solitary individuals and maternity colonies containing >50 individuals roosted under these bridges. Thus, bridges may be an important roost structure in areas where natural roosts are limited, and bridge surveys may be an excellent method to inventory bats on a regional scale.

14 Busse, M.D.; Sanchez, F.G.; Ratcliff, A.W. [and others]. 2009. **Soil carbon sequestration and changes in fungal and bacterial biomass following incorporation of forest residues.** Soil Biology and Biochemistry. 41: 220–227. [Editor's note: Southern Research Station scientists John R. Butnor and Emily A. Carter co-authored this publication.]

Sequestering carbon (C) in forest soils can benefit site fertility and help offset greenhouse gas emissions. However, identifying soil conditions and forest management practices which best promote C accumulation remains a challenging task. In this study, the effect of tilling woody slash into the soil on short-term C storage at forested sites in the Western and Southeastern United States was studied. It was hypothesized that woody residues would preferentially stimulate soil fungal biomass, resulting in improved C use efficiency and greater soil C storage. Total and active fungal biomass were not strongly affected by residue incorporation, despite the high input of organics. The findings suggest that incorporation of harvest debris has limited potential to enhance long-term soil C storage in these forests.

15 Butnor, John; Johnsen, Kurt; Samuelson, Lisa; Pruyn, Michele. 2009. **Current applications of GPR in forest research.** In: Symposium on the Application of Geophysics to Engineering and Environmental Problems. [Place of publication unknown]: [Publisher unknown]: 885–894.

This publication describes a variety of applications of ground-penetrating radar (GPR) currently being used in forest research. Forests, both naturally regenerated stands and plantations, are complex, long-lived systems which can be difficult to assess and monitor over time. This is especially true of belowground biomass and internal features of trees which were previously inaccessible except by destructive sampling. GPR has been very useful to quantify belowground biomass and spatial distribution of roots, measure root diameters, and even map individual roots nondestructively. In a departure from subsurface analysis, GPR was used to detect defects and moisture gradients in stems.

16 Haywood, James D. 2009. **Eight years of seasonal burning and herbicidal brush control influence sapling longleaf pine growth, understory vegetation, and the outcome of an ensuing wildfire.** Forest Ecology and Management. 258: 295–305.

Five treatments were initiated in sapling longleaf pine stands: check, arborescent plant control with herbicides, and prescribed burning in March, May, or July from 1999 to 2005. In 2006, longleaf pine survival and volume were significantly less on prescribed burned plots than on checks, and herbaceous plant cover averaged 4 percent on the two unburned treatments and 42 percent on the three prescribe burned treatments. However, a wildfire in 2007 disproportionately killed pine trees while rejuvenating herbaceous plant cover on the check and herbicide plots. These results showed both the destructive and restorative effects of wildfire within longleaf pine plant communities.

17 Ludovici, Kim H.; Kress, Lance W. 2006. **Decomposition and nutrient release from fresh and dried pine roots under two fertilizer regimes.** Canadian Journal of Forest Research. 36(1): 105–111.

Root decomposition and nutrient release are typically estimated from dried root tissues; however, it is unlikely that roots dehydrate prior to decomposing. This study monitored mass loss and nutrient concentrations of dried and fresh roots of two size classes (<2 and 2–5 mm) over a 12-month period in fertilized and control plots in a 13-year-old loblolly pine (*Pinus taeda*) plantation. Nutrient content was calculated and used to assess the effects of fertilization, root size, and initial

condition (hydration) on nutrient release rates. Results indicate that using dried root tissues will overestimate fine root decomposition and nutrient cycling rates.

18 Selgrade, James F.; Bostic, Jordan West; Roberds, James H. 2009. **Dynamical behaviour of a discrete selection-migration model with arbitrary dominance.** Journal of Difference Equations and Applications. 15(4): 371-385.

To study the effects of immigration of genes (possibly transgenic) into a natural population, a one-island selection-migration model with density-dependent regulation is used to track allele frequency and population size. The existence and uniqueness of a polymorphic genetic equilibrium is proved under a general assumption about dominance in fitnesses. Also, conditions are found which guarantee the existence of and determine the location of the global attractor for this model. The rate at which solutions approach the attractor is approximated. A measure of allelic diversity is introduced.

Forest Values, Uses, and Policies

19 Ashton, Sarah F.; Hubbard, William G.; Rauscher, H. Michael, eds. 2009. **A southern region conference on technology transfer and extension.** Gen. Tech. Rep. SRS–116. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 237 p.

Forest landowners and managers have different education and technology transfer needs and preferences. To be effective, it is important to use a multi-faceted science delivery/technology transfer program to reach them. Multi-faceted science delivery programs can provide similar content over a wide range of mechanisms, including printed publications, face-to-face workshops and training sessions, satellite-based and pod casting-based distributed learning courses, and a wide range of Internet-based products. Several opportunities exist to share theories, products, activities, successes and failures across the science delivery, Extension, and education communities. As a collection, these papers describe the state of activities and thinking in Southern United States natural resource science delivery and technology transfer.

20 Clark, Alexander III; Daniels, Richard F.; Miller, James H. 2006. **Effect of controlling herbaceous and woody competing vegetation on wood quality of planted loblolly pine.** Forest Products Journal. 56(2): 40-46.

Southern pine plantations are increasingly established using herbicides to control herbaceous and/or woody competing vegetation to enhance growth, but little is known about the effect on wood quality. A study established at 13 southern locations in 1984 examined effects of complete control of woody, herbaceous, and woody plus herbaceous competition for the first 3 to 5 years on the growth and stand dynamics of loblolly pine (*Pinus taeda*) plantations. After 15 years, herbaceous plus woody control increased pine merchantable volume per acre by an average of 23 to 121 percent compared to no competition control. The authors report on growth results and effects on ring specific gravity for the various study treatments.

21 Johnson, Cassandra Y.; Zipperer, Wayne C. 2007. **Culture, place, and urban growth in the U.S. South.** Urban Ecosystems. 10 [Number unknown]: 459-474.

People's connection to land is an important contributor to identity in traditional southern society. In small southern communities, to know where someone lives is to know who someone is because place assigns biography. Studies have investigated the physical and economic implication of landscape change in the South, but comparatively little research focuses on the impacts to culture of urban growth. We consider how sense of place (as an indicator of culture) may be impacted, over time, by physical and structural changes in a locale. This point of departure examines the temporal dimension of sense of place, or how place perceptions may vary as familiar places and practices are altered by landscape moderations. We review the literature on sense of place and changing southern landscapes and also offer a conceptual framework for analyzing sense of place over the long term.

22 Lim, Siew Hoon; Bowker, J.M.; Johnson, Cassandra Y.; Cordell, H. Ken. 2009. **Perspectives on prescribed fire in the South: does ethnicity matter?** Southern Journal of Applied Forestry. 33(1): 17-24.

Using a household survey and regression methods, we assessed preferences for prescribed fire in the Southern United States. We found that the majority of the respondents favored the use of prescribed fire. However, we observed pronounced racial variation in opinions on prescribed fire and its side effects. African-Americans and Hispanics were less supportive and were more concerned about the side effects of prescribed fire than whites. We also observed that females tended to be more concerned about the side effects of prescribed fire than males. In addition, education had no effect on preference for prescribed fire in general, but education was found to be negatively associated with concern levels in all three models pertaining to concerns over the side effects of prescribed fire. Concern over the side effects diminished as education increased.

23 Perkins, Brian; Smith, Bob; Araman, Philip. 2008. **Analyzing the feasibility of utilizing small diameter hardwood timber for solid wood products and residues.** Gen. Tech. Rep. SRS-111. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 6 p.

The eastern hardwood forest contains small diameter timber that is often of lower quality and lower value than larger sawtimber. This small diameter hardwood timber has traditionally been utilized for pulpwood, but it can also be used for lumber and residue production. In order to increase the utilization of this resource by sawmills, a number of analyses need to be conducted. These analyses include a resource analysis, a yield analysis, an economic analysis, and finally a market analysis. This report gives detailed instructions for conducting each of these analyses. The successful completion of these analyses will help hardwood lumber companies determine if using small diameter hardwood timber is a good decision for their company.

24 Poudyal, Neelam C.; Hodges, Donald G.; Bowker, J.M.; Cordell, H.K. 2009. **Evaluating natural resource amenities in a human life expectancy production function.** Forest Policy and Economics. 11(4): 253-259.

Findings from this study imply that communities rich in natural amenities like a high proportion of land in open spaces including forests, farmland, rangeland, and water bodies, and mild climate,

longer sunlight hours during winter, and cooler year around temperature can offer higher life expectancy than those without. Moreover, immediate access to state parks, outdoor recreation facilities, and Federal wilderness parks can also positively influence resident life expectancy. While public health approaches have historically focused on controlling diseases and treating patients, this study suggests that more comprehensive public health policies which increase public investment in environmental conservation, preserve and utilize natural resources, and promote civic engagement in environmental activities may be in order.

25 Prestemon, Jeffrey P. 2009. **Statistical power of intervention analyses: simulation and empirical application to treated lumber prices.** Forest Science. 55(1): 48-63.

Timber product markets are sometimes affected by large natural or policy shocks, such as hurricanes and regulation changes. These large shocks can lead to changes in prices, production, timber inventories, producers, and ultimately consumers. Statistical approaches—univariate and multivariate methods—vary in their ability to detect shocks. This study evaluated two statistical approaches to detecting shocks, quantifying their statistical power, and used them to evaluate the change from chromated copper arsenate to mainly alkaline copper quaternary treatment of southern pine lumber in 2004. The study found that the bivariate statistical methods were more powerful at detecting shocks generally and specifically for a rise in treated southern pine prices by just over 11 percent as a result of the chemical treatment change in 2004.

26 Siegel, William C.; Haney, Harry L.; Greene, John L. 2009. **Estate planning for forest landowners: what will become of your timberland?** Gen. Tech. Rep. SRS-112. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 180 p.

This book provides guidelines on the use of estate planning tools and techniques with a particular focus on forest properties. The first section describes the practical purposes for estate planning and its legal foundations. The second section explains and illustrates the use of general estate planning tools, including gifts, bequests, the marital deduction, trusts, and insurance. The third section explains and illustrates the use of tools that are especially useful with forest estates, such as special use valuation and the exclusion for land subject to a conservation easement. The fourth section describes forms of forest ownership and the basic features of state gift, inheritance, and estate taxes. It also includes an example of the benefit of planning—or the cost of not planning—a forest estate.

27 Wear, D.N.; Greis, J.G.; Walters, N. 2009. **The Southern Forest Futures Project: using public input to define the issues.** Gen. Tech. Rep. SRS-115. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 17 p.

The Southern Forest Futures Project will evaluate potential futures for the forests in the U.S. South. We started with a scoping of issues, using public meetings in 14 locations and three Webinars. We gathered > 2,200 comments and processed the data to define a comprehensive view of how forces of change may reshape forests, and the effects on the benefits of forest ecosystems. We identified a set of meta-issues that warrant indepth analysis: bioenergy, climate change, forest ownership change, invasive species, fire, taxes, and water. The input from these meetings will be used to organize subsequent stages of the project.

Threats to Forest Health

28 Achtemeier, Gary L. 2008. **On the formation and persistence of superfog in woodland smoke.** Meteorological Applications. 16(2): 215-225.

Dense fogs reducing visibility to less than 3 m (10 feet)—defined as superfog—have been associated with extreme visibility reductions over roadways. Superfog can form when two moist airmasses of widely different temperatures are mixed. This condition is best satisfied late at night or early morning when temperatures reach daily lows and when relative humidities are highest. When superfog events occur, multiple-vehicle pileups with injuries and fatalities often result. In the Southern United States, superfog events can be associated with smoldering from prescribed burns and wildfires—usually during the winter/spring burning season. Issues of conscience and threat of litigation make understanding how superfog forms critical to the continued widespread use of fire as a land management tool. Therefore, research seeks to increase understanding of the conditions that permit superfog to form.

29 Bishir, John; Roberds, James; Strom, Brian; Wan, Xiaohai. 2009. **Documentation and user guides for SPBLOB: a computer simulation model of the joint population dynamics for loblolly pine and the southern pine beetle.** Gen. Tech. Rep. SRS-114. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 83 p.

SPLOB is a computer simulation model for the interaction between loblolly pine (*Pinus taeda*), the economically most important forest crop in the United States, and the southern pine beetle (SPB) (*Dendroctonus frontalis*), the major insect pest for this species. The model simulates loblolly pine stands from time of planting until harvest. It mimics day-to-day changes in SPB populations, and the associated tree mortality caused by these bark beetles. In addition, it provides yearly updates of tree mortality due to competition and of growth for the surviving trees. Chiefly, the model and its simulation codes are designed to function as research tools for investigating the influence of stand properties on SPB activities, and of the reciprocal impact of beetles on tree mortality.

30 Cram, Michelle M.; Fraedrich, Stephen W. 2007. **Detection and management of stunt and stubby-root nematodes in a southern forest nursery.** In: Riley, L.E.; Dumroese, R.K.; Landis, T.D., tech coords. National proceedings: Forest and Conservation Nursery Association, 2006. Fort Collins, CO: U.S. Department of Agriculture Forest Service, Rocky Mountain Station: 91-96.

Reductions in pine seedling growth and quality are frequently noted in southern forest nurseries during the second year of production following fumigation. A year-long survey of loblolly pine (*Pinus taeda*) fields in one nursery discovered that the stunt nematode (*Tylenchorhynchus claytoni*) increased significantly following fumigation to levels that could impact seedling growth and cause stunting. The stubby root nematode (*Paratrichodorus minor*), which can also damage pine seedlings, was also found in these fields. The nursery had been alternating sorghum and grain rye cover crops with pine seedling production, and we subsequently found all of these species were excellent hosts for the stunt and stubby-root nematodes. In host range tests, population densities of the stubby-root and stunt nematodes declined with fallow or in fields where pearl millet (*Pennisetum americanum*) was used as a cover crop.

31 Goodrick, Scott L.; Hanley, Deborah E. 2009. **Florida wildfire activity and atmospheric teleconnections.** International Journal of Wildland Fire. 18(4): 476-482.

Since 1991, the Florida Division of Forestry has been making seasonal fire severity forecasts based on a relationship between area burned in Florida and El Niño–Southern Oscillation (ENSO). The present study extends the original analysis on which these forecasts area based and attempts to augment it with the addition of other patterns of climate variability. Two atmospheric teleconnection patterns, the North Atlantic Oscillation and Pacific–North American pattern (PNA), are examined as potential indicators of seasonal and monthly area burned in Florida. Although ENSO was the only climate index to show a significant correlation to area burned in Florida, the PNA is shown to be a factor in influencing fire season severity, although the relationship is not monotonic and, therefore, not revealed by correlation analysis.

32 Guo, Qinferg. 2009. **Interactive effects of diversity and biomass on productivity: insights from succession.** In: Wu, J.; Yang, J., eds. Lectures in modern ecology (IV): theory and applications. Beijing: Higher Education Press and Springer: 58-73.

Do commonly observed spatial relationships also exist over time? As an attempt to answer this question, this study examines whether the frequently observed diversity-biomass-productivity-relationships over space can also be seen over time. Syntheses of long-term data and literature show that when the full successional cycles are examined, diversity and productivity are usually positively related to each other but unimodally related to biomass. These relations are consistent with frequently observed patterns over space, and the same underlying mechanisms might apply to both spatial and temporal patterns. The results shed new light on restoration ecology and ecosystem management.

33 Hanula, James L.; Sullivan, Brian. 2008. **Manuka oil and phoebe oil are attractive baits for *Xyleborus glabratus* (Coleoptera: Scolytinae), the vector of laurel wilt.** Environmental Entomology. 37(6): 1403-1409.

Redbay ambrosia beetle is a native of Southeast Asia recently introduced into coastal forests of Georgia, South Carolina, and Florida. It carries a fungus causing a lethal wilt disease in redbay trees that can also kill sassafras. No practical monitoring system existed for this beetle, so we conducted studies to identify attractants produced by redbay trees that could be used as lures in traps. We tested several compounds individually. Those chemicals were available in crude extracts of manuka plants from New Zealand and a tree species in the genus *Phoebe* from Brazil. Manuka and phoebe extracts were as attractive as redbay wood to redbay ambrosia beetle. Manuka oil is readily available and is a good alternative to redbay wood as trap baits for monitoring redbay ambrosia beetle distribution and population trends. In addition, the availability of these new artificial lures suggests several unique ways they can be used to help control redbay ambrosia beetle.

34 Horn, Scott; Ulyshen, Michael D. 2009. **The importance of streamside sandbars to ground beetle (Coleoptera, Carabidae) communities in a deciduous forest.** Journal of Insect Conservation. 13 [Number unknown]: 119-123.

Riparian forests are dynamic systems that connect terrestrial and aquatic habitats. The transition zone created by these forests generates a patchwork of microhabitats which influences local biodiversity. Sand and gravel bars are examples of these transitional habitats which occur along rivers and streams worldwide. We used pitfall traps to sample ground beetles along a small woodland stream in the Georgia Piedmont and in the adjacent forest to determine the importance of these habitats to resident ground beetle populations. We captured a total of 1,477 ground beetles representing 41 species. In the future, these beetles can be used as bioindicators, allowing researchers and managers to detect change to local streamside environments. This study demonstrates that many unique species can be found in specialized microhabitats and emphasizes the need for biodiversity assessment surveys to include a wide range of habitats.

35 Klepzig, K.D.; Adams, A.S.; Handelsman, J.; Raffa, K.F. 2009. **Symbioses: a key driver of insect physiological processes, ecological interactions, evolutionary diversification, and impacts on humans.** Environmental Entomology. 38(1): 67-77.

In a symbiosis, organisms live together in close interaction. Sometimes both of the partners benefit from one another, sometimes only one does. Insects exist in symbiosis with a variety of fungi and bacteria. From their partners, insects may receive nutrition, improved reproduction, even protection from natural enemies. The microorganisms may receive transport and protection from the environment. These strong, ancient alliances can also have important effects on human well-being, affecting agriculture, human health, natural resources, and the impacts of invasive species. The authors explore symbiotic relations involving bark beetles as examples of the impacts of symbioses, and highlight new discoveries.

36 McLaughlin, S.B.; Wullschleger, S.D.; Sun, G.; Nosal, M. 2007. **Interactive effects of ozone and climate on water use, soil moisture content, and streamflow in a Southern Appalachian forest in the USA.** New Phytologist. 174 [Number unknown]: 125-136.

This study measured tree water use, soil moisture, and streamflow in three forested watersheds in east Tennessee. We found that an increase in ambient ozone level significantly correlated to elevated whole-tree canopy conductance, depletion of soil moisture, and reduction of late-season streamflow. This study suggests that current ambient ozone exposures may exacerbate the frequency and level of negative effects of drought on forest growth and stream health. Documentation of the degree and direction of effects of ozone on forest water loss is critically needed to model ozone effects on forest water use and growth in a warmer future climate.

37 Miller, Daniel R.; Rabaglia, Robert J. 2009. **Ethanol and (–)-α-pinene: attractant kairomones for bark and ambrosia beetles in Southeastern U.S.** Journal of Chemical Ecology. 35(4): 435-448.

In 2002–2004, we examined the responses of 49 species of native and exotic bark and ambrosia beetles to funnel traps baited with ethanol and/or (–)-α-pinene in Southeastern United States. We found that traps baited with ethanol were attractive to 10 species of ambrosia and two species of bark beetles. Traps baited with (–)-α-pinene were attractive to five bark beetles. In some locations, ethanol enhanced responses of some bark beetle species to traps baited with (–)-α-pinene, whereas (–)-α-pinene interrupted

attraction of some ambrosia beetle species to traps baited with ethanol. Of 23 species of ambrosia beetles captured in our field trials, nine were exotic and accounted for 70 to 97 percent of total catches of ambrosia beetles.

38 Mulrooney, J.E.; Gerard, P.D. 2007. **Toxicity of fipronil in Mississippi soil types against *Reticulitermes flavipes* (Isoptera: Rhinotermitidae).** Sociobiology. 50(1): 63-70.

Three soils (a silt loam, loamy sand, and sandy loam) found in Mississippi and pure silica sand were treated with fipronil and bioassayed using eastern subterranean termites, *Reticulitermes flavipes*. Soils were treated with aqueous solutions of Termidor (fipronil) at concentrations of 0, 0.12, 0.25, 2.5, 5.0, and 20.0 ppm (wt AI:wt soil) that brought the soils to 15 percent moisture. Estimated lethal concentrations (ppm) required to kill 50 percent of termite workers within 96 hours after placement on the soils were 0.49 (sand loam), 0.70 (sand), 4.21 (loamy sand), and 6.99 (silt loam). Termite mortality decreased with increases in organic matter content of the soils treated with fipronil.

39 Mulrooney, J.E.; Gerard, P.D. 2009. **Tunneling and activity of *Reticulitermes flavipes* (Isoptera: Rhinotermitidae) exposed to low concentrations of non-repellent termiticides.** Sociobiology. 53(3): 695-706.

This paper examines termite tunneling through sand treated with one of three delayed action non-repellent termiticides: chlorfenapyr, fipronil, or imidacloprid. Once termites passed the treated sand, measurements of termite tunneling in untreated sand were collected. None of the termiticides prevented tunneling entirely, and none were able to kill more than 60 percent of the termites. However both fipronil and imidacloprid did have significantly less total tunneling distance than either chlorfenapyr or water only controls (which performed similarly). Only exposure to fipronil resulted in significantly greater termite mortality than the controls. These data indicate that although popular, these termiticides do not completely prevent termite movement past treated areas.

40 Mulrooney, J.E.; Hasse, R.D.; Wagner, T.L.; Gerard, P.D. 2007. **Activity of *Reticulitermes flavipes* (Isoptera: Rhinotermitidae) exposed to nestmates treated with slow-acting nonrepellent termiticides.** Sociobiology. 50(1): 71-86.

Delayed action non-repellent (DANR) termiticides work slowly, killing off termites that visit treated soil. Previous laboratory studies have indicated that DANR-exposed termites can poison untreated nestmates through "termiticide transfer." In this paper, a prototype sound detection device was used to study transfer of two commonly sold DANR termiticides (fipronil and imidacloprid) at 50 ppm. Only fipronil was significantly different in terms of termite activity, mortality (which did not reach 100 percent), and wood consumption from water-only controls over two weeks. These results indicate that transfer may be unreliable for termite control.

41 Peterson, Chris; Wagner, Terence L.; Mulrooney, Joseph E.; Shelton, Thomas G. 2006. **Subterranean termites—their prevention and control in buildings.** Home and Garden Bulletin 64. Washington, DC: U.S. Department of Agriculture Forest Service, Southern Research Station. 32 p.

Structural damage repair and control costs associated with subterranean termites are estimated to exceed $1.5 billion annually in the United States. Protection measures to prevent termite damage are required in the building codes of many states. This booklet provides homeowners with background information on the biology and control of subterranean termites. Treatment strategies for termite control are discussed, including both pre-construction and remedial applications. The booklet details some of the good building practices which make buildings less "termite friendly." It includes basic termite biology, such as how to distinguish termites from ants, illustrations of damage, tunneling, and U.S. distributions.

42 Riitters, Kurt; Vogt, Peter; Soille, Pierre; Estreguil, Christine. 2009. **Landscape patterns from mathematical morphology on maps with contagion.** Landscape Ecology. 24(5): 699-709.

The perceived realism of simulated maps with contagion (spatial autocorrelation) has led to their use for comparing landscape pattern metrics and as habitat maps for modeling organism movement across landscapes. Many such studies have indicated "threshold-like" ecological responses which are said to be the result of sudden shifts in landscape patterns as the proportion of habitat is raised or lowered on a landscape. The objective of this study was to confirm sudden shifts in landscape patterns on maps with contagion using new types of pattern metrics which are known to be extremely sensitive to them. There was no evidence of sudden shifts of landscape patterns on maps with contagion, implying that any "threshold-like" ecological responses observed in other studies are not caused by sudden shifts in landscape patterns on such maps.

43 Ulyshen, Michael D.; Hanula, James L. 2009. **Litter-dwelling arthropod abundance peaks near coarse woody debris in loblolly pine forests of the Southeastern United States.** Florida Entomologist. 92(1): 163-164.

We collected leaf litter samples adjacent (= 15 cm) to and away (> 2 m) from logs at three stages of decay to determine how arthropod abundance varies with proximity to coarse woody debris in loblolly pine forests. Arthropods overall and several individual taxa (i.e., Araneae, Coleoptera, Psocoptera and holometabolous insect larvae) were significantly more abundant near logs than away from them. None of the taxa was more abundant away from logs, and there were no differences in abundance among decay classes. These results suggest that dead wood strongly affects the spatial distribution patterns of litter-dwelling arthropods in southeastern forests.

44 Wade, Timothy G.; Wickham, James D.; Zacarelli, Nicola; Riitters, Kurt H. 2009. **A multi-scale method of mapping urban influence.** Environmental Modelling & Software. 24(10): 1252-1256.

Urban development can impact environmental quality and ecosystem services well beyond urban extent. Many methods to map urban areas have been developed and used in the past, but most have simply tried to map existing extent of urban development, and all have been single-scale techniques. The method presented here uses a clustering approach to look beyond the extant urban area at multiple scales. The result is a single, synoptic multi-scale map of urban influence that should be useful in urban, regional, and environmental planning efforts.

45 Zhou, Guoyi; Sun, Ge; Wang, Xu. [and others]. 2008. **Estimating forest ecosystem evapotranspiration at multiple temporal scales with a dimension analysis approach.** Journal of American Water Resources Association. 44(1): 208-221. [Editor's note: Southern Research Station scientists Steven G. McNulty, James M. Vose, and Devendra M. Amatya co-authored this publication.]

Over 60 percent of precipitation returns back to the atmosphere and is not available for human use. Accurately quantifying evapotranspiration (ET) is critical to evaluating the effects of land management and global change on water availability, streamflow, nutrient and sediment loading, and ecosystem productivity. The developed ET model was tested with long-term hydro-meteorological data from five research sites in the Southeastern United States and China. Averaged simulation errors for annual ET were within 7.0 percent of measured values. The climate-driven model is sensitive to land surface characteristic parameters and thus has potential to be applied to examine the compounding hydrologic responses to landforms and climate changes at multiple spatial and temporal scales.

Forest Watershed Science

46 Adams, Susan B. 2009. **A selection of the crayfishes of Mississippi.** [Poster]. Memphis, TN: Graphics Systems, Inc.

Crayfishes, also known as crawfish, mudbugs, and crawdads, are related to shrimps, lobsters, and crabs. The Southeastern United States has the highest crayfish diversity in the world. Mississippi has about 63 named crayfish species and others that are still unnamed. Seventeen species live only in Mississippi. Crayfishes live in a wide variety of habitats, including lakes, rivers, streams, springs, seasonally wet habitats such as roadside ditches, and even relatively dry savannahs and lawns. Nearly all crayfishes will burrow during adverse conditions such as drought, but some species spend nearly all of their lives in complex burrows. In addition to being a popular food for people, crayfishes play diverse and important ecological roles in the various habitats they occupy.

47 Amatya, Devendra M.; Skaggs, Wayne R.; Trettin, Carl C. 2009. **Advancing the science of forest hydrology: a challenge to agricultural and biological engineers.** Resource. 16(5): 10-11.

Forests are an integral component of the landscape, and maintaining their functional integrity is fundamental to ecosystem sustainability. Tools and practices analogous to those developed to improve agricultural production and quantify environmental impacts are needed to ensure the entirety of ecosystem goods and services. Agricultural and biological engineering involves the requisite disciplines to address issues associated with the sustainability of contemporary landscapes, extending well beyond the boundary of agricultural lands. The American Society of Agricultural and Biological Engineers can play an important role in advancing the science of forest hydrology by strengthening collaborations of its professionals with forest scientists.

48 Barnhart, Christopher M.; Haag, Wendell R.; Roston, William N. 2008. **Adaptations to host infection and larval parasitism in Unionoida.** Journal of the North American Benthological Society. 27(2): 370-394.

This paper reviews adaptations of freshwater mussels for infecting and parasitizing their fish hosts. Mussel larvae must undergo a brief period as parasites on the gills or fins of fishes. Some mussel species are generalists that parasitize a wide range of fishes, while others are specialists, able to parasitize only a few, closely related fish species. Host specificity is a critical feature of the evolutionary diversification and conservation biology of mussels, and the host relationship is important in dispersal of otherwise sedentary mussels. Infection strategies exploit predator-prey relationships by mimicking food items of host fishes. The intricate relationships between mussels and fishes are easily disrupted, contributing to the imperilment of many mussel species.

49 Champlin, Tracey B.; Kilgo, John C.; Moorman, Christopher E. 2009. **Food abundance does not determine bird use of early-successional habitat.** Ecology. 90(6): 1586-1594.

Few attempts have been made to experimentally address the extent to which variation in food availability influences habitat use by birds. We investigated the role of food in determining habitat use by birds in forest canopy gaps within a bottomland hardwood forest in South Carolina. The response by birds to experimentally manipulated arthropod abundance was limited and inconsistent. We conclude that arthropod abundance did not control whether forest birds used our gaps. The abundance of food resources may not be as important in determining bird habitat selection as previous research has indicated, at least for forest birds in temperate subtropical regions.

50 Coleman, Mark. 2007. **Spatial and temporal patterns of root distribution in developing stands of four woody crop species grown with drip irrigation and fertilization.** Plant and Soil. 299: 195-213.

Belowground production is a poorly understood component of forest ecosystems because of difficulties in accessing and measuring roots. This study uses managed forest plantations as model forest to simplify the study of belowground production. Numerous factors are considered, including four different tree species, nutrient and water availability, soil depth, stand development, and spatial distribution difference caused by drip irrigation treatments. Stand age, depth, and driptubes had predominant effects. Subtle differences between species, nutrient availability, and soil moisture could not be identified until other predominant factors were defined. Hardwoods produce greater root length than pine, and nutrient availability stimulated root growth. This information will enhance understanding of root responses to environmental change.

51 Hawkins, Tracy S.; Baskin, Jerry M.; Baskin, Carol C. 2005. **Life cycles and biomass allocation in seed- and ramet-derived plants of *Cryptotaenia canadensis* (Apiaceae), a monocarpic species of Eastern North America.** Canadian Journal of Botany. 83 [Number unknown]: 518-528.

Life cycles, survivorship, and biomass allocation for seed- and ramet-derived plants of *Cryptotaenia canadensis* were studied. Seedlings emerged in spring and behaved as biennials, reproducing both sexually and asexually in the second growing season. Ramets emerged in late summer and reproduced sexually and asexually annually. Seed-derived plants had higher percent survival and lower flowering percentage than ramet-derived plants, but fewer seed-derived plants flowered than did ramet-derived plants. During reproduction, biomass allocation did not differ between ramet- and seed-derived plants. Equivalent reproductive output combined with differences in plant derivation life cycles optimize this species' ability to persist in its natural habitat.

52 Hawkins, Tracy S.; Schiff, Nathan M.; Leininger, Theodor D. [and others]. 2009. **Growth and intraspecific competitive abilities of the dioecious *Lindera melissifolia* (Lauraceae) in varied flooding regimes.** Journal of Torrey Botanical Society. 136: 91–101. [Editor's note: Southern Research Station scientists Emile S. Gardiner, Margaret S. Devall, Paul B. Hamel, A. Dan Wilson, and Kirstina F. Connor co-authored this publication.]

The contribution of growth characteristics and competitive abilities of male and female pondberry (*Lindera melissifolia*) to male-biased colony ratios observed in field populations was investigated. In three flooding treatments (no-flooding, 30-day-flooding, and 60-day-flooding) and in varying planting densities, males and females competed equally well. In both sexes, stem growth ceased and leaves were lost in response to flooding. However, growth characteristics of male pondberry grown alone suggested greater potential for competing with other plant species. Therefore, male pondberry may colonize suitable habitat more easily than female pondberry, which could indirectly contribute to male-biased colony ratios in field populations.

53 Kilgo, John C. 2009. **Coyotes in the East: are they impacting deer?** Forest Landowner. 68(2): 5-8.

Many hunters and landowners in the Eastern United States have expressed concern over whether recently established coyote populations might be affecting deer and other wildlife. Biologists in the region have not considered coyotes as a management problem, but recent research indicates that predation by coyotes may be more of a concern than previously thought. Much of this work has been conducted at the U.S. Department of Energy's Savannah River Site in western South Carolina. Researchers first studied coyote population size, movements, habitat use, food habits, and survival and mortality. This work later led to more direct assessments of their impact on the deer population. This article presents information from the Savannah River Site and elsewhere on this emerging and potentially important issue in wildlife management.

54 Lockhart, Brian Roy; Gardiner, Emile S.; Hodges, John D.; Ezell, Andrew W. 2008. **Carbon allocation and morphology of cherrybark oak seedlings and sprouts under three light regimes.** Annals of Forest Science. 65(8): 801p1–p8.

Carbon allocation and morphology were compared between cherrybark oak (*Quercus pagoda*) seedlings and sprouts at 1-Lag grown in full, 47 percent, and 20 percent sunlight. Results indicated that cherrybark oak seedling carbon allocation and morphology responded plastically to light availability. In full light, roots were sinks for ^{14}C, while shoots were sinks for ^{14}C under reduced light availability. Cherrybark oak sprouts exhibited similar carbon allocation patterns in response to light availability, but displayed stronger shoot sinks than seedlings when grown under reduced light availability. We also showed that young oak sprout roots are a sink for ^{14}C-photosynthates. Results from this study point to the need for a morphological index for oak sprout development so more precise comparisons in sprout development and physiology can be made with seedlings.

55 Nuckolls, April E.; Wurzburger, Nina; Ford, Chelcy R. [and others]. 2009. **Hemlock declines rapidly with hemlock woolly adelgid infestation: impacts on the carbon cycle of Southern Appalachian forests.** Ecosystems. 12(2): 179-190. [Editor's note: Southern Research Station scientist J.M. Vose co-authored this publication.]

Eastern hemlock, an important streamside and cove species in Southern Appalachian forests, is facing widespread mortality from hemlock woolly adelgid (HWA), an exotic invasive insect. We studied hemlock decline induced by either girdling or HWA infestation and quantified the concurrent changes to the carbon cycle in a mixed stand of hemlock and hardwoods. Hemlock tree growth declined substantially in response to girdling and infestation compared to reference hardwoods in three years. Following girdling and infestation, very fine root biomass declined by 20 to 40 percent in two years, and soil and root respiration declined by about 20 percent in one year. Our results suggest that hemlock is declining more rapidly from HWA infestation in the Southeast than in the Northeast, and that hemlock decline from HWA has a rapid effect on the carbon cycle.

56 Safdari, Vahidreza; Devall, Margaret S. 2009. **Elementary software for the hand lens identification of some common Iranian woods.** IAWA Journal. 30(1): 81-86.

The computer program "Hyrcania" has been developed for identifying some common woods (26 hardwoods and 6 softwoods) from the Hyrcanian forest type of Iran. The program has been written in JavaScript and is usable with computers as well as mobile phones. The databases use anatomical characteristics (visible with a hand lens) and wood color, and can be searched in English or Persian. Descriptions and images can be retrieved by their scientific names.

57 Schoeneberger, M.M. 2008. **Agroforestry: working trees for sequestering carbon on agricultural lands.** Agroforestry Systems. 75 [Number unknown]: 27-37.

Agroforestry, which integrates woody plants into agricultural production systems, can sequester significant amounts of new carbon while leaving the bulk of the land in agricultural production. Simultaneously, it can help landowners and society address many other issues facing these lands, such as bioenergy, biodiversity, and water quality. Agroforestry research, like that conducted at the National Agroforestry Center, is establishing the scientific foundation needed for building carbon accounting and modeling tools. Incorporation of agroforestry into the agricultural "toolbox" will enable comparison of different farm management scenarios, thereby improving the development of greenhouse gas mitigation strategies on these lands.

58 Trettin, C.C; Laiho, R.; Minkkinen, K.; Laine, J. 2005. **Influence of climate change factors on carbon dynamics in northern forested peatlands.** Canadian Journal Of Soil Science. 86 [Number unknown]: 269-280.

Peatlands are carbon-accumulating wetland ecosystems, developed through an imbalance among organic matter production and decomposition processes. Soil saturation is the principal cause of anoxic conditions that constrain organic matter decay. Accordingly, changes in the hydrologic regime will affect the carbon (C) dynamics in forested peatlands. Our objective is to review ecological studies and experiments on managed peatlands that provide a basis for assessing the effects of an altered hydrology on C dynamics. We conclude that climate change influences will be mediated primarily through the hydrologic cycle. A lower water table resulting from altered precipitation patterns and increased atmospheric temperature may be expected to decrease soil CH_4 and increase $C0_2$ emissions from the peat surface. Correspondingly, the C balance in forested peatlands is also sensitive to management and restoration prescriptions. Increases in soil $C0_2$ efflux do not necessarily equate with net losses from the soil C pool. While the fundamentals of the C balance in peatlands are well-established, the combined affects of global change stressors and management practices are best considered using process-based biogeochemical models. Long-term studies are needed both for validation and to provide a framework for longitudinal assessments of the peatland C cycle.

59 Warren, Melvin L.; Sheldon, Andrew L.; Haag, Wendell R. 2009. **Constructed wood micohabitat bundles for sampling fishes and crayfishes in Coastal Plain streams.** North American Journal of Fisheries Management. 29(2): 330-342.

Small woody material (e.g., stems, leaves) and fine roots of riparian trees contribute to structure and diversity of stream habitats. Woody material is especially important in Coastal Plain streams where sand dominates the stream bottom. In these habitats, woody material is the major source of fish cover and the primary substrate for production of fish food organisms. We investigated fish and crayfish use of constructed woody microhabitats (cane, leaf, and string bundles) in northern Mississippi streams in winter and spring. Two streams were channelized and had little woody cover; a third was unchannelized and not incised and had abundant woody cover. Occupancy of bundles by fish and crayfish was high and included 32 fish species representing 8 families. Fish and crayfish use of bundles was much higher in the channelized streams than in the unchannelized stream. Interestingly, after a cold winter storm fish use increased in channelized streams but not in the unchannelized stream, suggesting fishes are limited in channelized streams by lack of woody cover.

60 Wilson, Alphus D.; Baietto, Manuela. 2009. **Applications and advances in electronic-nose technologies.** Sensors. 9 [Number unknown]: 5099-5148.

Electronic-nose devices (e-noses) are innovative instruments that have received considerable attention the past 20 years. E-noses are engineered with sensors designed to electronically mimic the mammalian olfactory system (sense of smell) in order to identify, classify, discriminate, and characterize simple to complex vapor (gas) mixtures containing different types of volatile organic compounds (VOCs). These devices are different from traditional instruments used in analytical chemistry in that they are capable of recognizing complex vapors without having to separate or identify individual components within the sample mixture. This article provides a comprehensive review and description of the many and varied types and applications of e-noses in diverse industrial and scientific fields, particularly those that have been of greatest benefit to man.

Hiker. (U.S. Forest Service photo)

Young fisherman. (photo by Larry Korhnak, Interface South)

Research Work Units

Location and project leader	Name and Web site	Phone
Athens, GA Ken Cordell	Pioneering Forestry Research on Emerging Societal Changes	706-559-4263
Forest Ecosystem Restoration and Management		
Asheville, NC Cathryn Greenberg	Upland Hardwood Ecology and Management www.srs.fs.usda.gov/bentcreek	828-667-5261
Auburn, AL Kris Connor	Restoring and Managing Longleaf Pine Ecosystems www.srs.fs.usda.gov/4111	334-826-8700
Monticello, AR James Guldin	Southern Pine Ecology and Management www.srs.fs.usda.gov/4106	870-367-3464
Saucier, MS Kurt Johnsen, acting	Forest Genetics and Ecosystems Biology www.srs.fs.usda.gov/organization/unit/mississippi.htm#SRS-4153	228-832-2747
Forest Values, Uses, and Policies		
Gainesville, FL Vacant	Integrating Human and Natural Systems www.srs.fs.usda.gov/trends	352-376-3213
Auburn, AL Bob Rummer	Forest Operations www.srs.fs.usda.gov/forestops/	334-826-8700
Pineville, LA Les Groom	Utilization of Southern Forest Resources www.srs.fs.usda.gov/4701	318-473-7268
Research Triangle Park, NC David Wear	Forest Economics and Policy www.srs.fs.usda.gov/econ	919-549-4093
Threats to Forest Health		
Asheville, NC Danny Lee	Eastern Forest Environmental Threat Assessment Center www. forestthreats.org	828-257-4854
Athens, GA John Stanturf	Center for Forest Disturbance Science www.srs.fs.usda.gov/disturbance	706-559-4316
Pineville, LA Doug Streett	Insects, Diseases, and Invasive Plants of Southern Forests www.srs.fs.usda.gov/4501	318-473-7232
Forest Watershed Science		
Franklin, NC Jim Vose	Center for Forest Watershed Research www.srs.fs.usda.gov/coweeta	828-524-2128
Lincoln, NE Michele Schoeneberger	National Agroforestry Center - Research www.nac.gov	402-437-5178
Stoneville, MS Ted Leininger	Center for Bottomland Hardwoods Research www.srs.fs.usda.gov/cbhr	662-686-3154
Natural Resources Inventory and Monitoring		
Knoxville, TN Bill Burkman	Forest Inventory and Analysis www.srsfia2.fs.fed.us	865-862-2000

"Linking science and human purpose, adaptive management serves as a compass for us to use in searching for a sustainable future."

—Kai N. Lee, *The Compass and the Gyroscope—Integrating Science and Politics for the Environment*[1]

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The Forest Service provides private landowners with a range of resources to manage forest land. (U.S. Forest Service photo)