The Longleaf Alliance

7th Regional Conference and Forest Guild Annual Meeting

Forestry in a Changing World: New Challenges and Opportunities

forestGUILD

Longleaf Alliance
Report No. 14

July 2009

The Longleaf Alliance 7th Regional Conference and Forest Guild Annual Meeting

Forestry in a Changing World: New Challenges and Opportunities

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Forward: 7th Regional Conference a Great Success

by Rhett Johnson

The 7th regional conference, like its predeccessors, was a huge success. The conference was sited in Sandestin, Florida at the Baytown Resort and Conference Center in conjunction with the annual meeting of the Forest Guild and attracted about 350 attendees from around the region and nation. As in the past, attendees were from a vast array of backgrounds, with "'ologists" of all types, foresters, landowners, nurserymen, photographers, researchers, managers, etc., included in the mix. They represented everything from private foundations to federal agencies and included state agency personnel, private consultants, researchers and academics, landowners and representatives from an array of environmental organizations. The poster session, always a hit, contained about 60 entries and displayed some of the best longleaf ecosystem research and restoration projects currently going on in the region. We also saw our greatest number of exhibitors to date. Attendees of our regional conference had opportunities to meet and socialize with equipment manufacturers, native seed companies, tree and native plant nurseries, herbicide companies, nursery suppliers, professional photographers, book publishers, lumber and decorative manufacturers, seed companies, the producers of Discovering Alabama, a forest certification organization and other nonprofit organizations!

Presentations at the plenary and concurrent sessions were uniformly good, with timely topics and interesting and diverse perspectives in every case. Of course, the highlight of the entire conference was the presence of and presentation by Dr. Edward O. ("please just call me Ed") Wilson. His participation attarcted many to the conference who may have deferred because of tight budgets and travel restrictions.

Other notable presentations during the plenary sessions included "State of the Alliance" address, and introduction to Auburn's Center for Longleaf Pine Ecosystems, Dr. Reed Noss's excellent presentation on Grasslands and Geoff Hill's update on the search for the Ivory-Billed Woodpecker. A special introduction to the nearly complete range-wide restoration plan for longleaf, America's Longleaf, was included and an entire breakout session was dedicated to discussion of that plan.

Other topics included the projected impact of climate change on longleaf and other southeastern ecosystems and communities, and longleaf conservation and restoration efforts in the Florida Panhandle. The concurrent sessions, including the introduction of the America's Longleaf plan, included panel discussions or presentations on Education and Outreach, Assessment and Regeneration, Managing for Multiple Uses, Prescribed Fire and Understory Restoration Advances, Lessons Learned from Long-Term Research, and New Conservation Opportunities for Longleaf Landowners. Obviously, there was something for everyone, no matter what their background or interest.

A highlight of the meeting was the excellent field trip. We visited three sites: the outstanding restoration project on the 53,000 acre privately owned Nokuse Plantation; a unique old-growth longleaf stand immediately adjacent to the bayfront beach; and a beautifully restored longleaf forest on Eglin AFB. The presntations on the field trip ranged from underplanting longleaf in slash pine plantations to gopher tortoise relocation to red-cockaded management to understaory restoration to longleaf products to feral hog control to snag management for songbirds and on and on. The tours were leisurely, as always, but intricately timed and planned and went off like clockwork, surely a testimony to hours of hard work and preparation by our own JJ and a host of volunteers.

As always, the food was good, the beverages abundant, and the company excellent. The Thursday night band, Eclectic Acoustic, was perfect for the occasion and the weather couldn't have been better. Regular attendees and "newbies" alike commented over and over about the excitement and enthusiasm so obvious. A frequent comment was that our conferences are the best among conferences and that this was our best effort to date. I don't know whether that's true or just a failure of long term memory, but I couldn't agree more. See you in 2010!

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Longleaf Alliance and Forest Guild 2008 Joint Meeting Program

Forestry in a Changing World: New Challenges and Opportunities

Tuesday October 28, 2008

3:00-7:00 pm **Registration Open - Azalea Foyer**

3:00-5:00 pm **Poster Set-up - Camellia I & II**

5:00-7:00 pm **Poster Presentations and Refreshments - Camellia I & II**

Wednesday, October 29, 2008

7:30 am **Registration Opens - Azalea Foyer**

7:30-9:00 am **Continental Breakfast - Azalea Corridor**

Plenary Session - Azalea Ballroom

8:30 am **Welcome and Introduction to Longleaf Alliance Meeting** - Dean Gjerstad (Longleaf Alliance) and Howard Gross (Forest Guild)
- **State of the Alliance** - Rhett Johnson (Longleaf Alliance)
- **Center for Longleaf Pine Ecosystems** - Lisa Samuelson (Auburn University School of Forestry & Wildlife Sciences)

9:30 am **E.O. Wilson -** Dr. Wilson is Pellegrino University Research Professor in Entomology for the Department of Organismic and Evolutionary Biology at Harvard University and a world renowned ecologist, theorist, and author.

10:30-10:45 am **Refreshment Break - Azalea Corridor**

10:45 am **Longleaf Conservation Efforts in Florida**
- Vernon Compton (Nature Conservancy Florida)
- M.C. Davis (Nokuse Plantation)
- Matt Aresco (Director, Nokuse Plantation)

11:30 am **Unveiling of the First Draft of the Range-wide Conservation Plan for Longleaf Pine**
- Lark Hayes (Coordinator, Regional Working Group for America's Longleaf)
- Ken Arney (USFS Deputy Regional Forester for Region 8)
- Bill Ross (Secretary, North Carolina Department of Environment and Natural Resources)

12:00-1:30 pm **Lunch - Grand Lawn**

1:30-3:10 pm **CONCURRENT SESSION I**

Ia) Education and Outreach - Azalea I
Moderator: Johnny Stowe

1:30-1:50 pm Using the Novel Longleaf to Teach Kids about Longleaf - Roger Reid and Mark Hainds

1:50-2:10 pm Introducing Longleaf into Elementary Classrooms - Rhett Johnson

2:10-2:30 pm The E.O. Wilson Biophila Center's Educational Opportunities - Christy Scally

2:30-2:50 pm	Longleaf Academies: Developing more Longleaf Expertise through Training Foresters and Biologists - JJ Bachant-Brown
2:50-3:10 pm	Education Programs at the Joseph W. Jones Ecological Research Center - Kevin McIntyre

Ib) Longleaf Forest Assessment and Regeneration - Azalea II
Moderator: Rick Hatten

1:30-1:50 pm	The Longleaf Alliance GIS Database of Existing Longleaf Pine Stands- John G. Gilbert, John S. Kush, and Dean H. Gjerstad
1:50-2:10 pm	A Decision Support Tool for Longleaf Pine Restoration Using Southeast Regional GAP Data and Methodology Developed by the East Gulf Coastal Plain Joint Venture - James B. Grand
2:10-2:30 pm	Carbon Credits - Jim Elledge
2:30-2:50 pm	Naturally-regenerated Longleaf Pine: A new Site Index Model and Soon-to-be Growth and Yield Model - Dwight K. Lauer and John S. Kush
2:50-3:10 pm	Artificial Regeneration of Longleaf Pine Stands in Central Louisiana - Shi-Jean Susana Sung, Mary Anne Sword Sayer, and James Dave Haywood

Ic) Managing for Multiple Uses: From Military Training to Wildlife - Azalea III
Moderator: Will McDearman

1:30-1:50 pm	Managing for Longleaf Pine in Support of Military Training: Fort Benning Case Study– Robert K. Larimore
1:50-2:10 pm	Significance of forest structure to at-risk terrestrial vertebrate species in the Southeast - Sharon Hermann, John Kush, Craig Guyer, Geoff Sorrell, and Becky Estes
2:10-2:30 pm	Conservation Needs of Gopher Tortoises - Craig Guyer, Sharon Hermann, and Val Johnson
2:30-2:50 pm	Managing for Avian Diversity in the Longleaf Pine Ecosystem: Snags, Cavity-nesting Birds and the Need for Meaningful Guidelines – Lori Blanc and Jeffrey R. Walters
2:50-3:10	Managing for Diversity on Private Lands- Mark Bailey
3:10-3:30 pm	**Refreshment Break - Azalea Corridor**
3:30-5:10 pm	**CONCURRENT SESSION II**

IIa) Prescribed Fire Updates and Longleaf Ground Layer Restoration - Azalea I
Moderator: Jim McHugh

3:30-3:50 pm	The National Coalition of Prescribed Fire Councils: An Initiative to Nationally Address Key Management, Policy, and Regulatory Issues- Mark A. Melvin, Johnny Stowe, and Dale Wade
3:50-4:10 pm	Effects of fire regime on fire behavior in southeastern U.S. pine forests- Kevin Robertson
4:10-4:30 pm	Fire Management of Coastal Pine Savannas in the Context of Rapid Global Climate Change- William J. Platt

4:30-4:50 pm	A Strategy for Transitioning Loblolly Pine Stand to Longleaf: Implications for Restoring Native Groundcover– Robert M. Franklin and John S. Spearman
4:50-5:10 pm	Restoring Longleaf Groundlayer on Private Lands in Georgia, Alabama, and South Carolina – Jeff Glitzenstein, Jim Bates, Donna Streng, Beau Dudley, Lisa Lord, John Brubaker, Joe Cockrell, and Jill Barbour

IIb) Long-Term Research and Advances in Longleaf Pine Forest Knowledge - Azalea II
Moderator: Dale Brockway

3:30-3:50 pm	Palustris Experimental Forest - James Haywood and James Barnett
3:50-4:10 pm	Escambia Experimental Forest: History and Current Research- Kristina Connor, Bill Boyer and Dale Brockway
4:10-4:30 pm	Long-term Research at Tall Timbers Research Station – Ronald Masters
4:30-4:50 pm	Long-term Research at the J.W. Jones Ecological Research Center: Pursuing Emergent but Unexpected Outcomes– Steven B. Jack, Robert M. Mitchell, J. Kevin Hiers, L. Katherine Kirkman and Lindsay R. Boring
4:50-5:10 pm	The "Farm 40" - Sixty Years of Management for the Private Landowner– Becky Barlow, John S. Kush, and William D. Boyer

IIc) Panel Discussion - Azalea III

3:30-5:10 pm

Panel Discussion: New Conservation Opportunities for Longleaf Landowners - An Overview of Available Cost-Share Programs, Conservation Agreements, and a Look at New Markets
- Julie Moore presiding, US Fish and Wildlife Service

Incentive Programs for Longleaf Landowners in Florida and the Southeast - Erin Myers, Biologist, Natural Resource Conservation Service in Florida

NRCS's Healthy Forests Reserve Program - Shauna Ginger, US Fish and Wildlife Service, Jackson, MS, and Erin Myers

Opportunities in Alabama, Mississippi and Louisiana under the new regional Safe Harbor and Candidate Conservation Agreement for the gopher tortoise, black pine snake, and red-cockaded woodpecker - Shauna Ginger

Use of Conservation Banking as a Tool in Longleaf Pine Habitat Preservation/Restoration, from a Banker's Perspective - John McGuire, Biologist, Westervelt Corporation

Opportunities for Gopher Tortoise Relocations to Private Lands - Deborah Burr, Gopher Tortoise Plan Coordinator, Florida Fish and Wildlife Conservation Commission, and Todd Gartner, Center for Conservation Solutions, American Forest Foundation.

IId) America's Longleaf - Jasmine

3:30-5:10 pm	This 40-minute session will provide an opportunity for input on the America's Longleaf Initiative and the draft range-wide Conservation Plan. The session will begin with an overview of the Conservation Plan followed by participant comment and feedback on specific elements including goals, objectives, key actions, and considerations for implementation. This session will be repeated beginning at 4:20 p.m. Tom Darden, Co-Editor of Conservation Plan and Lark Hayes, Coordinator, Regional Working Group for America's Longleaf.

5:30 – 7:30 pm **Reception with Poster Presentations - Camellia I & II**

7:30 pm **Registration Closes**

7:30 pm **Dinner on Own**

7:30 pm **Forest Guild arrivals may gather informally at Amenity Terrace**

Thursday, October 30, 2008 (times are approximate) - **Azalea Ballroom**
(Due to our early departure, a bag breakfast will be provided on the bus @ 7:45 for all participants.)

7:00 am **Coffee and welcome to Forest Guild Members and Field Tour Logistical Information**

- JJ Bachant-Brown (Longleaf Alliance)

7:45 am **Buses Depart on Field Tours – 2 Concurrent Tours: Eglin Air Force Base and Nokuse Plantation**

- **Brier Creek, Eglin Air Force Base** - Speaker stations will showcase the herbaceous layer; seepage slope with pitcher plants; species density; the use of fire and time in restoration, developing desired future conditions, feral hog management, the use of native vegetation by native wildlife, forest products, and a red-cockaded woodpecker active cluster with cavity trees.

- **Nokuse Plantation** - This privately owned conservation initiative will highlight their management challenges and goals converting back to native longleaf pine; public-private partnerships; conservation easements; groundcover restoration, gopher tortoise habitat banking; the dendrology of the different southern pines; the E. O. Wilson Biophila Center; uneven aged management of southern pines; and longleaf restoration, green infrastructure and water.

11:30-2:10 pm **Tours Convene for Lunch at White Point, Eglin Air Force Base**

- **White Point, Eglin AFB** - A walking loop, with several speaker stations set up through what could be the last remaining estuarine (coastal) longleaf old-growth stands. Some of the trees are 450+ years old. Stations topics include: vegetation uniqueness of this location; hurricanes and wind firmness of longleaf; cone and seed collection; specialty forest products; Eglin's monitoring program; Eglin's invasive management; the importance of bees; fire equipment from Eglin; and a unique display of old naval store artifacts.

2:10 PM **Tours Continue** - Groups visit sites they didn't see in the morning

Approx 6:00 pm **Buses Return**

7:00 -10:00 pm **Florida Luau with Live Music from Eclectic Acoustic and Lots of Great Grilled Food - Great Lawn**

Friday, October 31, 2008

7:30 - 9:00 am **Continental Breakfast - Azalea Corridor** (Students and mentors wishing to participate in the student mentor breakfast will gather in **Azalea I**)

Plenary Session - Azalea Ballroom
8:30 am **Fire, Big Animals, and Bad Weather: Origins and Maintenance of Southern Grasslands**

- **Reed Noss**. Dr. Noss directs the SPICE (Science and Planning in Conservation

Ecology) lab at the University of Central Florida, which concentrates on basic and applied problems in biodiversity conservation. He is past president of the Society for Conservation Biology, former editor of the journal Conservation Biology, and a co-founder of The Wildlands Project.

9:30 am **Ivory-billed Woodpecker Update**

- **Geoff Hill**. Dr. Hill is the Scharnagel Professor of Ornithology at Auburn University and an Ivory-billed Woodpecker sleuth extraordinaire. He will present the latest evidence supporting the existence of the Ivory-billed Woodpecker.

10:15-10:30 am **Refreshment Break - Azalea Corridor**

10:30 am **Climate Change Plenary Session**

- How do we manage in the face of uncertainty? This session will focus on how climate change is affecting ecosystems, what actions are being taken on the ground, and how to address the challenges of building forest resistance in the context of climate change. Speakers include Sam Pearsall (Environmental Defense Fund), Larry Davenport (Samford University) and Linda Brett (USFS).

Longleaf Alliance Conference Adjourns

12:30-2:00 pm **Lunch – Provided for Forest Guild Meeting Attendees - Magnolia Ballroom F**

- **Forest Guild Regional Gatherings** - Have lunch with others in your region and learn what Guild members are up to in your area. (Access to Friday lunch and the afternoon sessions is available to Longleaf Alliance meeting attendees for a nominal fee at the registration desk.)

2:00 pm **Concurrent Sessions**

1. **Emerging Biomass Markets in the South -Camellia I**
   There has been a recent explosion of large scale biomass projects across the Southeast. Many of these have overlapping procurement zones and are being sited in areas where pulpwood markets already exist for low value wood products. In this section we will explore the feeding of these mills and what impact that may have on the market and the ecosystem. Guests include Bill Waller (Green Circle Energy), Ron Barmore (Range Fuels), Nathan McClure (Georgia Forestry Commission), and Will McDow, (Environmental Defense Fund).

2. **The Silvics of Sequestration - Camellia II**
   How can managers work on the ground to maximize the sequestration potential in their forests? In this session we will look at new research on sequestration and examples from across the country of how foresters are incorporating carbon into their management. Speakers include: Bill Wilkinson (Baldwin, Blomstrom, Wilkinson and Associates), David Ray (Tall Timbers), Kevin Robertson (Tall Timbers), and Kevin Hiers (Jones Ecological Center).

3:45-4:00 pm **Refreshment Break - Azalea Corridor**

4:00 pm **Forest Guild Introduction Circles**

- A Forest Guild tradition and opportunity to introduce yourself and let others know why you do what you do.

5:30 pm **Dinner on Own**

7:30 - 9:00 pm **Forest Guild Members Meeting – open to all - Azalea I**

Saturday, November 1, 2008

7:30 - 9:00 am **Continental Breakfast - Azalea Corridor** (Forest Guild Women's Circle will meet informally during breakfast in **Camellia I**. All are welcome.)

8:30 am **Concurrent Sessions**

1. **Forest Insects and Climate Change - Camellia I**
   Discuss the possible repercussions of climate change on populations and effects of several forest pests including the southern pine bark beetles, hemlock wooly adelgid, and the eastern oak Borer. Speakers include Alexander Evans (Forest Guild), Andy Londo (Mississippi State University), and John Riggins (Mississippi State University).

2. **Guest and Undocumented Forestry Workers - Camellia II**
   Learn about the issues facing migrant forestry workers managing our nation's forests and find out about what can be done to enforce existing laws and improve working conditions for these workers. Invited speakers include Mike DeBonis (Forest Guild), Beau Brodbeck (Alabama Cooperative Extension), and Andrew Turner (Southern Poverty Law Center).

10:00-10:15 am **Refreshment Break - Azalea Corridor**

10:15 am **Concurrent Sessions**

1. **Carbon Regulation and Trading - Camellia I**
   Learn about the nuts and bolts of carbon sequestration and hear about where the federal legislation may be leading us. Discussion of both market trading of credits and government led regulation. Speakers include Scott Schouse (Mountain Association for Community Economic Development), and Bob Perschel (Forest Guild).

2. **Biomass Harvesting and Technology - Camellia II**
   Explore new technologies in biomass harvesting with example from across the country of how people are getting this new product to market. Case studies and experimental equipment will be featured with some cost analysis. Zander Evans (Forest Guild), and Phillip Steele (Mississippi State University).

12:00-1:30 pm **Lunch on Own**

1:30 pm **Concurrent Sessions**

3. **Emerging Local-Scale Biomass Opportunities - Camellia I**
   There is a movement throughout the country to promote small scale biomass opportunities for rural economic development. These projects mainly focus on 10,000-100,000 ton capacity boilers fed from local sources. In this session we will examine some of these projects, and a pilot project focused on how local consulting foresters

can

   participate. Invites speakers include Adam Sherman (Biomass Energy Research Center) and Bob Perschel (Forest Guild).

4. **A. Certification for Small Landowners - Camellia II**
   Logistics of FSC certification and how group certification can help landowners improve access to new markets. Josh Dickinson (Southern Forest Network)

   B. Counting Carbon- Camellia II
   A look at carbon accounting systems and what foresters need to be measuring in the woods when working with the carbon market. Invited speakers include Scott Schouse. (Mountain Association for Community Economic Development)

3:00-3:30 pm **Refreshment Break - Azalea Corridor**

3:30 pm **Concurrent Sessions**

1. **Foresters of the Next Generation - Camellia I**
   A facilitated question-and-answer and discussion session between students and current natural resources professionals

2. **Silvicultural Showcase- Camellia II**
   A series of presentations by Guild members from across the country on innovative approaches to ecological management in their area - Speakers include:
      - Don Handley (Handley Forestry Services, South Carolina) - “Uneven-aged Management of Southern Yellow Pine - What I’ve done and why it works”
      - Other Speakers TBA

7:00 pm **Cookout Featuring Locally Grown Meats and Produce on the Amenity Terrace at the Village Inn**

Sunday November 2, 2008

9:00 am - noon **Forest Guild Board of Directors Meeting - Jasmine Room**

Longleaf Alliance 7th Regional Conference Field Trip

This year's Regional Conference field trip will visit properties that are owned and managed by two extremely different landowners … a private landowner and the Department of Defense. These properties are also distinctly different in that at one we will see where the restoration process has just begun and at the other we will experience what the end results of restoration can be with time and proper management. We are striving to give participants three exciting, diverse, and informative walks with numerous stations at the Nokuse Plantation site, Eglin's Brier Creek site, and Eglin's White Point.

Nokuse Plantation is a 48,000-acre private conservation initiative located in central Walton County, FL near the towns of Freeport and Bruce. It is touted as the largest private conservation project east of the Mississippi River and is a vital connection between the conservation lands of Eglin Air Force Base and the Choctawhatchee River Wildlife Management Area. The mission of Nokuse Plantation and its founder, M.C. Davis, is to restore and preserve viable ecosystems that support native plants and animals. With their success, they will become a model and a catalyst for future landscape-level conservation projects.

The Conference field trip will stop at a parcel within Nokuse where their restoration efforts are apparent. In addition to examining their management challenges and goals to converting back to the native longleaf pine, other stations will include exploring conservation easements and the Florida Scenic Trail, Nokuse's gopher tortoise mitigation banking program, the Gulf Coastal Plain Ecosystem Partnership – in which Nokuse is a partner, the dendrology of the different southern pines, the E.O. Wilson Biophila Center at Nokuse Plantation, groundcover restoration, and longleaf restoration, green infrastructure and water.

At 463,441 acres, Eglin Air Force Base is the largest military base in the United States. Eglin serves as the focal point for all Air Force armament. Undeveloped lands serving as buffers for military operations have also protected the largest remaining old growth longleaf pine forest in the world, along with other unique communities and species. The management of these undeveloped lands is through Eglin's Natural Resources Branch which is commonly known as Jackson Guard. The Conference field trip will stop at two of these managed areas.

Brier Creek is a mosaic of numerous seepage slopes (or bogs) embedded within rolling sandhills, mesic flatwoods and upland pine communities. This area is designated by Eglin natural resource managers as an Outstanding Natural Area due to its floristic diversity, fire-maintained baygall and seep ecotones, and habitat for endangered species including the red-cockaded woodpecker. This stop has a 1-mile walk with panoramic scenic views. Along the walk are seven stations that cover topics such as: the use of time and fire in restoration, seepage slopes…an up-close look, developing desired future conditions, red-cockaded woodpeckers, feral hog management, the use of native vegetation by native wildlife, and forest products.

White Point, where the group has lunch, is a 170-acre stand of old-growth on the shores of Choctawhatchee Bay. White Point represents an unusual transition from sandhill to flatwoods to salt marsh fringe. After eating lunch the group can take a stroll and visit eight stations. Out in the open will be fire equipment from Eglin and a unique display of old naval store artifacts. Take the loop trail and you'll see stations discussing longleaf's wind firmness and the area's vegetation, specialty forest products, longleaf cones, Eglin's monitoring program, Eglin's invasive management, and the importance of bees (next to a bee hive in an old cat-face scar).

In addition to the Eglin, Nokuse, Longleaf Alliance and Auburn University staff, this field trip would not be possible if it weren't for the involvement of: North Carolina State University, Northwest Florida Water Management District, The Nature Conservancy, South Carolina Department of Natural Resources, USDA, Alabama Forestry Commission, US Forest Service, Florida Trail Association, Don Handley, E.O. Wilson Biophila Center, Raymond Melvin, Mississippi State University, University of Florida, TR Miller, Knud Nielsen, Florida Natural Areas Inventory, Neil Hoskins, Lenny's Subs, and Emerald Waste Services. Thanks to all!

SPEAKER BIOS

The brief bios provided are presented in alphabetical order. The first series is for the Longleaf Alliance portion of the meeting and those for the Forest Guild follow.

LONGLEAF ALLIANCE

Matthew Aresco graduated from Florida State University in May 2005 with a PhD in Biological Science and has an M.S. in Zoology from Auburn University. He is currently the Director of Nokuse Plantation, a 48,000 acre privately-owned nature preserve in Walton County, Florida, in the western Panhandle. Dr. Aresco directs the ecological restoration of this property, converting pine plantations and agricultural areas back to the longleaf pine-wiregrass ecosystem. Restoration of this nature preserve provides critical habitat connectivity to other conservation lands in the Florida panhandle, including Eglin Air Force Base and the Choctawhatchee River Wildlife Management Area. A highlight of his work so far at Nokuse Plantation is his gopher tortoise restoration project which has provided safe refuge on the preserve for over 1,700 gopher tortoises relocated from sites throughout Florida slated for development. He also serves on the Florida Fish and Wildlife Conservation Commission's Advisory Group to help establish the protection and management requirements for the gopher tortoise, a State threatened species. Dr. Aresco is also an expert in the biology and conservation of Florida turtles and has conducted long-term research on the Florida softshell turtle, Florida snapping turtle, Florida cooter, and gopher tortoise in northwest Florida. Dr. Aresco's work is a combination of his training as a biologist and naturalist and his ability to work with government and private agencies to achieve practical solutions to conservation issues.

Ken Arney has served as Deputy Regional Forester for the Southern Region since 2001. He was previously the State Forester in Tennessee and also held various positions in the Tennessee Wildlife Resources Agency. Mr. Arney has played key roles in the redesign of State and Private Forestry programs of the Forest Service so they are more responsive to forest threats and are more effective in conserving forests. He has been a champion of large-scale protection and restoration efforts like America's Longleaf.

JJ Bachant-Brown is Outreach Coordinator for the Longleaf Alliance and has been with them since March 2008. JJ's BS degree is in Biology from Southwest Missouri State University and she received her MS from the University of West Florida in Ecology & Evolutionary Biology / Coastal Zone Studies. She started her professional career with Auburn University at the Auburn University Marine Extension & Research Center in Mobile, AL. There she was the Environmental Educator & Watershed Coordinator for the Dog River. Afterwards, for nearly nine years she worked for The Nature Conservancy in both the Alabama and Florida Chapters. Her expertise is providing organization, leadership, facilitation, administration and landscape level ecological expertise to federal, state and private land management partners within the longleaf region.

Mark Bailey is Senior Biologist with Conservation Southeast, a consulting firm he founded in 1998 that specializes in conservation planning, management, and monitoring of southeastern wildlife and natural communities. He received his M.S. degree in Zoology from Auburn University. Mark is currently President of the Alabama Chapter of The Wildlife Society, a director of the Alabama Wildlife Federation, and Alabama State Representative to the Gopher Tortoise Council. Mark's areas of interest include sandhill herpetofauna, red-cockaded woodpecker management, and conservation easements. Mark lives with his wife and daughter near Andalusia, Alabama, where he is working with state and federal partners to restore 70 acres adjacent to Conecuh National Forest back to a functioning longleaf ecosystem.

Becky Barlow is an Auburn University Extension Specialist with the School of Forestry and Wildlife Sciences, Dr. Becky Barlow aids private forest landowners in the management of their property for multiple uses. Currently, agroforestry research and demonstration areas are being developed to provide examples of low-cost forest farming methods that capitalize on the ability of landowners to generate additional revenue from natural resources, and to promote economic development of economically depressed and rural communities through outreach. In addition, she also teaches two upper level forest measurements courses at Auburn University's School of Forestry and Wildlife Sciences.

Lori Blanc is a post-doctoral research associate in the Avian Ecology Lab at Virginia Tech University. She conducted her dissertation research on the cavity-nesting bird community at Eglin Air Force Base, Florida and completed her Ph.D. at Virginia Tech in 2007. Lori's experience within the longleaf pine ecosystem includes over 10 years of field work on private and public lands within Florida, Georgia, North Carolina and South Carolina.

Deborah Burr is a Biological Administrator for the Species Conservation Planning section within the Florida Fish and Wildlife Conservation Commission (FWC). She has a M.P.A. and a Certificate in Environmental Dispute

Resolution from Florida State University. Deborah is a Fellow of the Florida Natural Resources Leadership Institute with a background in environmental leadership and policy development. In her current role with FWC, Deborah coordinates statewide efforts promoting gopher tortoise conservation through incentive-based programs, public-private partnerships, outreach and education, and by conserving and managing habitat for wildlife. Deborah has worked with the National Park Service, National Forest Service, Washington State Fish & Wildlife, the Florida Park Service, and the U.S. Peace Corps on habitat restoration and management, wildlife conservation, and agro-forestry projects respectively for over a decade.

Vernon Compton currently works for The Nature Conservancy as Project Director of the Gulf Coastal Plain Ecosystem Partnership. The Gulf Coastal Plain Ecosystem Partnership (GCPEP) is a voluntary landowner partnership formed in 1996 to sustain over 1,000,000 acres of longleaf pine habitat and portions of five major watersheds in northwestern Florida and southern Alabama. The nine partners are the Department of Defense (Naval Air Station Pensacola, Naval Air Station Whiting Field, and Eglin Air Force Base), the Florida Department of Environmental Protection, the Florida Division of Forestry, the Florida Fish & Wildlife Conservation Commission, the National Park Service, the Northwest Florida Water Management District, National Forests in Alabama, The Nature Conservancy, and Nokuse Plantation. The partnership allows the partners to combine their expertise and resources to more effectively manage their individual properties and to meet the challenges of sustaining the larger ecosystems. Vernon has a Bachelor of Science in Forest Management from LSU and has been Project Director of GCPEP since 1998.

Kristina Connor is a plant physiologist who received her bachelor's degree from Southern Illinois University, her master's from Virginia Tech, and her Ph.D. from Utah State. She spent her first years in the U.S. Forest Service with the Eastern Tree Seed Research group and with the Center for Bottomland Hardwoods Research. She is now the Project Leader for Research Work Unit 4158, which is in charge of Restoring and Managing Longleaf Pine Ecosystems.

Tom Darden currently serves as Senior Conservation Planner with Booz Allen Hamilton in support of America's Longleaf Initiative. He has served as co-editor of the draft Range-wide Conservation Plan. Prior to his work on America's Longleaf, Mr. Darden had a 34 year career with the U.S. Forest Service serving at local and state levels in Mississippi and at the regional, national and international levels. As the Regional Director of both the USFS's Cooperative Forestry Programs on private lands, and as Director for Biological and Physical Resources of the Southern National Forests, he worked to conserve plant and wildlife resources through collaborative efforts and programs. These efforts included work in longleaf restoration. National level responsibilities included program development and leadership for wildlife management on the nation's National Forest System as well as Legislative Branch assignments in natural resources.

M. C. Davis received a B.A. from the University of North Carolina and a J. D. from Samford University. Raised in Santa Rosa County, Florida and currently resides in Okaloosa County, Florida. Has been an avid conservationist for the past fourteen years and involved with a number of conservation projects all over the south, including: Mallory Swamp, Lafayette County, Florida, Glass Mountain, Dawson County, Georgia, Nokuse Plantation, Walton County, Florida, Founder of E. O. Wilson Biophila Center at Nokuse Plantation. Nokuse Plantation is my biggest and probably the most important project. It is comprised of 53,000 acres, which form a critical section of the proposed Greenway Corridor that would connect Eglin Air Force Base, Black Water River State Park, and Conecuh National Forest with the Apalachicola National Forest and Tate's Hell State Forest.

Jim Elledge graduated from Stephen F. Austin in 1984. He has been a consulting forester ever since. He has devoted his career to longleaf pine restoration and management.

Robert M. Franklin is an Area Forestry & Wildlife Extension Agent with the Clemson University Cooperative Extension Service, headquartered in Walterboro, SC. He plans, implements and evaluations natural resource education programs for landowners on the Coastal Plain of South Carolina. Current outreach efforts include education about restoring longleaf pine ecosystems (including restoring native groundcover and longleaf timber management); using prescribed fire; reducing land management risks and forest landowner leadership development. Bobby holds a B.S. and M.F. in Forestry from Auburn University. When not working, he enjoys hunting, fishing, camping out and assisting with the local Boy Scout troop. Lower priorities are yardwork, paperwork and obnoxious people.

Todd Gartner is the Conservation Incentives Manager for the American Forest Foundation's Center for Conservation Solutions. Gartner is a Master of Forestry graduate from the Yale School of Forestry and Environmental Studies. He is also a Doris Duke Conservation Fellow and Switzer Environmental Fellow with a strong background in economics, wildlife, and forestry. He focuses on place-based conservation incentives and market-based strategies, such as biodiversity offsets, payments for watershed services, and carbon markets, to achieve conservation objectives on family forestlands. Gartner's previous work included researching the effects of fire on small mammal communities in Botswana, and studying the impact of eco-tourism in Botswana and India, business consulting for the USDA Forest Service and several years as a corporate financial consultant.

John Gilbert is a Research Associate at Auburn University. He is responsible for developing a GIS database of existing longleaf pine stands. Mr. Gilbert holds a BS in Forestry and a Master of Science from the School of Forestry and Wildlife Sciences at Auburn University. His master's research examined environmental effects on the growth of young longleaf pine.

Shauna Ginger is an endangered species biologist with the U.S. Fish and Wildlife Service (USFWS) in Mississippi. She has a M.S. in Wildlife Ecology from Oklahoma State and a B.S. in Zoology from University of Arkansas. Her background is in landscape ecology and mammalogy, and she most recently was the LSU bear field crew leader before coming to Mississippi in 2004. In her biologist role for the Ecological Services branch of USFWS, Shauna works primarily on recovery and restoration of gopher tortoise, black bear, and bats, and restoration of their habitat - mostly in bottomland hardwood and longleaf pine ecosystems. She is currently involved in spearheading multi-state conservation agreements for imperiled species in the longleaf pine ecosystem, assessing the status for two wide-ranging bat species, and finding innovative ways to partner with landowners to achieve common conservation goals.

Dean Gjerstad is Co-Director and co-founder of the Longleaf Alliance and Professor in the School of Forestry & Wildlife Sciences at Auburn University. He has been on the faculty at Auburn since 1975 and has led several regional research and outreach efforts involving forest productivity and plant competition. This includes serving as director of both the Silvicultural Herbicide Cooperative and the Southern Forest Nursery Management Cooperative.

Dr. Jeff Glitzenstein is a Research Associate for Tall Timbers Research Station in Tallahassee, FL. Jeff and his wife, Dr. Donna Streng, also a Research Associate at Tall Timbers, obtained their doctorates in plant ecology at Rice University in Houston, TX in the 1980's. Over the last couple of decades, they have, among other topics, worked on fire ecology, plant surveys, and restoration of longleaf pine habitats. They have an extensive knowledge of longleaf pine ground cover from east Texas to South Carolina.

James B. Grand has over 20 years of experience as a professional research wildlife biologist with Department of Interior agencies. For the last 10 years he has served as Leader of the Alabama Cooperative Fish and Wildlife Research Unit and an Associate Professor in the School of Forestry and Wildlife Sciences at Auburn University. Prior to moving to Auburn, Dr. Grand was a project leader for the U.S. Geological Survey at the Alaska Biological Science Center in Anchorage where he conducted waterfowl studies throughout the state. He received his Doctoral degree in 1988 from Texas A&M University, his Master of Science in 1984 from Auburn University, and his Bachelor of Science in 1981 from Louisiana State University. Dr. Grand's published research has focused on estimating the distribution and population dynamics of wildlife populations including many species of waterfowl and birds of the longleaf ecosystem. He has great interest in conservation and biodiversity and is a co-investigator for the Southeast gap analysis project and several projects examining the potential effects of climate change and urbanization on conservation strategies.

Howard Gross's background is in field research, natural resource management, collaboration, and non-profit leadership and advocacy. He began serving as the Executive Director of the Forest Guild in January 2007. Prior to coming to the Guild, Howard worked for four years with the National Parks Conservation Association in the California desert, promoting protection and increased public support for Joshua Tree and Death Valley national parks and the Mojave National Preserve. From 1999-2003 Howard was the Executive Director for HawkWatch International, which works to monitor and protect birds of prey and their environment. Howard also worked for five years as a consulting ecologist in Utah and was the founding treasurer for Friends of Great Salt Lake. Howard received an M.S. in Watershed Science from Utah State University in 1995. He has published peer-reviewed articles and made presentations at scientific conferences on a diverse range of topics including raptor migration, salmon recovery, limnology, lead poisoning of wildlife, and wetlands issues.

Craig Guyer is a professor of herpetology at Auburn University. He, his students, and colleagues study reptiles and amphibians native to longleaf pine forests. Topics of special interest to him include fire effects on herp assemblages, rattlesnake biology, and viability of gopher tortoise populations.

Lark Hayes is an environmental lawyer who has specialized in forest-related issues for over two decades. In recent years, she has focused on non-regulatory approaches to forestland conservation, including incentives for private landowners. Based at the Southern Environmental Law

Center, she has been coordinating the Regional Working Group for America's Longleaf for the past year.

James D. (Dave) Haywood is a Supervisory Research Forester with the U.S. Department of Agriculture, Forest Service, Southern Research Station. He has been located in Pineville, Louisiana since 1978. He has a PhD, Forestry, from Louisiana State University, Baton Rouge, Louisiana. Dave's current research includes longleaf pine regeneration and restoration as influenced by various means of vegetation control, fertilization, and fire; assessing the effects of container cavity size, use of copper treated containers, and other nutrient amendments on root system development and above ground growth of longleaf pine seedlings through stand establishment and canopy closure; comparing the growth and yield of loblolly, longleaf, and slash pine plantings; and assessing the effects of harvesting and regeneration practices on the long-term productivity of pine stands through several rotations.

Sharon Hermann is currently a visiting researcher at Auburn University; previously she served as the Fire and Plant Ecologist at Tall Timbers Research Station where she studied and managed longleaf pine forests. Her interests include effects of fire, ground cover composition and dynamics, natural regeneration of longleaf, forest restoration, plus ecology and conservation of gopher tortoises, carnivorous plants, and arthropods.

Dr. Geoff Hill was born in Ft. Mitchell, Kentucky and developed an interest in wildlife and especially birds at an early age. He got his bachelor's degree from Indiana University, his master's from the University of New Mexico, and his Ph.D. from the University of Michigan. He joined the faculty at Auburn in 1993 and now holds the rank of professor. Dr. Hill has published over 160 papers in scientific journals and authored four books including a book on the search for Ivory-billed Woodpeckers.

Steve Jack is Conservation Ecologist for the Joseph W. Jones Ecological Research Center at Ichauway, a 29,000 acre preserve with extensive longleaf pine forests, near Newton, GA. In this position he is involved in the operational management of Ichauway, provides an interface between the research and resource management staffs, and conducts applied research on conservation-oriented management of longleaf pine for forest and wildlife objectives. A particular focus of his work is the application and adaptation of the Stoddard-Neel approach of forest management to pine-grassland forests of the coastal plain. He has been at the Jones Center for over 11 years, and held prior positions at Utah State and Texas A&M Universities.

Rhett Johnson is a co-founder and Co-Director of the Longleaf Alliance and serves as the President of The Longleaf Alliance, Inc., the non-profit arm of the Alliance. He retired in 2006 after 27 years on the Auburn University faculty as Director of the Solon Dixon Forestry Education Center. He earned wildlife biology and forestry degrees from North Carolina State University and Clemson University, respectively. He served terms as President of the Alabama Wildlife Federation, Chairman of the Alabama Chapter of the Wildlife Society, Chairman of the Alabama Division of the Society of American Foresters as well as the Southeastern SAF. He was named an SAF Fellow and received the Alabama Wildlife Federation Governor's Award as both Wildlife Biologist and Forester of the Year.

Bob Larimore is a Forester for the U.S. Army Installation Management Command - Southeast Region. Prior to this recent assignment he spent 25 years at Fort Benning, Georgia, an 182,000 acre military training base with extensive mixed pine forests and is one of thirteen designated red-cockaded woodpecker recovery sites. As Chief of the Land Management Branch, he supervised the management of land and timber resources on the installation to provide optimum forest conditions to enhance the military training mission while meeting natural resource stewardship requirements. A particular focus of his work was the reestablishment of fire and longleaf pine.

Dwight Lauer is owner, Silvics Analytic, and Affiliate Assistant Professor, School of Forestry and Wildlife Sciences, Auburn University. He has been involved with silvicultural and forest health and protection research for over 25 years.

Dr. Ron Masters is Director of Research with Tall Timbers Research Station. He has adjunct appointments as Associate Professor of Natural Resource Ecology and Management at Oklahoma State University and Forestry and Wildlife Ecology at Auburn University. Ron was an Associate Professor of Forestry and Wildlife Ecology with OSU for 11 years with appointments in extension and research and team taught a graduate course in Wildland Fire among others. He has been at Tall Timbers for 6 years. He is a Certified Wildlife Biologist, a Certified Forester and a Registered Forester and holds a Certification in Prescribed Burning. He received his Ph.D. in Wildlife and Fisheries Ecology from Oklahoma State University (OSU); a MS in Wildlife Biology from Abilene Christian University in West Texas; and a B.S. in Forest Management and a B.S. in Wildlife and Fisheries Science from the University of Tennessee. His research interests are in restoration ecology and in fire, wildlife, and plant community ecology.

John McGuire is a Senior Project Manager located in the southeast regional office for Westervelt Ecological Services (WES). He specializes in the restoration and management of upland and flatwood pine forests; including issues related to prescribed burning, sustainable forestry practices, managing habitat for imperiled wildlife species and other issues that are key to managing conservation and mitigation banks for WES. He has worked in the southeastern U.S. for over a decade. He was previously employed with the Longleaf Alliance for seven years as their Outreach Coordinator, and, prior to that, was a student of the Jones Ecological Research Center.

Kevin McIntyre is a native Georgian whose professional interests center on the application of science to conservation and management of natural resources, with a focus on restoration and management of protected lands and natural areas of the coastal plain. He has an M. S. in wildlife from the University of Florida. His professional experience includes many years in natural area management as well as land protection efforts with conservation organizations. Specific interests at the Jones Center include ecological forestry, groundcover restoration, and social and economic aspects of natural resource management. When not working, he enjoys fishing, hunting, canoeing, kayaking, gardening, and riding his tractor at home in Decatur County, GA.

Julie Moore is national coordinator for Safe Harbor and Candidate Conservation Agreements for the U.S. Fish and Wildlife Service's (USFWS) Endangered Species Program and has participated in the development of the Health Forests Reserve Program administered by the Natural Resources Conservation Service. She has worked on variety of southern forest ecosystems most recently with longleaf pine forests and the many associated plant and animal species in the pineywoods of south Mississippi for the MS Natural Heritage Program and the MS office of The Nature Conservancy coordinating a DoD funded biological inventory of Camp Shelby National Guard Training Site. She is the author of "Managing the Forest and the Trees," a guide for longleaf forest landowners funded by The Nature Conservancy, the Longleaf Alliance, and the Southern Group of State Foresters. As director of conservation at Tall Timbers Research Station, she initiated a conservation easement program for the Red Hills region of south Georgia and the Florida panhandle. She is a board member of the Longleaf Alliance and serves on the Operating Committee of the American Forest Foundation's Center for Conservation Solutions.

Erin P. Myers is the State Biologist with USDA Natural Resources Conservation Service (NRCS) in Florida. Currently, she provides technical assistance on management of invasive plant species, declining habitats and declining species through Farm Bill Program implementation. She develops and maintains the FL NRCS conservation practice standards for wildlife habitat and forestry management and assists with prescribed burning standards. She has worked with Florida private landowners over the past six years, specifically assisting with wildlife disease issues, nuisance wildlife issues, wildlife habitat and forestry management, invasive vegetation management and incentive program implementation. She is a board member of the Florida Chapter of the Wildlife Society, co-chair of the Florida Invasive Species Partnership, member of the Florida Exotic Pest Plant Council, member of the Longleaf Alliance, and sits on the North Florida Prescribed Fire Council Steering Committee and the Florida Forest Stewardship Coordinating Committee.

Dr. William Platt is Professor of Ecology at Louisiana State University (Geaux Tigers!), studies the disturbance ecology of southeastern coastal plain habitats. Current research focuses on interactive effects of sea level rise, fires and hurricanes affect coastal transitions from marine to upland terrestrial pine savannas and forests along the Gulf of Mexico coastline.

Roger Reid: as a writer and producer of the award-winning Discovering Alabama television series, Roger Reid has spent many hours exploring the backcountry with series Creator and Host Dr. Doug Phillips. Reid has taken his experiences and turned them into two novels for young adults. Longleaf, set in Alabama's Conecuh National Forest, begins the adventures of fourteen-year-old Jason Caldwell. On his first visit to Alabama, Jason witnesses a crime, and he and his new forest-smart friend, Leah, will have to use all their knowledge of the outdoors to outwit a trio of villains. Jason's saga continues in Space, set at the Conrad Swanson Observatory on Huntsville's Monte Sano Mountain. Like Longleaf, Space combines real-life locations and scientific fact with an engaging, multi-layered whodunit. Longleaf was chosen to represent the sate of Alabama at the 2008 National Book Festival in Washington DC. Longleaf and Space are published by NewSouth Books. Roger Reid grew up in Huntsville; he now lives with his family in Birmingham.

Dr. Kevin Robertson received his BS in Botany from Louisiana State University where he conducted fire ecology research in pinelands of Everglade National Park, southern Georgia, and Louisiana. He received his Ph.D. in Plant Biology at the University of Illinois where he studied primary forest succession in relation to the geomorphology of meandering rivers of the southeastern U.S. He is currently the Fire Ecology Research Scientist at Tall Timbers Research Station. There he studies the plant community ecology of southeastern U.S. pine ecosystems, the natural history of the Gulf Coastal Plain, remote sensing of fire, and fire regime effects on plant communities, soils, and fire behavior. He also provides extension and education regarding the use of prescribed burning in fire-dependent ecosystems of the southeastern U.S.

Bill Ross has been the Secretary of the North Carolina Department of Natural Resources for almost eight years. An environmental lawyer, he has been a leading advocate for open space, parks and greenways, and environmental education. Secretary Ross also played a leadership role in reaching out to the Department of Defense and other federal agencies to establish the Southeast Regional Partnership for Planning and Sustainability (SERPPAS) to promote better collaboration with state environmental and natural resources officials. One of SERPPAS' priority projects is "Sustaining the Land of the Longleaf Pine" in collaboration with the America's Longleaf Initiative.

Lisa Samuelson is a Professor and the Director of the Center for Longleaf Pine Ecosystems in the School of Forestry and Wildlife Sciences at Auburn University. She received her B.S. and M.S. in Forestry from the School of Forest Resources at the University of Georgia, and her Ph.D. in Forestry in 1992 from Virginia Tech. Her interests include longleaf pine physiological responses to environmental influences and plant diversity and carbon sequestration in longleaf pine ecosystems.

Christy Scally has a B.A. from Auburn University. Raised in Alpharetta, Georgia, she has resided in Walton County, Florida for over 8 years. After working with developers in Atlanta, dealing with litigation rezonings and collaborating with County Commissioners, she is now a reformed environmental activist. Having served as an original facilitator for Sandy Springs Revitalization in Atlanta, Georgia, initiated the "Blue Bag" Recycle Program in Walton County, Christy now serves as the Director of the E.O. Wilson Biophilia Center at Nokuse Plantation.

As a wife and mother of two children, Christy views environmental education as a moral responsibility to protect future natural resources. By combining her adoration for children with her passion for the saving biodiversity, it is a monumental joy for her to be a part of the process of teaching children about the valuable and fragile environment in which we live. Christy hopes to spur the next generation on to realize that they have a responsibility to protect, preserve, and sometimes resort our environment.

Dr. Susana Sung is a Research Plant Physiologist with the US Forest Service Southern Research Station's "Restoring and Managing Longleaf Pine Ecosystems" Unit at Pineville, Louisiana. Before moving to Louisiana in 2005, Dr. Sung worked for 15 years at the Forest Service Southern Research Station's Institute of Tree Root Biology in Athens, Georgia. She devoted most of her efforts in artificial regeneration of oaks and southern pines. Her research interests include physiology and biochemistry of tree seedlings in nursery and in field. Her recent research emphasis includes nursery protocols and field physiology of container-grown longleaf pine seedlings. She is also interested in root system architecture of longleaf pine trees from container-grown and bareroot seedling stock, and direct seeding.

FOREST GUILD

Ron Barmore is the Director of Project Development for Range Fuels, Inc. In this role he leads the company's efforts in the siting, development and permitting of new projects and the sourcing of feedstock materials. The company is building its first facility in Soperton, Ga. to produce cellulosic ethanol from the sustainable and abundant woody biomass resources of middle Georgia. Ron is a member of the Council of Sustainable Biomass Production, serves on the executive committee of the Pine 2 Energy Coalition and is a frequent speaker at Bio-Energy conferences on issues that are critical to the development of the advanced Biofuels industry.

Mr. Barmore has spent the majority of his career developing projects in the alternative energy field, primarily in the waste-to-energy industry (municipal solid waste to power). Most recently he spent six years as the senior executive in charge of business development efforts for Barlow Projects, Inc. His career also includes five years with ABB Resource Recovery Systems as a Regional Manager of Business Development and a number of years as an independent consultant. Ron began his career with one of the leaders in the waste to energy industry, Wheelabrator Technologies, Inc., a pioneer in the alternative energy field. Ron graduated from the University of Iowa with a Bachelors of Business Administration and a major in Accounting. Ron lives in the Atlanta, GA area with his wife Kathy.

Linda C. Brett received a B.S. in Biology in 1974 from the University of New Mexico and a M.A. in Anthropology in 1984 from Eastern New Mexico University. Linda started with the Forest Service in 1986 as the forest archaeologist for the Sequoia National Forest in California. She spent nearly 15 years in California as a district ranger and as forest ecosystem management staff. In 1999 she moved to the WO as a policy analyst for the Programs and Legislation deputy area and in 2005 moved to the forest management staff to serve as a forest planning and policy analyst.

Her recent accomplishments include contributions to the background analysis and draft proclamation establishing the Giant Sequoia National Monument; co-authored, with Doug Maccleery, a report to the Chief on "Process Predicament"; authored background papers on subjects including: TMDL, the Four Threats, and forest product certification. She also served as the program manager for the implementation of the Secure Rural Schools Act of 2000. During a work assignment to the US Senate, she drafted legislation for the protection of deep sea cold water corals. Linda's current work interests include global climate change and forest planning issues.

Beau Brodbeck was born and raised in Guatemala and moved to Alabama to pursue a bachelors of science in forestry from Auburn University. Upon completing his degree he worked for three years as a professional forestry consultant and co-operated a small forest operations business in Opelika, Alabama. In 2003 he returned to Auburn University to pursue a Master's of Science in forestry. Upon completion of his degree he took a three year position with the Alabama Cooperative Extension System managing the Hurricane Ivan and later Hurricane Katrina urban and community forestry grant programs awarded to Alabama in the aftermath of these storms. Currently Beau continues to work with Alabama Extension as a Regional Extension Agent in forestry, wildlife & Natural Resources in Southwestern, Alabama. Additionally, Beau is an ISA Certified Arborist and an Alabama Registered Forester.

Larry Davenport holds a Ph.D. in biology from the University of Alabama. He is a professor of Biological & Environmental Sciences at Samford University, Birmingham, AL, where he also serves as Director of the Vulcan Materials Center for Environmental Stewardship and Education. He is considered to be an expert on Alabama's plant life, aquatic plants, wetlands, and rare, threatened and endangered species, including the Cahaba Lily. His most recent research has focused on the potential effects of climate change on Alabama's plant life. (See www.samford.edu/images/Davenport_CLIMATECHANGE2007.pdf.) Dr. Davenport was named 2007 Alabama Professor of the Year by the Carnegie Foundation for the Advancement of Teaching.

Michael DeBonis is the Southwest Region Director for the Forest Guild. At the Guild, Michael is responsible for the development and implementation of community-based forestry projects in the Southwest, providing technical assistance to rural communities engaged in forest restoration, community, and support of the Guild's regional and national education, forest policy, and membership initiatives. Prior to working for the Guild, Michael was employed by the Maine Forest Service as the state's urban and community forestry coordinator. Michael has also worked as an environmental consultant in CT, a park ranger in VT, and a Peace Corps Volunteer in Jamaica. Michael holds a Master of Forestry degree from Yale University.

Joshua C. Dickinson: following graduation from the US Naval Academy, served for 4 years with the US Sixth Fleet in the Mediterranean. After receiving a PhD in geography with a forest management emphasis from the University of Florida, he taught and served as Assistant Director of the Center for Tropical Agriculture at Florida for 4 years. Following a Post Doc in Ecology at the University of Georgia, worked as a natural resources management consultant in Florida and Latin America for 10 years. In 1985 founded Tropical Research & Development, Inc. carrying out natural resources management projects in 66 countries, including forestry activities Mexico, Honduras, Madagascar and Bolivia. In Bolivia helped bring one million hectares of tropical forest under FSC certification. Following retirement from TR&D in 2001, have focused the Forest Management Trust, in concert with Don Handley, on promoting forest management practices beneficial to family forest owners with emphasis on uneven-age management. Professional affiliations include: American Association for the Advancement of Science, Southern Forests Network, Forest Guild (Associate member), Society of American Foresters, and Forest Stewardship Council (FSC-US Board Member 1998 - present).

Dr. Zander Evans is Research Director at the Forest Guild. He studies ecological forestry, sustainable biomass removal, and the carbon impacts of forest management. Zander's past research includes the impact of hemlock woolly adelgid on eastern forests and an investigation of factors that influence wind storm impacts on forests. He received his PhD for the Yale School of Forestry and Environmental Studies after working as a cartographer and spatial analyst with the US Geological Survey.

Don Handley began work in the timber industry hewing cross ties for his father. They later ran a sawmill and logged with horses. After serving in the Korean War, Don received his BSF degree from Arkansas A&M College in 1957. He has worked for Pomeroy and McGowin, and the South Carolina Forestry Commission and has been a private forestry consultant since 1959. Don has more than 50 years of field experience managing southern pines in North and South Carolina.

Kevin Hiers has spent more than a decade at the interface of fire science and management. As a fire ecologist at the J. W. Jones Ecological Research Center, he currently leads collaborative research in applied fire ecology with an emphasis on fuel characteristics and fire behavior. His work also focuses on the integration of fuels management and fire ecology into ecological forestry. Other areas of interest include smoke management and emission production, fine-scale variation in fire behavior, fire-induced mortality of canopy pines, and fire as a processor of dead trees and coarse woody debris. He has participated in more than 200,000 acres of prescribed burning as fire ecologist at Eglin AFB in the Florida Panhandle and Fire Program Manager for The Nature Conservancy in Georgia and Alabama.

Dr. Andrew Londo is a Professor and Extension Forester with Mississippi State University. He is also the author of 134 publications relating to the forestry profession. He received his undergraduate degree and PhD. from Michigan Technical University, and his masters degree from Texas A & M. His current research involves the Southern Pine Beetle and other bark beetles affecting southern pines.

Nathan McClure currently leads the Georgia Forestry Commission's Forest Products Utilization, Marketing, and Development program. He also serves as the Director of Forest Energy and Development for the agency. Nathan has worked in a variety of positions over the past 24 years with the Commission. Nathan is a Georgia Registered Forester and a Society of American Foresters Certified Forester. He received the SAF Presidential Field Forester Award in 2005. He is a graduate of the University of Georgia with a Bachelor of Science in Forest Resources Management; 1983.

Nathan's recent assignments includes the challenge of creating additional values from Georgia's forests through marketing and new product development; including facilitating the development of a forest biomass energy industry, initiating Georgia's new carbon sequestration registry, as well as working with traditional forest products industries. Nathan has placed focus on developing a cellulosic ethanol industry in Georgia to integrate with Georgia's forest products industry.

Will McDow is Southeast Regional Director of Environmental Defense Fund's Center for Conservation Incentives. Will received a Master of Forestry and Master of Environmental Management from Duke University's Nicholas School of the Environment. Will focuses on improving management of the Southeast's privately owned forestlands through conservation incentive programs and market mechanisms, with an emphasis on Farm Bill programs, property tax, carbon markets and biomass utilization. He engages with local landowners in targeted landscapes with special emphasis on longleaf pine and bottomland hardwood systems. Will serves on the North Carolina Forestry Technical Advisory Committee which is responsible for developing best management practices. He also sits on the North Carolina Forestry Council which advises the State Forester in the direction and activities of the Division of Forest Resources.

Dr. Reed F. Noss directs the SPICE (Science and Planning in Conservation Ecology) lab at the University of Central Florida, which concentrates on basic and applied problems in biodiversity conservation. He is past president of the Society for Conservation Biology, former editor of the journal Conservation Biology, and a co-founder of The Wildlands Project.

Sam Pearsall is the Environmental Defense Fund's SE Regional Director for Land, Water, and Wildlife. He was previously Director of Science for The Nature Conservancy's NC Chapter. His focus is getting from good science to good policy for the sustainable management of natural resources and the conservation of ecosystem resilience. He has worked most recently on adaptation to global climate disruption and on the establishment of ecological flows. He has also served as the Executive Director of the Coastal Resources Center in Maine, Natural Areas Program Manager for Tennessee, and served in various assignments with TNC and Natural Heritage Programs in Tennessee, Hawaii, the South Pacific, and North Carolina. He has a BS from the University of Tennessee, MPS from Cornell, and PhD. from the University of Hawaii.

Robert T. Perschel is currently Northeast Region Director for the Forest Guild. In his 25 years as a conservation professional he has worked on both forestry and wilderness issues. Bob worked for forest industry before establishing his own forestry consulting business, founding the Land Ethic Institute and co-founding the Forest Guild. He has also been Director of The Wilderness Society's Network of Wildlands Program, Regional Director for Northeast Region, chairman of The Northern Forest Alliance and the Eastern Forest Partnership. Bob also served as Director of The Wilderness Society's Land Ethic Program where he developed and published The Land Ethic Toolbox: Using Ethics, Emotion and Spiritual Values to Advance American Land Conservation.

Bob is drawing upon his experience as conservation professional to develop a new model of environmental leadership that will allow us to reconnect people to the natural world and rally them to work on sound environmental policy. In his current research he is considering the emotional, spiritual and psychological aspects that contribute to excellence in environmental leadership. Bob is senior partner with Germane Consulting, of Worcester, Massachusetts and is bringing his research together under a book tentatively titled The Heart and Mind of Environmental Leadership.

In his current role with the Forest Guild, Bob is developing a regional program for the Northeast that will promote ecological forestry, rural community enhancement and bring forestry professionals into critical policy debates. He produced the Guild report Ensuring Sustainable Forestry Through Working Forest Conservation Easements in the Northeast and co-authored Climate Change, Carbon, and the Forests of the Northeast Bob represents the Guild as steering committee member of the national Forests and Climate Working Group which is investigating appropriate forestry components of national climate legislation.

Bob has a master's degree in forestry from the Yale School of Forestry and Environmental Studies and a psychology degree from Yale College. He lives in Holden, Massachusetts.

David Ray
-BS Forestry from U Maine (1993)
-Consulting forester with Southern New England Woodland Services
-MS Silviculture from SUNY-ESF (1997)
-Research Associate with Woods Hole Research Center working on a variety of forest ecology related issues in Brazil's Amazon Basin
-PhD Candidate Silviculture at U Maine (finishing up) working on forest growth models and carbon consequences of various silvicultural practices.
-Forestry Scientist, Tall Timbers Research Station (current) research and outreach/extension focusing on the practice of ecological forestry in the upland pine ecosystems of the SE Coastal Plain.

John J. Riggins, Ph.D. - Assistant Professor, Forest Entomology and Remote Sensing Department of Entomology and Plant Pathology, Mississippi State University, Starkville, MS. I completed a M.S. in biology at the University of Nebraska at Kearney, where I utilized biodiversity of below-ground invertebrates as a measure of habitat restoration success in critically threatened habitats. I recently received my Ph.D. in entomology from the University of Arkansas. My research focused on population surveys for red oak borer during and after a severe oak decline event in the Arkansas Ozarks. I also utilized remote sensing and GIS techniques to detect red oak borer related declines in tree health, as well as to model aboveground forest biomass at the landscape level.

My current research focus is to broaden scientific understanding of native and introduced forest insect pest ecology and management through the use of traditional ecological methods and modern geospatial techniques. A major theme of my research interests is to understand how anthropogenic and environmental disturbances (e.g. management practices, climatic disturbances, habitat restoration, etc…) influence the population ecology and biodiversity of forest insect pests and their hosts.

Adam Sherman is Program Manager at the Biomass Energy Resource Center (BERC) and has been with BERC for four years. He is BERC's biomass fuel supply expert and has worked on numerous projects throughout the country to evaluate regional supply of wood fuel, develop wood fuel specifications, and help secure reliable wood fuel for community-scale biomass energy systems. In addition to his work on fuel supply, Sherman frequently works on energy projects, assessing the technical and economic feasibility of installing woodchip heating systems throughout the US.

Prior to working for the Biomass Energy Resource Center, Sherman was the General Manager of a commercial composting operation in Burlington, Vermont for 10 years. He received his Bachelor's degree from the University of

Vermont.

Scott Shouse joined MACED's staff in January 2008 after several months of consulting work with the Forest Opportunities Initiative. Scott's responsibilities are focused on the carbon credits program but also include other sustainable forestry work. He has diverse forestry experience including tropical agro-forestry, urban forestry, forestry research and social/environmental certification. He is also experienced in database design and implementation as well as Geographic Information Systems. Scott holds a Masters of Science degree in forestry from the University of Kentucky.

Dr. Philip Steele has been a Professor in the Dept. of Forest Products, College of Forest Resources, Mississippi State University (MSU) for 20 years with both research and teaching duties. Dr. Steele is the Thrust Leader of the MSU Sustainable Energy Research Center Bio-Oil Research Group and manager of the Bio-Oil Laboratory at MSU. The MSU Bio-Oil Research Group is comprised of 10 on-campus faculty in the Departments of Agricultural and Biological Engineering, Chemistry, Chemical Engineering, Forest Products, Mechanical Engineering, and the Institute for Clean Energy who are developing technology for the production of fuels from bio-oils made from various types of wood and agricultural feed stocks.

Dr. Steele has won several research awards including the College of Forest Resources Outstanding Research Award and awards for exceptional research papers from both the Hardwood Research Council and the Forest Products Society. He has published widely and is the author or co-author of over 100 research papers.

Andrew Turner is a 2002 graduate of the New York University School of Law, where he was an Arthur Garfield Hays Fellow in Civil Liberties. Mr. Turner represented indigent migrant and immigrant workers at the Virginia Justice Center before joining Montgomery Alabama's Southern Poverty Law Center, when the Center founded its Immigrant Justice Project in 2005. Mr. Turner specializes in federal class action litigation in the areas of labor standards and human trafficking and has represented more than 6,000 migrant workers in cases before numerous U.S. District Courts and the U.S. Courts of Appeals for the 6th and 11th Circuits. Mr. Turner has represented many forestry guestworkers brought to the United States through the H-2B guestworker program in labor standards cases against their employers.

Bill Waller grew up in Lynn Haven, FL and received a B.S. degree in Forest Land Management from Auburn University in 1981. He worked for St. Joe Paper Company from 1981 until 1993 and Stone Container in Panama City from 1993-1994. He started with Green Circle BioEnergy in April of 2004 and is currently the Raw Material Manager, in charge of procuring feedstock for the world's largest wood pellet mill in Cottondale, FL.

Bill Wilkinson is a partner in Baldwin, Blomstrom, Wilkinson and Associates, a forestry consulting firm in Arcata, CA, comprised of seven partners who are all Guild members and registered professional foresters. Bill has a B.S. from the University of Tennessee and an M.S. from the University of Idaho, both in Forest Resource Management. Bill's specialty is the practice of silviculture and he is certified as a silviculturist by the USDI. BBW Associates is noted for preparation of landscape-level environmental plans, for working with Indian tribes and individual Indians to inventory and manage their forests, and for developing and implementing management plans for community-owned and managed forests. Bill is on the board of the Forest Stewardship Council-U.S. and formerly held the position of Senior Forester with FSC-US, where he coordinated the development of the nine regional U.S. certification standards. He also serves on the Membership and Policy Council of the Forest Guild.

PRESENTERS

Ecosystem Level Restoration of Longleaf Pine Communities on a Private Conservation Preserve in Northwest Florida

Matthew J. Aresco, Ph.D.[1], Vernon Compton and M.C. Davis

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Abstract
The longleaf pine ecosystem originally covered 60-90 million acres in the southeastern United States, but <2.5 million acres remains today. Logging, agriculture, conversion to dense pine plantations, and fire exclusion have all contributed to the loss and degradation of longleaf pine forests. Scattered remnant tracts of this ecosystem, including old-growth trees and intact native groundcover vegetation, represent <0.01% of its pre-European settlement distribution and much of this is found on public land. Preservation and management of existing large tracts of longleaf pine on public land is only one part of the effort to conserve this ecosystem. In order to achieve the meaningful goal of increasing the current extent of the longleaf pine ecosystem and creating landscape level connectivity of conservation lands, restoration of former longleaf pine communities on private land must be undertaken. Such restoration efforts not only include reforestation of longleaf pine but also reestablishment of native groundcover plants (especially wiregrass and legumes), prescribed fire, and translocation of key wildlife species including gopher tortoises and red cockaded woodpeckers.

Nokuse Plantation is a 48,000 private conservation preserve located in Walton County, Florida. The land was acquired specifically to conserve biodiversity and create a key connection between Eglin AFB and the Choctawhatchee River WMA, part of 1 million acres of conservation land in northwest Florida and southern Alabama. High quality natural communities on Nokuse include about 1100 acres of remnant longleaf pine-wiregrass sandhill and 600 acres of high quality wet wiregrass flatwoods and prairie. Land conversion in the 20th century of the former longleaf pine ecosystem was typical of that on private lands throughout the Gulf Coastal Plain. About 20,000 acres of former longleaf pine flatwoods, savanna, and sandhill on Nokuse was commercial timberland (primarily International Paper Co.) planted in slash, loblolly, and sand pine since the mid-1950's. About 25,000 acres of former longleaf pine-turkey oak sandhill was cleared for commercial agriculture by First American Farms Corp. in the late 1960's and planted in soybeans, cotton, and peanuts for about two decades. Thus, with about 45,000 acres of Nokuse Plantation needing various degrees of restoration, it can serve as a model for conducting large-scale restoration of longleaf pine ecosystems. Since 2004, Nokuse has planted 11,700 acres in longleaf pine (1.6 million seedlings) [4000 acres (2.4 million seedlings) was planted in longleaf prior in 1998 by a previous owner]. Nokuse has thinned about 15,000 acres of mature slash pine plantations to 40-50 trees per acre (no-row thinning) and underplanted these areas with longleaf. Sand and loblolly pine has been clear cut and replanted in longleaf. The prescribe fire program on Nokuse has burned an average of 8000 acres per year since 2003. Since 2006, over 1700 gopher tortoises were translocated to Nokuse Plantation from development sites in Florida. Restoration of longleaf pine ecosystems on large private lands requires creative and efficient use of personnel and resources and must be viewed as a long-term commitment.

The Longleaf Academy: Developing More Longleaf Expertise Through Training Foresters and Biologists

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Introduction
The Longleaf Academy's poster and subsequent presentation during the Education and Outreach session at the conference examined the need for additional longleaf expertise across the region and how The Longleaf Alliance is addressing that need with the development of The Longleaf Academy. The first two courses held by The Longleaf Alliance, the Longleaf Stand Dynamics Lab and Auburn University were discussed with a focus on the curriculum, structure, and exercises of each. Also discussed were the future direction of the academy and our ultimate goal of creating a "Certified Longleaf Manager" designation. What follows is a brief overview of what was covered on the poster and during the presentation.

What is The Longleaf Academy?
An in-depth classroom and field course of instruction in "all things longleaf". The purpose is to better prepare foresters and other natural resource professionals to address management problems specific to longleaf forests and, as

a result, to create a uniformly well-informed network of longleaf managers to extend the reach of The Longleaf Alliance. Up to a total of 30 CFEs can be earned by each attendee.

Why the Need for The Longleaf Academy?

There has been a growing interest in longleaf among landowners due to evolving science and management tools, changing landowner demographics, and changing markets. Currently, demand for technical assistance outstrips the ability of The Longleaf Alliance staff to provide it. In addition, there is a high degree of variability in knowledge of and experience in longleaf restoration and management within the professional community.

Goals for The Longleaf Academy

- The goal of these academies is to educate foresters and biologists on specifics of longleaf management and restoration so that they can provide appropriate advice to landowners and land managers;
- Build a workforce of knowledgeable professionals to extend capacity to reach interested landowners;
- Establish a standard and recognized level of knowledge among professionals that ensures successful establishment, management, and/or restoration of longleaf forests; and
- Inform participating agencies, NGOs, and natural resource professionals about The Longleaf Alliance and the opportunity future courses have to offer.

Curriculum

- Natural and cultural history of longleaf pine, including a comparison between longleaf and other southern pines
- The use and effects of fire in longleaf ecosystems
- Artificial regeneration considerations (e.g., site selection, site prep, seedling quality, planting techniques, and release treatments)
- Natural regeneration systems
- Use of prescribed fire in managing and restoring longleaf systems
- Stand management considerations, including uneven-aged systems
- Longleaf growth and yield and stand dynamics
- Economics and products
- Wildlife management in longleaf systems
- Threatened and endangered species concerns
- Non-consumptive values
- Cost-share opportunities
- Native understory restoration
- Invasive species management
- Disease and pest identification
- Available resources and materials

Field Exercises, Demonstrations, Discussions and Assignments

- Measurements on long-term growth and yield plots
- Regeneration assessments in naturally regenerated stands
- Cone counts
- Pole classification
- Shelterwood regeneration systems
- Uneven and even-aged management systems
- Gopher tortoise and red-cockaded woodpecker habitat management
- Understory identification and management (with an emphasis on wildlife values)
- Prescribed fire effects on young as well as older longleaf stands
- Effects of management on growth and pole production
- Stand conversion
- Develop proposed management prescriptions for actual management scenarios with landowner objectives

How The Longleaf Academy was Developed

- First met with the Alabama Forestry Commission, a key funding source of these initial courses, to discuss and plan the development and direction of The Longleaf Academy.
- Developed a detailed course listing with descriptions, proposed length of course, and potential instructors.
- On June 26-27, 2008, held a "Pre-Academy" for supervisors to preview the curricula, receive input into emphasis areas, and "test drive" several Academy models. Agencies and groups in attendance from Alabama included the Alabama Forestry Commission, NRCS; the State Parks, State Lands, and Wildlife and Freshwater Fish Divisions of the Alabama Department of Conservation and Natural Resources. The U.S. Forest Service and U.S. Fish and Wildlife Service were represented, as were the Alabama Chapter of The Nature Conservancy and the Alabama Wildlife Federation. Representatives from Georgia's Forestry Commission and Department of Conservation were in attendance along with their counterparts from the Florida Division of Forestry and Florida's Fish and Wildlife agency. In total, nineteen participants attended.
- Combining classroom overviews and field trips with open and candid discussion, the group set tentative standards for academy length, breadth, and depth; endorsed the creation of a "Certified Longleaf Manager" designation; and set the stage for the multi-disciplinary, cross-agency and cross-state cooperation uniquely well-suited to longleaf management and restoration.
- Based upon responses from the questionnaires at the supervisors' academy, a week-long Longleaf Academy program was developed.

The First Two Longleaf Academy Courses

- First Longleaf Academy course was held August 18-22 and the second one was September 8-12, 2008. Both were held at the Solon Dixon Center in Alabama.
- Attendees represented he Alabama Forestry

Commission, the Alabama Department of Conservation and Natural Resources, NRCS, and the Alabama Wildlife Federation. In total, there were 45 participants.

- The sessions began mid-morning on Mondays with orientation and background information on longleaf ecosystems and The Longleaf Alliance and proceeded through the week with classroom lectures augmented by field trips and exercises on the Dixon Center, the Conecuh National Forest and the Escambia Experimental Forest.
- After a very busy week, we wrapped up and sent everybody home after lunch on Fridays.
- An evening presentation was made at each academy by a local landowner whose objectives include longleaf pine restoration. The passion and thoughtfulness of each of these landowners was apparent and inspirational. Each was extremely complimentary of the assistance he had received from the agencies and groups represented in the room.
- In the second version of the academy, the class was divided into teams and each presented with an actual management scenario, including a set of landowner objectives, and given the time to develop proposed management prescriptions for presentation to the class. It proved to be instructive to all, including us, to see the changes in thinking from Monday, when the management challenges were presented, to Friday at the culmination of the Academy.
- Insights gained in the first Academy led to refinements and improvements in the second to make the experience better attuned to the needs and interests of the class.
- A total of 30 CFEs were earned during the week by each attendee and, in return, we broadened our network of knowledgeable longleaf technical assistance providers.

The Future Direction of The Longleaf Academy

- A total of six additional courses are scheduled for FY 2009. In addition, it is anticipated that intensive courses will be offered throughout the year in topics like Managing Longleaf with Prescribed Fire, Artificial Regeneration of Longleaf, Natural Regeneration Systems for Longleaf Pine, Managing Wildlife Habitat in Longleaf Ecosystems, etc. to augment the training received in the general academies.
- Creation of a "Certified Longleaf Manager" designation.

We greatly appreciate the financial support provided by the Alabama Forestry Commission and the Georgia Forestry Commission that are making these initial academies possible.

Managing for Diversity on Private Lands

Mark Bailey

Conservation Southeast, Inc.

Abstract

The private land manager's toolkit includes a variety of strategies for enhancing both game and non-game diversity, and federal programs are available to assist in management as well as to reduce the legal burden of harboring endangered species such as red-cockaded woodpeckers. Frequent prescribed fire is the single most important tool in retaining and enhancing longleaf community diversity, and lightning season burns have been shown to be compatible with both bobwhite quail and wild turkey management. Where present, retention of gopher tortoises and southeastern pocket gophers, both keystone species, is important. Without control measures, introduced exotic species such as feral hogs and cogongrass can be devastating to native flora and fauna. Embedded within the longleaf-dominated landscape are distinct habitats such as ponds, stream margins, bays, and bogs, and these may require special consideration. Where absent, small isolated wetlands can be created to greatly increase amphibian and bird diversity. Provisioning of artificial nest cavities for birds and cover objects for reptiles are other strategies to consider. With an understanding of the needs of longleaf-adapted plant and animal populations, private landowners can make a significant contribution to wildlife conservation.

The "Farm 40" - Sixty Years of Management for the Private Landowner

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Abstract
A management demonstration in a 40-acre tract of second growth longleaf pine (*Pinus palustris* Mill.) has its 60th anniversary in 2008. The demonstration was initiated by the U.S. Forest Service in 1948 on the Escambia Experimental Forest in south Alabama. At the time, the management goal for this "Farm 40" was to produce high-quality poles and logs on a 60-year rotation. The goal was to be accomplished entirely through management of the existing natural forest with little to no capital investment other than the cost for prescribed burning, marking trees for cut, and limited control of cull hardwoods. Frequent harvests and small capital outlay make this type of management strategy especially appealing to landowners with limited resources. This presentation celebrates the 60th anniversary of the "Farm 40".

Palustris Experimental Forest

James Barnett (SRS-4159) and James Haywood (SRS-4158)

Background
The Palustris Experimental Forest (PEF) located within the Kisatchie National Forest in central Louisiana represents the millions of acres of southern pine forests decimated by the "cut-out and get-out" harvesting practices of the late 1800s and early 1900s; the experimental forest was named Palustris to reflect the longleaf pine (*Pinus palustris*) forests that once formed the dominant ecosystem in the area. PEF's 2,700-acre J.K. Johnson Tract was established in 1935 by Phillip C. Wakeley to serve as a test site for developing bareroot seedling technology needed to replant almost barren land with southern pines. In 1954, the 4,800-acre Longleaf Tract was added to the forest to provide for additional forest management and range research sites.

Major research emphases
Beginning in 1935 and continuing to the present, the PEF has provided an experimental area to develop forest and range management practices that have been applied across the southern Coastal Plain from the Atlantic coast to Texas plains. Brief descriptions of some of these major developments follow:

- Seedling specifications for planting southern pines (longleaf, loblolly, shortleaf, and slash pines) developed during the late 1930s with support of Civilian Conservation Corps personnel continue to be applied throughout the South. Over 670,000 seedlings were planted in these research studies. Our oldest longleaf pine study (+70 years) originated from this work.
- Direct seeding technology for the southern pines was developed to speed reforestation of millions of acres of barren cut-over forests. Seed physiology studies are supportive. The oldest large direct seeded longleaf pine tract is +50-years-old.
- Technology to plant container stock of southern pines was developed on the PEF. This technology has made restoration of longleaf pine more consistently successful.
- Southern pine genetics research, especially with longleaf pine, has been a significant long-term research program on the PEF that continues today.
- The initial focus on the Longleaf Tract was range research. Development of supplemental feeding technology made cattle grazing on cut-over land more profitable. This research was critical to reforestation efforts following World War II, and led to early agroforestry programs.
- As part of the range research effort, prescribed burning was studied over many decades both as a means to stimulate grass production but as a tool in longleaf pine management.
- Chemical control of undesirable cull hardwood species on upland sites was pioneered on the PEF. These procedures were applied across the South to make reforestation both more successful and economical.
- Stand management practices such as planting spacing, thinning levels and timing, and length of stand rotations are a focus on both tracts of the PEF with longleaf pine.
- Long-term research continues today on establishment of longleaf pine using prescribed fire and chemical weed control.

Conclusions
The Palustris Experimental Forest has hosted a lengthy program of research dedicated primarily to forest

management needs, but also supporting range management, genetics research, and intensive forest practices as well. The results of this research effort have been applied regionally and recognized nationally. It is rare that a program of research makes such a significant economic and societal impact on a region. Research conducted on this forest has changed the "face of the south."

Managing for Avian Diversity in the Longleaf Pine Ecosystem: Snags, Cavity-nesting Birds and the Need for Meaningful Guidelines

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Abstract
Dead and decaying standing trees (snags) have been long been recognized as an important part of managing forests for biological diversity, however relatively little attention has been given to snag management within the longleaf pine (*Pinus palustris*) ecosystem. Up to one third of avian species that breed within the longleaf pine ecosystem require cavities, and thus snags, for nesting. Our goals in this paper are to (a) revive discussion on the ecological importance of snags within the longleaf pine ecosystem and (b) present issues that arose when 'ground-truthing' existing snag management guidelines with cavity-nesting bird nest site selection data at one of the largest remaining tracts of intact, fire-maintained, mature longleaf pine forests in the Southeastern U.S. We conclude by identifying areas of research that are needed if meaningful snag management guidelines are to be developed for the longleaf pine ecosystem.

Introduction
It is the ecological wealth that is the fundamental basis for all of the values we attribute to longleaf pine ecosystems… Literally thousands of species of fungi, lichens, grasses, forbs, shrubs, trees, arthropods, amphibians, reptiles, birds, mammals and more comprise these ecosystems. Many of these species are mutually interdependent, and wholly reliant upon some attribute or aspect of longleaf pine systems for at least a portion of their life cycle. -- America's Longleaf Conservation Plan, 1st draft 2008.

Biodiversity conservation is emerging as a major goal in the management of forest ecosystems (Kessler et al 1992, Sharitz et al 1992). Not surprisingly, conservation of the longleaf pine (*Pinus palustris*) ecosystem, one of the most biologically diverse ecosystems in temperate North America, has received increasing attention over the years (Gillam and Platt 2006, Kirkman and Mitchell 2006, Mitchell et al. 2006). Recently, the first draft of America's Longleaf Conservation Plan was released, citing its overarching vision as "functional, viable longleaf pine ecosystems with the full spectrum of ecological, economic and social values" (America's Longleaf 2008). In order to meet these conservation goals, ecosystem components critical to the maintenance of composition, structure, function and biodiversity must be identified and integrated into long-term conservation management plans. Undoubtedly, the most widely recognized ecological factor responsible for shaping and sustaining the structure and composition of the longleaf pine ecosystem is a disturbance regime consisting of frequent, low-intensity fires (Van Lear and Harlow 2002). This recognition has led to impressive gains in the application of prescribed burning as a management tool to guide ecological restoration, and a strong understanding of how fire influences and benefits a wide range of flora and fauna within the longleaf pine ecosystem. However, another ecosystem component that may play a critical role in the maintenance of biodiversity within the longleaf pine ecosystem - the presence of dead and decaying wood - remains relatively unappreciated.

Dead and decaying wood (i.e. course woody debris) occurs in the form of dead standing trees (snags) and downed logs. Course woody debris is an integral part of healthy forest ecosystems because it influences nutrient cycling, energy flow and habitat heterogeneity, all of which regulate biodiversity (Harmon et al. 1986, McMinn and Crossley 1993). There is abundant life associated with the death of a tree, as a substantial number of species, including microbes, bacteria, fungi, insects, earthworms, amphibians, reptiles, birds and mammals, require dead and decaying wood to fulfill some aspect of their life-history requirements (Harmon et al 1986, McMinn and Crossley 1993, McComb and Lindenmayer 1999). For years after its death, as it progresses through different stages of decay, a dead tree can provide critical habitat for wildlife. For example, a recently-dead tree with loosening bark can provide habitat for insects and arthropods, foraging substrate for birds, and roosting sites for bats. While the tree remains standing as a snag, it becomes suitable for cavity-excavation by woodpeckers, providing an essential resource for many other species that require tree cavities for nesting and roosting. After a dead tree falls, it provides foraging habitat and cover for insects, arthropods, herpetofauna, birds and small mammals.

The importance of retaining a broad range of species, sizes, and decay classes of snags within managed forests has long been recognized, particularly within the Pacific Northwest region of the U.S. In comparison, snags have received far less attention within southern pine forests, despite intensive silvicultural practices and the increasing focus on restoring and conserving the longleaf pine ecosystem. Thirty years ago, the importance of snags and their management within southern forests was discussed by Conner (1978), and in 1996, McWinn and Crossley published a USDA technical report which provided an overview of the state of knowledge at that time on the influences of course woody debris on the biodiversity in the South. McWinn and Crossley (1996) concluded that there was a paucity of knowledge on almost every aspect of course woody debris dynamics in southeastern forests, despite the fact that a large array of flora and fauna in the South appeared to be associated with dead and decaying wood. Over ten years later, snags and other forms of course woody debris continue to be a surprisingly overlooked aspect of longleaf pine ecology.

Our goal in this paper is to revive discussion on the ecological importance of dead standing trees (snags) within the longleaf pine ecosystem with a particular focus on cavity-nesting birds. Cavity-nesting birds constitute up to one third of avian species that breed within the longleaf pine ecosystem. Here, we (a) provide a brief review of research on snags and their use by cavity-nesting birds within the longleaf pine ecosystem, and (b) identify some limitations of existing snag management guidelines for southern pine forests, based on a 'ground-truthing' conducted at one of the largest remaining tracts of intact, fire-maintained, mature longleaf pine forests in the Southeastern U.S. We conclude by identifying areas of further research necessary if meaningful snag management guidelines are to be developed for the longleaf pine ecosystem.

Cavity-nesting birds and snags

In North America, snags provide habitat for at least 85 avian species which nest in tree cavities (Scott et al. 1977). Cavities in snags are a critical resource for many species and cavity-nesting birds can comprise up to 40% of the avian community within some forested systems (Hunter 1990). In conifer-dominated forests, where naturally occurring cavities may be uncommon (Waters et al. 1990, Bull et al. 1997, Walter and Maguire 2005), woodpeckers play a particularly important role as providers of cavities for other cavity-users (Aitken and Martin 2007). Woodpeckers typically excavate new cavities each year for nesting, and abandoned woodpecker cavities are regularly used by nonexcavating species. Nonexcavating cavity-users include a wide range of birds, small mammals, herpetofauna and insects. Because most woodpecker cavity excavation cannot occur without the availability of dead and decaying wood, snags provide the critical foundation upon which cavity-nesting communities are based. Not surprisingly, many studies have found a positive relationship between snag density and the number and diversity of cavity-nesting birds (Dickson et al. 1983, Zarnowitz and Manuwal 1985, McComb et al. 1986, Brawn and Balda 1988, Shackelford and Conner 1997) and this relationship has been confirmed experimentally (Scott and Oldemeyer 1983, Raphael and White 1984, Lohr et al. 2002).

Although fire-maintained longleaf pine forests are often described as being relatively snag-poor environments, these forests support 45 avian species that use snags for nesting, roosting or perching, including 19 obligate cavity-nesting species (Hamel 1992). Landers and Boyer (1999) estimated that snag densities within old-growth longleaf pine forests averaged 2.7 per hectare (range: 0.2 to 17.3 snags per hectare), and several studies have quantified snag densities within loblolly (*Pinus taeda*), slash (*P. elliottii*), shortleaf (*P. echinata*) and longleaf pine forests in the South (range: 3.1 to 21.3 snags per hectare; Carmichael and Guynn 1983, Harlow and Guynn 1983, McComb et al. 1983, Land et al. 1989, Miller and Marion 1995, Moorman et al. 1999, Lohr et al. 2002). These studies found that pine forests have lower densities of snags than hardwood and pine-hardwood forests in the South however, the extent to which snag density is the primary limiting factor for cavity -nesting bird populations within southern pine forests remains unclear.

While a positive association has been found between cavity-nesting birds and snag density (Dickson et al. 1983, McComb et al. 1983, Shackleford and Conner 1997, Lohr et al. 2002), some studies suggest that the relationship between cavity-nesting birds and snags in southern pine forests may not be a simple, linear association between birds and snag quantity (Land et al. 1989, Miller and Marion 1995, Moorman et al. 1999). For example, Miller and Marion (1995) found that a mature longleaf pine forest, which had 40% fewer snags than a younger slash pine plantation within the same region, had (a) a greater proportion of snags that contained cavities, (b) significantly more cavities per snag and (c) a higher density and diversity of cavity-nesting birds. Large, old longleaf snags became usable by cavity-nesters sooner than younger, smaller snags within the slash pine plantations and persisted longer on the landscape. Land et al. (1989) did not find a simple liner relationship between cavity-nesters and snag density, but instead noted that snag characteristics and stand age had a stronger influence on cavity-nesting bird density, diversity and species richness.

Snag management

Retaining a range of snag species, sizes, and decay classes has long been recognized as an important part of managing forests for biodiversity. However, because some snags appear to be preferred by cavity-nesting wildlife, while other snags remain unused for nesting, effective and meaningful snag management guidelines will require more than a simple number per acre prescription. Other factors, such as qualitative snag characteristics and ecological processes underlying the flow of snag recruitment and loss, must be considered if the goal is to ensure the continued availability of snags for wildlife use over the long term (Moorman et al. 1999, Bednarz et al. 2004, Jackson and Jackson 2004, Laudenslayer 2005). Factors influencing snag quality include cause of death, time standing, rate and stage of decay, size, and tree species (Mannan et al. 1980, Raphael and White 1984, Bunnell et al. 1999, Bunnell et al. 2002, Farris and Zack 2005). Snag recruitment, persistence, and loss are influenced by disturbances such as fire, hurricanes, lightening and insect outbreaks. All of these factors are ultimately tied to local site conditions which, for the longleaf pine ecosystem, may vary greatly across its range.

To our knowledge, there are no snag management guidelines which are tailored specifically to the longleaf pine ecosystem or southern pine forests in general. Several studies used snag management recommendations from Evans and Conner (1979) (published in the proceedings of a workshop on management of north central and northeastern forests), and applied them to southern pine forests (Hamel et al. 1982, Conner et al. 1983, Harlow and Guynn 1983, Carmichael and Guynn 1983, Hamel 1992). Hamel et al. (1982) compiled available literature and produced the Land Manager's Guide to Birds of the South (updated in 1992), which is a document describing avian habitat associations, densities and nesting requirements within southern forests. Harlow and Guynn (1983) and Carmichael and Guynn (1983) estimated densities of snags necessary to sustain levels of cavity-nesting bird populations reported by Hamel (1982) for southern forests. Carmichael and Guynn (1983) then recommended increasing these recommendations to provide surplus snags for cavity-nesters. All of these studies used snag diameter recommendations presented in Evans and Conner (1979). Harlow and Guynn (1983), Carmichael and Guynn (1983) and McComb et al. (1983) used these adapted snag management guidelines to assess whether various southern forests had sufficient snags to support cavity-nesting bird populations. All three studies concluded that the pine forests they examined had sufficient snags to support cavity-nesting bird populations only within the smallest diameter size classes. Because they found a shortage of snags within the medium and large size classes, it was concluded that these forests could not sustain healthy populations of medium and large cavity-nesters over the long term.

Despite the adaptation of the guidelines to reflect desired local bird densities, it was never confirmed that the original snag diameter requirements provided by Evans and Conner (1983), which were based on cavity nest-site selection data from studies in midwestern and northeastern forests, were representative of cavity nest-site selection in the South. Thus, the extent to which these guidelines are appropriate for southern pine forests is unclear. A recent study of the cavity-nesting bird community at Eglin Air Force Base, Florida, has enabled us to 'ground-truth' these existing snag management guidelines using nest-site selection data.

The cavity-nesting bird community at Eglin Air Force Base, Florida

Eglin Air Force base, spanning almost half a million acres on the Florida Panhandle, falls within one of the top six biodiversity hotspots in the U. S. (Stein et al. 2000). Eglin is dominated by longleaf sandhills habitat (78% of the reservation), has mature longleaf pine, is managed with prescribed burning, and its land managers generally do not harvest or remove snags from the landscape. Given its size and condition, Eglin may be one of the best remaining reference sites available to ground truth existing snag management guidelines by examining snag availability and use by cavity-nesting birds within the longleaf pine ecosystem.

From 2001-2005, we documented snag densities and cavity-nest site selection for the cavity-nesting bird community on over 1,725 hectares (ha) (4,260 acres) of longleaf sandhills habitat at Eglin. We provide a brief summary of relevant findings here; for further details on study design, methods and results, see Blanc (2007) and Blanc and Walters (2008a,b). Over the 4-year period, we found 867 cavity-nests for 14 of the 15 obligate cavity-nesting birds that comprise roughly 30% of the breeding bird community in Eglin's sandhills. Naturally occurring cavities were uncommon. Almost all nests occurred in woodpecker-excavated cavities, which occurred in three substrates: living pine (excavated only by red-cockaded woodpeckers (*Picoides borealis*)), pine snags, and hardwood snags (Table 1). The majority of cavity-nests occurred in pine snags, which were used significantly over-proportionate to their availability. Both hardwood snags and red-cockaded woodpecker cavities in living pine were used under-proportionate to their availability. For all three substrate types, nests occurred in trees that were significantly larger in diameter than what was available. Roughly 10% of the nests for 11 avian species occurred in hardwood snags. Hardwood snags used for nesting supported the same bird species with significantly smaller diameters than pine; the median diameter at breast height (dbh) of hardwood nest trees averaged 58% of the size of pines used for nesting.

Snag densities at Eglin were among the highest reported for southern pine forests, largely due to the density of small hardwood snags. Hardwood snag density was roughly twice that of pine snags and consisted primarily of turkey oak (*Quercus laevis*). Overall, snag densities at Eglin exceeded the recommended number of snags per ha for smaller snag size classes, but similar to Harlow and Guynn (1983) and McComb et al. (1986), fell below recommended densities for all size classes >38 cm dbh. The adapted snag management guidelines from Harlow and Guynn (1983) and McComb et al. (1986) indicate that Eglin has insufficient numbers of snags to support populations of medium and large cavity-nesting birds. If we assume that Eglin is one of the best remaining reference sites available to obtain data on cavity-nester ecology within the longleaf pine ecosystem, then these results are perplexing, particularly given the abundance and diversity of the cavity-nesting bird population that occurs there (Blanc 2008a, Provencher et al. 2002). However, given Eglin's nest-site selection data, we propose an alternative conclusion - existing guidelines, which are based on nest-site selection data within Northeastern and Midwestern forests, may not be appropriate for Eglin's longleaf pine sandhills.

Using Evans and Conner (1979) snag management recommendations as a guideline, it is generally assumed that woodpeckers in southern forests require snags ≥23cm dbh for cavity-excavation. This was not the case at Eglin, however, despite the fact that birds were nesting in trees that were significantly larger in diameter than what was available (Blanc 2007). In fact, for almost all cavity-nesting species at Eglin, the median dbh of nest snags fell below the low end of the diameter range recommended by Evans and Conner (1979), and this discrepancy is magnified when hardwood and pine snags are examined separately. In addition, the smallest trees used by cavity-nesters at Eglin averaged 30% (for pine) and 43% (for hardwood) smaller than the smallest recommended diameters. We believe that these results reflect the relatively small diameter of trees that occur at Eglin, and suggest that the range of recommended snag diameters provided in the snag management guidelines for southern pine forests is too large for Eglin's sandhills. Indeed, pines >45 cm dbh are uncommon at Eglin, even in stands over 300 years old. Whether the availability and use of smaller diameter snags by cavity-nesting birds is unique to Eglin or also reflective of other southern pine forests is not yet known. A similar, ongoing study of cavity-nesting birds at Camp Lejeune, NC (Rose et al. 2009, this issue) will enable us to examine this further. Another potential problem is that existing guidelines do not account for qualitative differences between pine and hardwood snags, in particular, the suitability of hardwoods for cavity excavation at much smaller diameters than pine. Combining the two substrates together within snag density recommendations could exclude small, but usable hardwood snags or include small pine snags that are unsuitable for cavity-excavation.

These results indicate that meaningful snag management guidelines will require an ecosystem- and region-specific approach which considers stand characteristics, tree species composition and the nesting requirements of the cavity-nesters that occur within the managed area. Other studies have noted that variation in forest productivity associated with soils can influence the characteristics of snags in different sites (Boyland and Bunnell et al. 2002, Laudenslayer 2005) and make snag management guidelines based on tree diameters in one region unrealistic elsewhere. This appears to be the case with the application of existing snag management guidelines for southern pine forests to Eglin Air Force Base. Given the high variation in site conditions throughout its range, developing uniform snag management guidelines for the longleaf pine ecosystem may prove to be challenging.

Snag management in longleaf pine forests: general rules of thumb

Based on the documented importance of course woody debris in the Pacific Northwest and other areas, as well as on the information presented at this workshop, it would be prudent for land managers in the Southeast to recognize course woody debris as an important structural and functional component of forest ecosystems rather than as a hindrance that must be removed at a high cost. -- D.H. VanLear (1996)

Currently, our understanding of snag ecology within the longleaf pine ecosystem is limited and existing snag management recommendations may be problematic. Until we have sufficient knowledge of snag ecology within the longleaf pine ecosystem to develop meaningful guidelines tailored specifically to longleaf pine forests and local site conditions, we suggest the following general rules of thumb:

(1) Prevent or minimize the removal of dead and decayed trees (both hardwood and pine) from the landscape. If it is not absolutely necessary to remove a snag, then do not;
(2) Do not overlook the value of small dead and decaying hardwoods to cavity-nesters, even those as small as 10.5 cm (4 inches) in diameter. When hardwoods are killed as part of midstory reduction management regime (e.g., through the application of fire or herbicidal treatment), let the dead and decaying hardwood trees remain on the landscape for use by cavity-nesters. Hardwood snags were used by 11 of the 14 cavity-nesting birds at Eglin, suggesting that complete elimination of all hardwoods from the landscape (as opposed to just preventing them from dominating the landscape) may contribute to loss of nesting habitat for some species. Indeed, Landers and Boyer (1999) and Engstrom and Conner (2006) suggested that a small amount of scattered oaks were probably normal in historical, fire-maintained, longleaf pine forests;
(3) Leave some large, old 'legacy' trees on the landscape for future snag recruitment. While living, individual legacy trees that remain on the landscape within managed forests can have significant value to wildlife (Mazurek and Zielinski 2004). After a large, old legacy tree dies and becomes a snag, it may have much greater value to cavity-nesting vertebrates, for a longer period of time, than numerous smaller snags (Miller and Marion 1995, Blanc 2007);
(4) Maintain a diverse range of tree sizes on the landscape to provide sufficient niche space for the full suite of cavity-users (from tiny nuthatches and chickadees to large pileated woodpeckers and screech-owls);
(5) Document nest-site selection data for cavity-nesting birds at the local level to confirm that snag

diameter recommendations are appropriate for your site. Publish or make publically available these nest-site selection data so we can increase our knowledge of cavity-nesting bird nesting requirements throughout the range of the longleaf pine ecosystem, and develop relevant and meaningful snag management guidelines;

(6) When documenting cavity-nest site selection and snag densities, differentiate between hardwood and pine snags. The qualitative difference between the two, in their ability to accommodate cavity-nesting species at significantly different sizes, can confound dbh recommendations by including pine snags that are too small for use, or by excluding small hardwood snags that are usable.

Snag management in longleaf pine forests: future research

No other manageable property of the forest environment has a greater impact on biodiversity than course woody debris. -- M. A. Huston (1996)

If snag management is to be a viable option for conserving avian (and other) biodiversity within the longleaf pine ecosystem, then we must start filling in the blanks concerning snag dynamics and factors that determine or limit densities of cavity-nester populations within southern pine forests. The following areas of research are still needed:

(1) Describe snag dynamics for longleaf pine and any hardwoods that occur within the landscape, including size distribution, recruitment and loss rates, decay rates, and stages of snags by tree species.

(2) Quantify the relationships between occurrence, richness and diversity of bird species with the characteristics (e.g., type, size, etc) and distribution of snags on the landscape.

(3) Obtain nest-site selection data and breeding bird densities within intact forests at different locations throughout the range of longleaf pine to provide baseline targets for restoration. Such data can be used to identify and define (a) the characteristics of those nest sites which different species use for nesting, (b) what a 'healthy' target population size is for the species or community, and (c) the relationship between the availability of nesting resources and the desired population densities.

(4) Determine the conditions under which "not removing snags" is sufficient and when active snag management is needed.

(5) Determine if there a minimum target of snag types and sizes to manage for within longleaf pine forests, and if there is a threshold at which snag density is no longer the limiting factor for these populations (relative to factors such as predation, habitat quality and food limitation).

(6) Document how decay dynamics differ across longleaf and hardwood snags created by natural (e.g., fire, insects, wind damage) and artificial (herbicides, girdling, topping) means, and how these decay dynamics translate into use by wildlife. Two studies have examined decay dynamics of slash pine (Miller and Marion 1995) and loblolly pine (Moorman et al. 1999) snags in the South, and Cain (1996) examined decay and loss rates of hardwoods within a managed loblolly forest. These data are lacking for longleaf pine.

(7) Document community interactions associated with snags, to determine which, if any, species within the community can serve as good indicators of the overall health of the ecological community. For example, snags may serve as an important 'node' in the interconnected web of species that use cavities within southern pine forests, facilitating direct and indirect interactions between different species (e.g., Blanc and Walters 2008b). The extent to which snags facilitate critical interactions among species within the longleaf pine ecosystem is currently unknown.

Dead and decaying wood within the longleaf pine ecosystem: conclusions

With an enlarged view, death appears not antagonistic to life, but integral to it…Death makes life. -- T. Volk (2002)

Restoration and conservation of the structure, function and biodiversity of the longleaf pine ecosystem is now a major goal of organizations such as the Longleaf Alliance and America's Longleaf Regional Working Group. To this end, ongoing research on and application of prescribed burning as a management tool has been highly successful. In contrast, there is a paucity of knowledge on the role that dead and decaying wood plays in sustaining the biodiversity of life within the longleaf pine ecosystem. Indeed, the potential for developing a strong understanding of and management for snags and course woody debris has yet to be tapped. We propose that snag and course woody debris ecology may be our next big frontier in advancing longleaf pine ecosystem conservation and management. Given the large body of research that has demonstrated a link between course woody debris and biodiversity within forest ecosystems, combined with the recent surge in interest in conserving the functional integrity of the longleaf pine ecosystem, it seems timely and prudent to focus our efforts on understanding the ecology and management of dead and decaying wood within longleaf pine forests.

References

Aitken, K. and K. Martin. 2007. The importance of excavators in hole-nesting communities: availability and use of natural tree holes in old mixed forests of western Canada. Journal of Ornithology 148:425-434.

America's Longleaf Regional Working Group. 2008. Range-wide Conservation Plan for Longleaf Pine, 1st Draft.

October 2008. http://www.americaslongleaf.org/plan

Bednarz, J.C., D. Ripper and P.M. Radley. 2004. Emerging concepts and research directions in the study of cavity-nesting birds: keystone ecological processes. Condor 106:1-4.

Blanc, L.A. 2007. Experimental study of an avian cavity-nesting community: nest webs, nesting ecology, and interspecific interactions. Ph.D. dissertation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA.

Blanc, L.A. and J.R. Walters. 2008a. Cavity-nest webs in a longleaf pine ecosystem. Condor, 110:80-92.

Blanc, L. and J.R. Walters. 2008b. Cavity excavation and enlargement as mechanisms for indirect interactions in an avian community. Ecology 89:506-514.

Boyland, M. and F.L. Bunnell. 2002. Vertebrate use of dead wood in the Pacific Northwest. Extension Report, University of British Columbia, Vancouver, CA.

Brawn, J.D. and R.P. Balda. 1988. Population biology of cavity nesters in northern Arizona: Do nest sites limit breeding densities? Condor 90:61-71.

Bull, E.L., C.G. Parks and T.R. Torgersen. 1997. Trees and logs important to wildlife in the interior Columbia River Basin. U.S. Forest Service General Technical Report PNW-391.

Bunnell F.L., L.L. Kremsater and E. Wind. 1999. Managing to sustain vertebrate richness in forests of the Pacific Northwest: relationships within stands. Environmental Review 7:97-146.

Bunnell, F.L., E. Wind and R.W. Wells. 2002. Dying and dead hardwoods: their implications to management. Pages 695-716 *in* W. F. Laudenslayer Jr, P.J. Shea, B. E. Valentine, C. P. Weatherspoon, and T. E. Lisle, technical coordinators. Proceedings of the symposium on the ecology and management of dead wood in western forests. U.S. Forest Service General Technical Report PSW-GTR-181.

Carmichael, D.B. and D.C. Guynn, Jr. 1983. Snag density and utilization by wildlife in the upper Piedmont of South Carolina. Pages 107–110 *in*: Davis, J.W., Goodwin, G.A., Ockenfels, R.A. (Eds), Snag Habitat Management, Proceedings of the Symposium. U.S. Forest Service General Technical Report RM-99.

Conner, R.N. 1978. Snag management for cavity nesting birds. Pages 120-128 *in* R. M. DeGraaf, technical coordinator. Proceedings of the workshop for management of southern forests for nongame birds. U.S. Forest Service General Technical Report GTR-SE-14.

Conner, R.N., J.C. Kroll and D.L. Kulhavy. 1983. The potential of girdled and 2,4-D-injected southern red oaks as woodpecker nesting and foraging sites. Southern Journal of Applied Forestry 7:125-128.

Dickson, J.G., R.N. Conner and J.H. Williamson. 1983. Snag retention increases bird use of a clear-cut. Journal of Wildlife Management 47:799-804.

Engstrom, R.T. and R.N. Conner. 2006. Ecological forestry, old growth, and birds in the longleaf pine (*Pinus palustris*) ecosystem. Acta Zoologica Sinica 52:697-701.

Evans, K.E. and R.N. Conner. 1979. Snag management. Pages 214-224 *in* R. M. DeGraaf, and K. E. Evans, technical coordinators. Proceedings of the workshop on management of north central and northeastern forests for nongame birds. U.S. Forest Service General Technical Report. NC-51.

Farris, K.L. and S. Zack. 2005. Woodpecker-snag interactions: an overview of current knowledge in ponderosa pine systems. Pages 183-195 in M. W. Ritchie, A. Youngblood, and D. A. Maguire, editors. Proceedings of the symposium on Ponderosa pine: management, issues, and trends. U.S. Forest Service General Technical Report PSW-GTR-198.

Gillam, F.S. and W.J. Platt. 2006. Conservation and restoration of the *Pinus palustris* ecosystem. Applied Vegetation Science 9:7-10.

Hamel, P.B., H.E. LeGrand Jr., M.R. Lennartz and S.A. Gautreaux Jr. 1982. Bird-habitat relationships on southeastern forest land. U.S. Forest Service General Technical Report SE-22.

Hamel, P.B. 1992. The land manager's guide to the birds of the south. The Nature Conservancy and U.S. Forest Service, Atlanta, Georgia, USA.

Harlow, R.F. and D.C. Guynn. 1983. Snag densities in managed stands of the South Carolina Coastal Plain. Southern Journal of Applied Forestry 7:224-229.

Harmon M.E., J.F. Franklin, F.J. Swanson, P. Sollins, S.V. Gregory, J.D. Lattin, N.H. Anderson, S.P. Cline, N.G. Aumen, J.R. Sedell, G.W. Lienkaemper, K. Cromack Jr. and K.W. Cummins. 1986. Ecology of coarse woody debris in temperate ecosystems. Advances in Ecological Research. 15:133-302.

Hunter, M.L. 1990. Wildlife, forests and forestry: principles of managing forests for biological diversity. Prentice Hall. New Jersey, NJ. 370 p.

Huston, M.A. 1996. Models and Management Implications of Coarse Woody Debris Impacts on Biodiversity. Pages 139-143 *in* McMinn, J. W., and D.A. Crossley (Eds).

Biodiversity and Coarse Woody Debris in Southern Forests, Proceedings of the Workshop on Coarse Woody Debris in Southern Forests: Effects on Biodiversity; 18-20 October; Athens, GA, U.S. Forest Service General Technical Report SE-94.

Jackson, J.A. and B.J.S. Jackson. 2004. Ecological relationships between fungi and woodpecker cavity sites. Condor 106:37-49.

Kessler, W.B., H. Salwasser, C.W. Cartwright, Jr. and J. A. Caplan. 1992. New perspectives for sustainable natural resources management. Ecological Applications 2:221-225.

Kirkman, L.K. and R.J. Mitchell. 2006. Conservation management of *Pinus palustris* ecosystems from a landscape perspective. Applied Vegetation Science 9:67-74.

Land, D., W.R. Marion and T.E. O'Meara. 1989. Snag availability and cavity nesting birds in slash pine plantations. Journal of Wildlife Management 53:1165-1171.

Landers, J.L. and W.D. Boyer. 1999. An old-growth definition for upland longleaf and south Florida slash pine forests, woodlands and savannahs. U.S. Forest Service General Technical Report SRS-29.

Laudenslayer Jr., W.F. 2005. Effects of site on the demographics of standing dead trees in eastside pine forests. Pages 171-181 *in* M. W. Ritchie, A. Youngblood, and D. A. Maguire, editors. Proceedings of the symposium on Ponderosa pine: management, issues, and trends. U.S. Forest Service General Technical Report PSW-GTR-198.

Lohr, S.M., S.A. Gauthreaux and J.C. Kilgo. 2002. Importance of Coarse Woody Debris to Avian Communities in Loblolly Pine Forests. Conservation Biology 16:767-777.

Mannan, R.W., E.C. Meslow and H.M. Wight. 1980. Use of snags by birds in Douglas fir forests. Journal of Wildlife Management 44:787-797.

Mazurek M.J. and W.J. Zielinski. 2004. Individual legacy trees influence vertebrate wildlife diversity in commercial forests. Forest Ecology and Management 193:321-334.

McComb, W.C., S.A. Bonney, R.M. Sheffield and N.D. Cost. 1986. Snag resources in Florida- are they sufficient for average populations of primary cavity-nesters? Wildlife Society Bulletin 14:40-48.

McComb, W. and D. Lindenmayer. 1999. Dying, dead, and downed trees. Pages 335-372 *in* M. L. Hunter Jr., editor. Maintaining biodiversity in forest ecosystems. Cambridge University Press, Cambridge, UK.

McMinn, J.W. and D.A. Crossley (Eds). 1996. Biodiversity and Coarse Woody Debris in Southern Forests, Proceedings of the Workshop on Coarse Woody Debris in Southern Forests: Effects on Biodiversity; 18–20 October; Athens, GA, U.S. Forest Service General Technical Report SE-94.

Miller, S.H. and W.R. Marion. 1995. Natural and created snags and cavity-nesting birds in north Florida pine forests. Florida Game and Freshwater Fish Commission. Nongame Wildlife Program Final Report, St. Petersburg, Florida, USA.

Mitchell R.J., J.K. Hiers, J.J. O'Brien, S.B. Jack and R.T. Engstrom. 2006. Silviculture that sustains: the nexus between silviculture, frequent prescribed fire, and conservation of biodiversity in longleaf pine forests of the southeastern United States. Canadian Journal of Forest Research 36:2724-2736.

Moorman, C.E., K.R. Russell, G.R. Sabin and D.C. Guynn. 1999. Snag dynamics and cavity occurrence in the South Carolina Piedmont. Forest Ecology and Management 118:37-48

Provencher, L., N.M. Gobris, L.A. Brennan, D.R. Gordon and J.L. Hardesty. 2002. Breeding bird response to midstory hardwood reduction in Florida sandhill longleaf pine forests. Journal of Wildlife Management 66:641-661.

Raphael, M.G. and M. White. 1984. Use of snags by cavity-nesting birds in the Sierra Nevada. Wildlife Monographs 86:1-86.

Rose, K., L.A. Blanc, K.M. Hudgins, and J.R. Walters. 2009. An investigation of the avian cavity-nesting community at Marine Corps Base Camp Lejeune. Proceedings of the Longleaf Alliance Meeting 2009.

Scott, V.E., K.E. Evans, D.R. Patton and C.P. Sone. 1977. Cavity-nesting birds of North American forests. U.S. Forest Service Agriculture Handbook 511. Washington, D.C., USA.

Scott V.E. and J.L. Oldemeyer. 1983. Cavity-nesting bird requirements and response to snag cutting in ponderosa pine. Pages 19-23 *in* J. W. Davis, G. A. Goodwin, and R. A. Ockenfels, editors. Snag habitat management: Proceedings of the Symposium. U.S. Forest Service General Technical Report RM-99.

Sharitz, R.R., L.R. Boring, D.H. Van Lear and J.E. Pinder III. 1992. Integrating ecological concepts with natural resource management of southern forests. Ecological Applications 2:226-237.

Shackelford, C.E. and R.N. Conner. 1997. Woodpecker abundance and habitat use in three forest types in eastern Texas. Wilson Bulletin 109:614-629.

Stein, B., L.S. Kutner and J.S. Adams. 2000. Precious heritage: the status of biodiversity in the United States. Oxford University Press, New York.

Van Lear, D.H. 1996. Dynamics of coarse woody debris in Southern forest ecosystems. Pages 10-17 *in* McMinn, J. W., and D.A. Crossley (Eds). Biodiversity and Coarse Woody Debris in Southern Forests, Proceedings of the Workshop on Coarse Woody Debris in Southern Forests: Effects on Biodiversity; 18-20 October; Athens, GA, U.S. Forest Service General Technical Report SE-94.

Van Lear, D.H. and R.F. Harlow. 2002. Fire in the eastern United States: influence on wildlife habitat. Pages 2–10 *in* W. M. Ford, K. R. Russell, and C. E. Moorman, editors. The role of fire in nongame wildlife management and community restoration: traditional uses and new directions. U.S. Forest Service General Technical Report NE-288.

Volk T. 2002.What Is Death? A Scientist Looks at the Cycle of Life. New York: John Wiley and Sons.

Walter, S.T. and C.C. Maguire. 2005. Snags, cavity-nesting birds, and silvicultural treatments in Western Oregon. Journal of Wildlife Management 69:1578-1591.

Waters, J.R., B.R. Noon and J. Verner. 1990. Lack of nest site limitation in a cavity-nesting bird community. Journal of Wildlife Management 54:329-335.

Zarnowitz, J. and D. Manuwal. 1985. The effect of forest management on cavity-nesting in northwestern Washington. Journal of Wildlife Management 49:255-263.

Table 1. Cavity-nesting bird species that breed in sandhills habitat on Eglin Air Force Base, Florida, and the nesting substrates they use. Nesting substrates are listed in order of frequency used. Living pine refers to cavities originally excavated by the red-cockaded woodpecker. This table is based on 867 nests and is modified from data presented in Blanc and Walters 2008a,b.

Scientific name	Common name	Nesting substrates
Excavating species		
Melanerpes carolinus	Red-bellied woodpecker	Pine snag, living pine, hardwood snag
Melanerpes erythrocephalus	Red-headed woodpecker	Pine snag, living pine
Picoides pubescens	Downy woodpecker	Hardwood snag
Picoides villosus	Hairy woodpecker	Hardwood snag
Picoides borealis	Red-cockaded woodpecker	Living pine
Colaptes auratus	Northern flicker	Pine snag, living pine, hardwood snag
Dryocopus pileatus	Pileated woodpecker	Pine snag, living pine
Parus carolinensis	Carolina chickadee	Hardwood snag
Sitta pusilla	Brown-headed nuthatch	Hardwood snag, pine snag
Non-excavating species		
Aix sponsa	Wood duck	No nests found, but has been observed breeding in the Eglin's sandhills
Falco sparverius	American kestrel	Pine snag, living pine, hardwood snag
Otus asio	Eastern screech-owl	Living pine, pine snag, hardwood snag
Myiarchus crinitus	Great-crested flycatcher	Pine snag, hardwood snag
Parus bicolor	Tufted titmouse	Hardwood snag, pine snag
Sialia sialis	Eastern bluebird	Hardwood snag, pine snag, living pine

The Escambia Experimental Forest

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Background

In 1874, a sawmill was established on the Conecuh River, near the mouth of Lindsey Creek in Escambia County, AL. Some of the creek tributaries were ditched, and a dam for a storage pond was built. The harvesting of the adjacent stands of longleaf pine trees (Pinus palustris Mill.) began at a modest rate; then, around the turn of the century, railroads were extended into southern forests. From 1900 to 1919, all merchantable longleaf pine trees on land now occupied by the Escambia Experimental Forest (Escambia) were cut (Croker 1987). This was typical throughout the South when intensive and extensive harvest reduced the southern longleaf pine forests from 93 million acres to the fewer than 3 million fragmented acres they occupy today. Longleaf pine forests are now one of the most threatened ecosystems in the United States (Noss et al. 1995).

The U.S. Forest Service established research centers throughout the country in the early 20th century. Six of these were located within the native range of longleaf pine, including one at Brewton, AL. The Escambia was established near the Brewton unit of the East Gulf Coast Research Center, Southern Forest Experiment Station, on April 1, 1947, when the T.R. Miller Mill Company of Brewton, AL, represented by Tom Neal Sr., Ed Leigh McMillan, John Miller Sr., and John Richard Miller, provided land, at no cost, to the U.S. Forest Service through a 99-year lease. This 3000-acre tract in southwest Alabama, with trees then averaging 35-45 years of age, was selected because it typified the low density, second-growth longleaf pine forests that then covered about 6.2 million acres in southern Alabama and northwestern Florida (Croker 1987). The Escambia is centrally located in the longleaf pine belt and well situated for the study of the species.

Climate at the Escambia is temperate (humid, subtropical) with long, hot summers and a growing season exceeding 200 days. Winters are generally mild. Mean daily temperatures range from 34 to 90 °F. Annual precipitation of 68 inches arrives almost entirely as rain and is uniformly distributed throughout the year. Escambia soils are dominated by the Troup-Bibb-Benndale-Orangeburg association (Mattox 1975) and range from well-drained gently rolling sandy uplands to lesser areas of poorly drained stream bottoms. The understory plant community is dominated by bluestem (Andropogon spp. L.) and similar grasses; a variety of legumes, composites and other forbs; shrubs; and hardwood tree species which persistently sprout and expand unless periodically burned by prescribed fire.

The First Half-Century of Progress

Following establishment, the land was surveyed and divided into 40-acre compartments. Three 40-acre studies were immediately installed:

(1) The Management Systems Study was established in even-aged and uneven-aged compartments to examine the forest management and economic aspects of three rotations for longleaf pine forests: short (40 years), medium (60 years), and long (80 years).

(2) The Farm Forty Study demonstrated management of a 40-acre farm woodlot. It was managed for logs and poles on an 80-year rotation. An annual field day was held to showcase the products harvested from the woodlot in a typical year (for a 30-year summary see Boyer and Farrar 1981).

(3) The Investment Forest Study was set up to simulate forest management of a typical investor. Records were kept of all activities such as timber marking, maintenance of roads and boundary lines, and prescribed burning.

Three significant events occurred in 1947, the consequences of which still resonate today. One was a wildfire, the second was a bumper seed crop of longleaf pine, and the third was a decision to intentionally burn another 26,000 acres of land in and around the Escambia (Croker 1987). The resulting successful establishment of longleaf pine seedlings on burned areas was evidence of what could be achieved by applying reasoning, deduction, and scientific principles to the issue of longleaf pine regeneration. Fire, long considered the enemy of America's forests, was now viewed as necessary for successful longleaf pine stand establishment. Thomas Croker (1987) wrote about his astonishment that almost all of the prolific advanced regeneration in his seed-tree study area resulted from the 1947 naturally established seedlings and little if any from the seed trees. Many of the third growth forests at the Escambia were established from this one seed crop, and the seed-tree reproduction method for longleaf pine was abandoned on the Escambia. In addition to the resulting poor regeneration, the seed-tree method did not provide pine needles and other fine fuels in sufficient quantity to carry prescribed fire across the study sites.

In 1951, organizational changes in the research stations resulted in discontinuation of the management systems study at the forest. Other studies were put on a maintenance basis and efforts concentrated on the Farm 40 and Investment Forest studies. However, in 1955, with strong local support, young foresters were hired to assist with studies and research management data. One of these, William D. (Bill) Boyer later became the Project Leader of the research unit responsible for managing the Escambia. In 1956, Thomas Croker suggested that the shelterwood reproduction method be used to regenerate longleaf pine forests and published his article in the Journal of Forestry (Croker 1956; Boyer 1963; Croker and Boyer 1975).

In 1964, a region-wide longleaf pine growth study was initiated on the Escambia by Forest Service scientist Robert M. Farrar and later expanded to other locations in Alabama, Mississippi, Florida, Georgia, and North Carolina (Kush and Tomczak 2007). Nearly half of the 305 plots in this study are located on the Escambia. The objective at the time of initiation, and currently, was to quantify growth and yield of natural, thinned longleaf pine forests spanning a range of ages, site types, and residual stand densities across the Southern Region. Site quality was measured by site index (from 50-90 feet) and stand age determined (from 20-80 years). Study sites are thinned to maintain the target basal area for each stand (from 30 to 150 square feet), and new stands are added every 10 years for temporal replication. All plots are re-measured every 5 years, with the 45-year remeasurement scheduled to take place in 2009. In addition to the original objective of the study, scientists are now examining their data to determine whether recent increases in longleaf pine growth are a result of increasing levels of atmospheric CO2 and whether the carbon storage capacity of longleaf pine can serve as a potential mitigation factor for climate change.

The region-wide longleaf pine seed production study began in 1966 as part of the shelterwood test study entitled "Longleaf Regeneration Trials". Mature longleaf pine trees from Louisiana to North Carolina are annually monitored and the number of longleaf pine flowers, conelets, and cones are counted to assess seed production (Boyer 1974, 1987, 1998; Croker 1973). After many observations of cone production in stands at varying densities, stands are now thinned to maintain a maximum shelterwood density of about 30 square feet per acre. There are 10-15 seed-bearing longleaf pine trees per study site. At the Escambia, pollen counts are also conducted annually. A report containing estimates for the regional cone crop is sent to forest managers every June.

Fire studies have been conducted at the Escambia since 1973. In one continuing study, plots are either burned once every 2 years in spring, summer, or winter, or left unburned as a control. In conjunction with the season of burn, some plots received an initial herbicide treatment while on others vegetation was periodically cleared away by hand. Initially, all pine height and diameters were measured, fire behavior was documented, and crown scorch recorded every three years. Understory species were also measured and sampled. While still in progress, the study measurements are now taken every five years. A second study, established in 1985, examines both fire season and the length of time between burns (e.g., one fire every 2, 3, or 5 years) (Boyer 1990).

Following successful management of operations on the Farm 40 Study (which uses the group selection reproduction method) and Tom Croker's publication in the Journal of Forestry (emphasizing benefits of the shelterwood reproduction method), land managers began rethinking their approach to longleaf pine regeneration and stand management methods. As a result, an uneven-aged management study was initiated on the Escambia by Robert M. Farrrar. The objective of the study was to demonstrate and compare three uneven-aged management techniques with fixed basal area per acre stand regulation methods. Plot sizes range from 30 to 40 acres. Fire is applied every 3 years, and diameters of all trees on the study sites are measured every 5 years. The Methods study, or phase one, was established in 1977 and used the volume-guiding diameter limit method (V-GDL). The second phase of the study, installed in 1981, employed the Basal Area-Maximum Diameter Diminution Quotient method (BDq). The third phase, added in 1991, tested the Diameter Limit Cutting method (DLC).

Current and Future Directions

A little more than 80% of the Escambia is currently occupied by longleaf pine stands, with the remainder in slash pine and hardwood bottoms. Tree ages range from young seedlings to 160 years, with the second-growth timber approximately 95-years-old. Over 1200 acres of the forest have been naturally regenerated and more than half of this is in stands ranging from 35-50 years of age. Stand densities vary widely; some variations were artificially created for the growth and yield studies started in 1964. Site quality averages 70-75 feet at 50 years (range = 65-83 feet). Very few locations in the South can boast the combinations of stand ages, sites, and conditions that are found at the Escambia.

After Hurricane Ivan struck the Escambia in September 2004, some of the heavily damaged longleaf pine stands were salvage harvested by clearcutting. On these areas, scientists installed a study to examine the influence of intensive management practices on accelerating restoration of the longleaf pine forest. Study plots received herbicide treatments of either (a) 2.5 lbs of Velpar®, (b) 0.75 lb of Chopper®, (c) 6 lbs of Garlon® XRT, or (d) none as a control. Soon after tree planting, half of the plots were fertilized with superphosphate and potash and will receive 140 lbs of urea per acre at ages 15 and 30. The other half of the plots will remain unfertilized. Seedling survival will be monitored and growth will be measured at established intervals to track developmental progress.

The advantages of the long-term work in progress at the Escambia are exemplified by the discoveries that cannot be made by short-term experiments. For example, because of the long-term records, Bill Boyer noted significant growth differences between second-growth and third-growth stands (Boyer 2001). While trees from second-growth stands in 16 compartments averaged 66.5 feet in one study and 66.4 feet in a second, estimates of height growth in third-growth stands obtained from studies in 17 compartments averaged 81.3 feet. All of these stands are intermixed and cover a similar range of soil-site conditions. Additionally, less than 5% of second-growth trees in the study showed signs of early suppression followed by later release. In fact, based on early radial growth measurements of the first 25 rings, second-growth trees outgrew third-growth trees, suggesting that changes in growth aren't due to differences in site or early tree growth. The study may have significant implications for climate change researchers.

Another observation is that, in 33 years, natural longleaf pine regeneration catches and surpasses planted longleaf pine in height, even with understory control on the planted sites (Boyer 1997). For a landowner or forest manager with longleaf pine already in place, natural regeneration methods are both effective and economical, eliminating the large sums needed for planting and related costs. Carrying such costs over the years diminishes the economic benefit to the forest owner.

Lastly, cone crop information has been collected for 50 years on the Escambia and at many sites across the region. Because of this extensive long-term database, scientists have noted that cone production by longleaf pine trees on the Escambia has more than doubled during the period from 1986 to 2008 compared to the preceding 20 year average (Figure 1). At this time, researchers are uncertain as to the cause for this increasing frequency of good cone crops. It may be related to tree age or a result of climate change.

The importance of the preceding examples is that all were possible because of the long-term databases now available from experimental forests such as the Esambia, where studies can be actively maintained and protected for decades of information gathering. Because of research on the Escambia, we now know that the shelterwood reproduction method is a successful and cost-efficient means of regenerating longleaf pine forests; that fire is essential for longleaf pine regeneration; that height growth of naturally regenerated longleaf pine catches up to and surpasses planted seedlings after 33 years; and above all that longleaf pine ecosystems are an integral and vital part of the southern economy and culture.

The Escambia Experimental Forest is managed by the U.S. Forest Service, Southern Research Station, Unit SRS-4158, headquartered in Auburn, Alabama, with scientists also stationed at Clemson, South Carolina and Pineville, Louisiana.

References

Boyer, W.D. 1963. Development of longleaf pine seedlings under parent trees. U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station Research Paper SO-4. 5 p.

Boyer, W.D. 1974. Longleaf pine cone production related to pollen density. In: Kraus, J. (ed.), Proceedings of a colloquium: seed yield from southern pine seed orchards. Georgia Forest Research Council. pp 8-14.

Boyer, W.D. 1979. Regenerating the natural longleaf pine forest. Journal of Forestry 77: 572-575.

Boyer, W.D. 1987. Annual and geographic variation in cone production by longleaf pine. In: Phillips, D.R., (comp.), Proceedings of the fourth biennial southern silvicultural research conference. U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station General Technical Report SE-424. pp. 73-76.

Boyer, W.D. 1990. Growing season burns for control of hardwoods in longleaf pine stands. U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station Research Paper SO 256. 7 p.

Boyer, W.D. 1997. Longleaf pine can catch up. In: Kush, J.S. (comp.), Proceedings of the first Longleaf Alliance conference. Longleaf pine: a regional perspective of challenges and opportunities. Auburn University, AL. Longleaf Alliance Report No. 1. pp. 28-29.

Boyer, W.D. 1998. Long-term changes in flowering and cone production by longleaf pine. In: Waldrop, T.A. (ed.), Proceedings of the ninth biennial southern silvicultural research conference. U.S. Department of Agriculture, Forest Service, Southern Research Station General Technical Report SRS- 20. pp. 92-98.

Boyer, W.D. 2001. A generational change in site index for naturally established longleaf pine on a south Alabama coastal plain site. Southern Journal of Applied Forestry 25(2): 88-92.

Boyer, W.D. and R.M. Farrar, Jr. 1981. Thirty years of management on a small longleaf pine forest. Southern Journal of Applied Forestry 5: 73-77.

Croker, Jr., T.C. 1956. Can the shelterwood method successfully regenerate longleaf pine? Journal of Forestry 54: 258-260.

Croker, Jr., T.C. 1973. Longleaf pine cone production in relation to site index, stand age, and stand density. U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station Research Note SO-156. 3 p.

Croker, Jr., T.C. 1987. Longleaf pine, a history of man and a forest. U.S. Department of Agriculture, Forest Service, Southern Region, Forestry Report R8-FR7. 37 p.

Croker, Jr., T.C. and W.D. Boyer. 1975. Regenerating longleaf pine naturally. U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station Research Paper SO-105. 21 p.

Kush, J.S. and D. Tomczak. 2007. The regional longleaf pine growth study – 40 years old. In: Estes, B.L. and J.S. Kush (comps.), Proceedings of the sixth Longleaf Alliance regional conference. Report No. 10. pp. 102-103.

Mattox, M.G. 1975. Soil survey of Escambia County, Alabama. U.S. Department of Agriculture, Soil Conservation Service and Forest Service in cooperation with Alabama Department of Agriculture and Industries and Alabama Agric. Exp. Sta. 98 p.

Noss, R., E.T. LaRoe and J.M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation.. U.S. Department of Interior, National Biological Service, Washington, DC, Biological Report 28. 59 p.

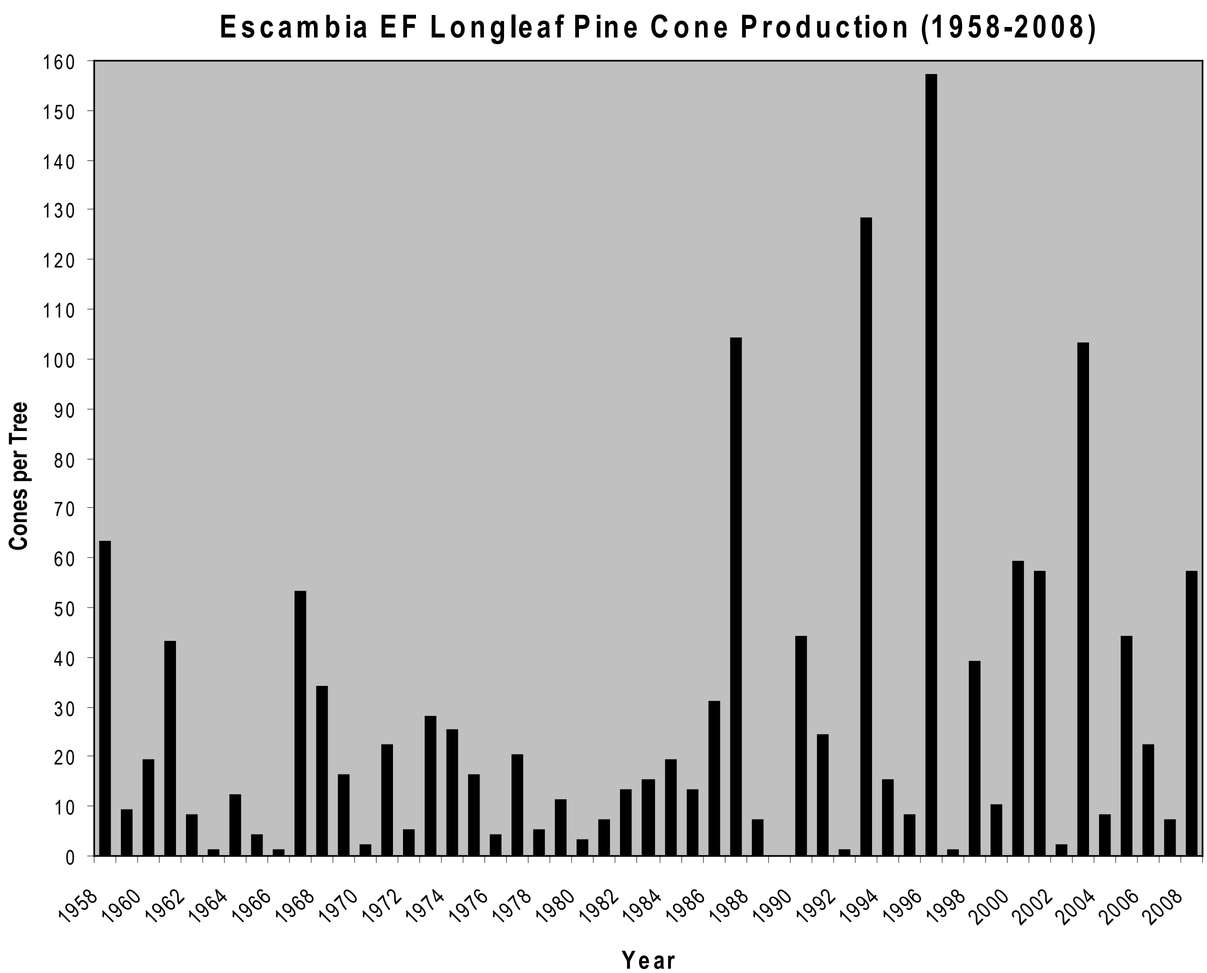

Figure 1. Escambia longleaf pine cone production, from 1958 through 2008. A strategy for transitioning loblolly pine stand to longleaf: implications for restoring native groundcover.

A Strategy for Transitioning Loblolly Pine Stand to Longleaf: Implications for Restoring Native Groundcover

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Abstract

Many Family Forest Landowners within the range of longleaf pine wish to convert their loblolly stands to longleaf. However, they are concerned about losing potential revenue from timber and associated wildlife habitat by clearcutting loblolly and replanting longleaf. A strategy of gradually converting existing loblolly plantations to longleaf through patch cutting and underplanting longleaf while encouraging native groundcover restoration is discussed.

Many landowners desiring to convert their lands to longleaf are still concerned about the length of time it will take to regrow habitat and merchantable timber in a clearcut and plant conversion process. Thanks to the interest and generosity of John Spearman and his family, we were able to set up a demonstration of converting an even-aged, old field loblolly pine plantation to longleaf. The process started in 2005. We report here our plan, what we've been able to accomplish and lessons that we've learned about the process and implications for native groundcover restoration in these situations.

The Plan

On Deer Hill Plantation in Williamsburg County, South Carolina we have a 15 year, old 50-acre old-field loblolly pine plantation on a typical Coastal Plain site that was planted with 726 trees per acre after an herbicide application and a site preparation burn. The transition begins with the first thinning when the loblolly plantation is 15 years old. During the logging operations small patches averaging one-half acre in size were randomly cut on 20% of the 50 acres (ten acres of patches). Existing openings were taken advantage of and enlarged as needed to create the desired patch size.

In the remainder of the loblolly stand, 33% to 40% of the volume was selectively thinned and removed. The remaining trees are left to create a "thick and thin" pattern, leaving a varying stocking in the stand. Another way of achieving this is to set a target residual basal area of 60 square feet per acre with a range of 50 to 75 square feet of basal area per acre across the stand. This was a challenge because the Spearman's consulting forester had difficulty accepting the plan and getting the loggers to thin that heavily. When the logging was complete, we wound up with residual basal areas of 65 to 75 square feet per acre.

In the open patches, after chemical site preparation during the summer 2005, in January, 2006, containerized longleaf seedlings were planted at 622 trees per acre (7'X10' spacing). Prescribed burning is being used on a two-year rotation in the entire plantation to control competing vegetation. Some modification of this burn plan may be needed when the young longleaf trees are two to four feet tall and susceptible to fire damage.

This process is repeated every ten years until all the loblolly is removed and replaced with longleaf. This will carry the last of the loblolly to age 55. At this time the longleaf stand will have trees from one to forty years old.

At the end of the conversion process, you are left with an uneven aged stand of longleaf with five separate age classes. The older classes will allow uninterrupted flow of revenue from the sale of timber.

As the longleaf becomes merchantable, plans are to selectively harvest two-thirds of the previous ten-year's growth.

Today, we have successfully planted the first ten acre group of patches, year-two survival is in the low 80% range and some longleaf seedlings have commenced height growth. In spite of a chemical site prep that featured a mixture of Chopper and Garlon 4, we have a moderate to severe dewberry problem that must be dealt with. Also, in the first post-planting prescribed fire, conducted in March 2007, all the fires burned out when they reached the openings the longleaf were planted in. Mowing that following summer was able to encourage growth of some native grasses, primarily broomstraw. However, grass recruitment remains slow. Plans are to burn the patches again this winter, using headfires or closely spaced spot fires. Any areas of poor longleaf survival will be interplanted, if necessary. Dewberry resprouts will be spot treated in the spring with Garlon 4.

Based on our experience, it may be better to start the conversion process after the second thinning, especially if the stand is prescribed burned periodically starting around the time of the first thinning. The longer prescribed fire has to work on the landscape, the better the opportunity desirable fine fuels will have to develop in the understory and be present in the planted openings. Fine fuels such as native warm season grasses are absolutely critical in order to get fire to move through these openings where longleaf pine is planted. Periodic fire will also be needed to keep hardwood resprouts and loblolly "weedlings" from dominating the longleaf plantings. That said, our conversion process will get easier by the time the next planting comes around, simply from allowing fire to work in the stand longer.

As another part of this project, we attempted to use low cost, hand sowing to establish native warm season grasses on replicated 20 foot by 10 foot plots at another location in an old field pine plantation on the property. During the summer of 2006, the vegetation in the study plots was sprayed 4 times with generic Roundup. In April of 2007, beaked panicum, giant plumegrass, narrowleaf plumegrass, and indiangrass were hand sowed on the plots. Half of each plot was lightly disked and native lespedezas were sown in all plots but the controls. When the plots were evaluated at the end of the 2008 growing season, only the indiangrass plots succeeded. Yet, there were several native grasses and lespedezas growing in all the control plots on the disked portion.

The biggest lessons learned from this project are two. First, don't discount the role of fire and time in restoring native groundcover on the landscape. There are many sites that may have a good seedbank that only needs to be encouraged by fire, periodic fire over long periods of time. Second, on some old field sites, light random disking coupled with fire may work to restore desirable plants. More research needs to be done with both these issues over the long term.

Finally, the mechanics of this conversion process from loblolly to longleaf appear to be sound. Longleaf seedlings are surviving and starting height growth. Early and fast conversion will be a challenge, a slower and more deliberate, less intensive process may offer the best chance for success.

The Longleaf Alliance GIS Database of Existing Longleaf Pine Stands

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Abstract

In response to increasing interest in restoring functional longleaf pine ecosystems, the Longleaf Alliance is working in coordination with numerous partners on an effort to develop a GIS database of existing longleaf pine stand data. The GIS database was created by collecting and compiling existing available spatial data about longleaf pine stands. Sources include natural and planted stands from all types of land ownership (public and private), old growth stands, and known populations of target species like red-cockaded woodpeckers and gopher tortoises. Spatial data have been received in various forms and include point and polygon shapefiles with various levels of detail. The information received ranges from coordinates for a single point within a stand to polygons with attributes like acreage, density, fire history, etc. This GIS database helps assess the extent and condition of available spatial data on longleaf pine forests, which provides a building block in the restoration of the longleaf pine ecosystem. The database will serve as an effective conservation tool by targeting areas of high ecological potential and thereby maximizing the impact of restoration dollars. Among the various utilities of this database are the abilities to identify areas that lack spatial data about longleaf pine stands, to develop potential ways to prioritize likely restoration areas and/or corridors, and to serve as an educational tool to promote longleaf restoration.

Restoring Longleaf Groundlayer on Private Lands in Georgia, Alabama, and South Carolina

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Abstract

The United States Fish and Wildlife Service, Partners for Fish & Wildlife (PFW) Program, within the Northeast Gulf (NEG) region, considers the restoration / enhancement of the longleaf pine ecosystem as a high funding and technical support priority. The NEG Native Groundcover Working Group, comprised of several Federal and state resource agencies and NGO representatives, has devised an initiative to: 1) establish a regional native seed source, 2) install native groundcover demonstration areas, and 3) restore

upland habitat on private and public sites. PFW works primarily with private landowners to accomplish these objectives. This talk will review restoration efforts directed by PFW biologists Jim Bates in the west GA and east AL area, and Joe Cockrell in SC. A privately funded effort is underway at Yeamans Hall Club in Hanahan, SC. USDA Forest Service Seed Laboratory in Macon, GA, especially Seed Biologist Jill Barbour has provided invaluable help with seed cleaning and propagation procedures. In brief, our approach for these projects emphasizes nursery-propagated plugs using techniques developed for pine seedling propagation. Hundreds of thousands of plugs of over 90 ground layer species have been planted thus far. In addition to planting plugs, we have used direct seeding via seed-slinger or Grasslander on some sites. Retaining residual biodiversity of native groundlayer species is a priority and techniques are used that accommodate that objective. Restoration results have ranged from success to less successful, though no site has failed entirely. Limiting factors to plug success include drought, high herbivory levels, and, on some sites, evident residual soil herbicide impacts. Herbivory and soil herbicide impacts appear more limiting to forb growth and survival than to grasses and legumes.

A Decision Support Tool for Longleaf Pine Restoration for the East Gulf Coastal Plain Joint Venture

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Abstract

The loss of 95% of the longleaf pine ecosystem has adversely affected not only longleaf pine understory forbs and grasses, but animal species that live within this community as well. Strategically focusing restoration efforts may be the most effective way to restore animal communities associated with the longleaf ecosystem. We developed a decision support tool (DST) for the East Gulf Coastal Plain Joint Venture (EGCPJV) that identifies locations which, if restored to longleaf pine, will likely provide the greatest benefit to bird populations. The DST utilizes Southeast Regional GAP data such as land cover and predicted species distributions, considers the potential of adjacent land cover, and relies on density functions as surrogates for more complex conservation concepts such as patch size and connectivity. Currently, the DST is limited to the coastal plain from the Apalachicola/Chattahoochee Rivers westward to the Mississippi River. We anticipate funding that will enable the expansion of this decision support tool throughout the range of longleaf pine. This talk will describe the creation and function of the DST in the context of range- wide expansion.

Conservation Needs of Gopher Tortoises

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Abstract

The gopher tortoise (*Gopherus polyphemus*), a keystone species of the Coastal Plains of the southeastern United States, is federally protected in the western portion of its geographic range and is protected by state legislation throughout the remainder of its distribution. Habitat loss and fragmentation associated with land use practices are the primary causes of imperilment. Because gopher tortoises are long-lived, they may persist in a degraded landscape for extended periods of time with the population in decline and this may obscure understanding of what is required to conserve the species. Long-term conservation of gopher tortoises depends upon knowing what constitutes a minimum population size and what distinguishes areas where management efforts can maintain or increase population density from those sites where populations are likely to decline. To better prioritize sites for conservation efforts it is important to be able to estimate carrying capacities. Carrying capacity refers to the maximum number of individuals that can be maintained in a specified area given specific habitat conditions. During this presentation we review how carrying capacity can be estimated for a block of land if the areas of priority, suitable, and marginal soils are known as well as tree basal area associated with each soil type. We predict that a viable tortoise population must exceed 100-300 individuals. Preliminary information

indicates that tortoise density ultimately expected for a proposed conservation site must exceed 0.06 tortoises/ha (0.15 tortoises/ac) in order to represent a viable population. This information coupled with appropriate habitat management that includes frequent, low-intensity fire in order to maintain the open forest structure provides an initial assessment of some conservation needs required to sustain gopher tortoise populations in the modern landscape.

Palustris Experimental Forest: Changing the Face of the South

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Legacy

The Palustris Experimental Forest located within the Kisatchie National Forest in central Louisiana represents the millions of acres of southern pine forests decimated by the "cut-out and get-out" harvesting practices of the late 1800s and early 1900s. The experimental forest was named Palustris in consideration of the longleaf pine (Pinus palustris Mill.) forests that once formed the dominant ecosystem in the area. Palustris' 2,700-acre J.K. Johnson Tract was established in 1935 by Phillip C. Wakeley to serve as a test site for developing the bareroot seedling technology needed to replant nearly barren lands with southern pines. This tract was named in honor of the South's first industrial forester who supported early cooperative nursery research at the Great Southern Lumber Co. in Bogalusa, LA. In 1954, the 4,800-acre Longleaf Tract was added to provide additional forest management and range research sites. Both of these tracts continue to support even-aged pine management research studies.

Major Research Emphases

The Palustris Experimental Forest has provided an extensive research area to develop forest and range management practices applied across the southern Coastal Plain from the Atlantic coast to East Texas, and currently, both Restoring and Managing Longleaf Pine Ecosystems and Southern Pine Ecology and Management Research Work Units in Pineville, LA maintain studies on the Palustris. Many important avenues of research have been carried out over the past 8 decades:

- Seedling specifications for planting southern pines (longleaf, loblolly, shortleaf, and slash pines) were developed during the late 1930s. With support of the Civilian Conservation Corps, over 670,000 seedlings were planted in these research studies on the J.K. Johnson Tract. The publication, Planting of the Southern Pines, resulted from this effort and provided guidelines for reforesting pine lands across the South.
- Early research also focused on seed and seedling diseases, especially brown-spot needle blight.
- Wakeley found a disease-free seedling in a nursery bed overwhelmed by brown-spot needle blight. This seedling was genetically immune to the fungus. It was planted on the Palustris and named "Father Abraham." This tree became the basis of a longleaf pine improvement program; several progeny from Father Abraham were planted on the Palustris.
- Longleaf pine genetics research continues on the Palustris where many long-term studies have been established. Currently, the Forest Genetics and Ecosystems Biology Research Work Unit in Saucier, MS leads this effort.
- The initial emphasis on the Longleaf Tract was range research as it was part of the barren, cut-over forestlands that covered millions of acres. Reforesting these lands conflicted with cattle use. Research to accommodate both uses was implemented and continued for many years with development of supplemental feeding programs to help cattlemen. The range research effort developed into silvopasture programs as livestock grazing declined.
- Over-harvesting the pine forests denuded many properties, and direct seeding technology, developed on the Palustris, was used to reforest hundreds of thousands of acres. Every aspect of this technology was studied including seed collection, processing, storage, treatment with fungicides and bird and rodent repellants, and application techniques to increase the likelihood of field success.
- Bare-root planting stock was often difficult to establish, and technology to plant container stock of southern pines was tested with much of this research being done on the Palustris. Container seedlings are now used to reestablish longleaf seedlings on sites where other species are offsite or where restoration to longleaf pine is desired.
- Windthrow of container-grown seedlings by strong and sustained winds has become a problem, and we are studying this problem on several sites on the Palustris.
- Chemical control of undesirable cull hardwood species on upland sites was pioneered on the Palustris and results were applied across the South. Application techniques at first were crude, but developed with time. The 'hack and squirt' approach moved into 'tree injectors', basal sprays, mist blowing, and back to the hypo-hatchet. Another development was to

incorporate appropriate chemicals in granules that would be spread directly on the soil.

- Soil-site related questions have been addressed for decades. A major effort was the 'Choice of Species' study, in which the performance of the four major southern pines on hundreds of soil/site conditions was evaluated. Soils studies addressing soil nutrition, fertilization, site amelioration, and long-term soil productivity (LTSP) are still underway, and the first LTSP site, which is now an international research effort, continues to be monitored on the Palustris.
- Many other studies evaluating different stand management practices such as planting spacing, vegetation control, thinning levels and timing, and rotation length are still active and have produced growth and yield data bases for loblolly, longleaf, and slash pine over a 75-year period. Repeated measurements on over 100,000 trees are in these data sets.
- Prescribed fire has been a vital management tool on the Palustris because fire was recognized as a basic need early in the management of longleaf pine. Prescribed burning studies continue to look at frequency, season, techniques, and severity of fire, as well as long-term effects of fire on soil quality and on the physiological response of longleaf pine to burning. Root system architecture studies are evaluating root system quality among different types of planting stock and investigating the role of repeated prescribed fire as a tool to manipulate the depth of woody roots near the surface of the soil.
- In support of climate change initiatives, one of the first stand-level loblolly pine ecophysiology studies was established on the Palustris. Operational stand density and fertilization treatments created a wide range of experimental conditions. Simultaneous and intensive measurement of soil and canopy environment, fascicle and root physiology, and above- and belowground growth are providing information about how light and soil resources control stand production, and how these relationships might change with shifts in the stand environment.
- The Palustris continues to serve as a resource for southern pine beetle and forest product utilization initiatives because long-term studies can provide valuable settings for short-term intensive research.

Conclusion

The Palustris Experimental Forest has hosted a lengthy program of research dedicated primarily to forest management needs, but also has supported range management, genetics, and intensive forest practices research as well. Results of this research effort have been applied regionally and recognized nationally. It is rare that a program of research makes such a significant economic and societal impact on a region. Research conducted on the Palustris Experimental Forest has changed the "face of the South."

The Palustris Experimental Forest is administered by USDA Forest Service, Southern Research Station, Research Work Unit SRS-4158, Restoring and Managing Longleaf Pine, headquartered in Auburn, AL, with scientists also stationed at Clemson, SC and Pineville, LA.

References

Barnett, James P. 2004. Southern forest resource conditions and management practices from 1900—1950: Benefits of research. In: General Tech. Report SRS-75. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. Chapter 3. p. 15-22.

Wakeley, Philip C. 1954. Planting the southern pines. Agricultural Monograph 18. Washington, D.C.: U.S. Department of Agriculture, Forest Service. 233 p

Wakeley, Philip C. 1964. A biased history of the Southern Forest Experiment Station through fiscal year 1933. New Orleans, LA: Unpublished document.

Significance of Forest Structure to At-Risk Terrestrial Vertebrate Species in the Southeast

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Abstract

In 2005, Van Lear and others highlighted the ecological significance of longleaf pine forests to at-risk species that are dependent on this declining ecosystem. That important paper reviewed reasons for loss of longleaf forests, championed restoration efforts for this once-common ecosystem, and called for increased attention to habitat requirements of associated at-risk species. In the current presentation, we explore existing information on requirements of sixteen southeastern terrestrial vertebrates labeled by US Fish and Wildlife Service as special concern, candidate, threatened, or endangered species. We determine that almost 90% of at-risk species share a general habitat requirement for grassland and/or open-canopied

forest, at least during some portion of their life cycle. The open-canopied species includes 4 birds, 2 mammals, 2 amphibians, and 6 snakes.

We review existing information on the at-risk species and conclude that there is little direct reliance on specific plant species but rather a strong need for the habitat structure created when longleaf pine and associated ground layer plants interact with frequent fire. In addition, some of the at-risk vertebrates have requirements that seem to be satisfied by broad categories of plants (pines, legumes, grasses, etc.) rather than specific species. However, some plant species indirectly promote open-canopied structure because of their propensity to carry fire. We highlight habitat requirements of the gopher tortoise and discuss information on habitat structure that would improve management for this species.

Although conservation biologists and land managers have long understood the relationship between habitat structure and many of the at-risk species, ecosystem-level management is not commonly discussed. By taking this approach we focus attention on the most immediately useful types of land management actions that are likely to improve habitat. It will also aid in prioritization of conservation actions and to provide a basis for ranking sites with disparate current conditions, for example recently planted longleaf pine plantation compared to mature second-growth longleaf forests that have been subjected to fire-exclusion. We suggest that estimating time and effort required to create an open-canopy habitat will aid in prioritizing conservation efforts for at-risk vertebrates. It is apparent that maintaining vital structure of existing high-quality forest stands is critical for perpetuation of at-risk species. In addition, reclaiming fire-excluded degraded stands may often be worth the cost of restoration because forest structure will likely be re-established sooner than if the area was cleared and replanted. Planting longleaf must happen to recover this once-dominant ecosystem but many conservation benefits will be lost if existing stands of mature trees are not maintained.

Ivory-billed Woodpecker Update

Geoff Hill

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Abstract
In 2005, the Cornell Lab of Ornithology announced the discovery of Ivory-billed Woodpeckers in the Big Woods of eastern Arkansas. Following that announcement, Geoff Hill and two student took a kayaking trip down the Choctawhatcheee River in Florida and heard and sighted Ivory-billed Woodpeckers in the large forested wetland along this river. Over the past three years, Dr. Hill and his colleagues have amassed a large body of evidence to support their claims that ivorybills still persist in this remote region of Florida.

Long-term Research at the J.W. Jones Ecological Research Center: Pursuing Emergent but Unexpected Outcomes

Steven B. Jack, Robert M. Mitchell, J. Kevin Hiers, L. Katherine Kirkman and Lindsay R. Boring

Abstract
Long-term research focused on the longleaf pine forest at the Joseph W. Jones Ecological Research Center is guided by the Center's mission "…to understand, to demonstrate, and to promote excellence in natural resource management and conservation on the landscape of the southeastern coastal plain." Explicit in this mission is a goal to understand the basic ecology of the longleaf pine ecosystem, but implied goals are to also develop direct, reciprocal linkages between research and operational resource management and to make this information available to a wide audience. One important lesson realized from pursuing long-term research projects at the Center is to look for and be receptive to unexpected results and relationships. These unexpected outcomes have often provided the most interesting questions that guide additional research and can also have significant influence on practical management applications. Some specific examples of emergent outcomes and their impact will be presented in the context of long-term projects exploring ecological silviculture approaches, prescribed fire management, carbon cycling and sequestration, and restoration of biodiversity.

Introducing Longleaf into Elementary Classrooms

Rhett Johnson

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Abstract
Recognizing that the wealth of natural resource educational materials available to elementary and middle school teachers was heavily oriented to tropical and northwestern ecosystems, with no materials focused on native longleaf ecosystems, Longleaf Alliance staff took it on themselves to remedy that situation. Building on artwork created by Tallahassee artist Patrick Elliott for an early longleaf calendar, the Alliance commissioned a landscape poster depicting some of the diversity contained in longleaf forests and a series of smaller drawings detailing both the cultural and natural history of that ecosystem. These items can be downloaded in both color and black and white versions from the Longleaf Alliance website and can be used in a variety of ways in the classroom. Each comes with narratives for both students and teachers and includes a glossary of appropriate terms. Suggested activities and lesson plans are available and the site is interactive to allow input from users. Although the material is targeted for grades 3-7, older students also find them entertaining and educational. Alliance staff have conducted workshops in several Southern states for educators in the use of these materials.

Managing for Longleaf Pine in Support of Military Training: Fort Benning Case Study

Robert Larimore

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Abstract
Fort Benning was established in 1918 with significant acreage added in 1941 to reach the current size of 182,000 acres. When acquired the property as a whole was fairly open due to past farming and upland forests were dominated by shortleaf and loblolly pines, but with some longleaf pine present in the mix. Early attempts to manage the forest resources met with limited success until the first full-time forester was hired in 1950. Early management focused primarily on the production of wood fiber and on fire suppression to protect resources and assets. This period also saw increasing disease and insect problems along with rising interest in management for the endangered red-cockaded woodpecker (RCW). In the late 1980s resource management focus shifted from fiber production to a broader interest in restoration and stewardship of the native longleaf pine ecosystem to benefit a comprehensive suite of ecosystem components while meeting the military mission. The Stoddard-Neel (S-N) approach to forest and wildlife management was adopted to pursue the new objectives, and Fort Benning personnel were mentored in the S-N approach through a collaborative effort.

Implementation of the S-N approach at Fort Benning resulted more in a change of guiding philosophy than drastic changes in on-the-ground operations. Specific changes in applied management include: increased use and higher priority of prescribed fire with greater attention to smoke management; operations guided by site-specific resource assessments and gradual manipulations to achieve long-term results; clearcutting only as a last resort and more emphasis on what is left behind rather than what is removed; and the use of an ecologically friendly cut-to-length harvesting system which causes little residual damage to harvested stands. Several challenges were encountered as management activities were modified. These include the need to reduce fuel loads, complaints about smoke and air quality issues from more frequent burning, ability to factor in long timeframes when others are looking for rapid changes, and educating hunters on the new philosophy and effects on wildlife habitat. Some successes to date include more longleaf pine and RCW on the installation, fewer wildfires, reduced insect and disease problems, higher biological diversity, and most importantly a more desirable training area.

Though early in the process and with new training requirements on the horizon we are confident this new approach to resource management will result in a unique, healthy, sustainable and productive forest (products as well as other values), while also producing and sustaining quality training areas.

Naturally-regenerated Longleaf Pine: A New Site Index Model and Soon-to-Be Growth and Yield Model

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[1]Silvics Analytic, Wingate, NC and [2]School of Forestry and Wildlife Sciences, Auburn University, Auburn, AL

Abstract

The Auburn University longleaf stand dynamics laboratory initiated a project in 2008 that uses 40 years of permanent plot data (Regional Longleaf Pine Growth Study) to model longleaf pine growth. This initiative was focused on the impact of climate on tree growth. There are existing growth and yield models and these models have been used with climate data to develop an understanding of the relationship between climate and growth with marginal success. A literature review indicated that the first step in a better understanding of climate was that of updating and improving existing growth models to better isolate perturbations due to climate. A new site index equation based on site index theory and statistical techniques that have been available only within the past decade has been completed. This dynamic site equation was derived using the generalized algebraic difference approach (GADA). The base model predicts height growth of trees once they reach 4.5 ft. The model was fit to individual tree trajectories to overcome the problems of ring count age distribution and thinning. The base model was algebraically rearranged so the user can modify the definition of base age and account for the number of years it takes trees to reach 4.5 ft. This model improved prediction of site index in young stands and can be used for stands up to 120 years old.

Long-Term Research at Tall Timbers Research Station

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Abstract

From Tall Timbers beginnings in 1958 long-term research has been an institutional focus and hallmark. Henry Beadel, benefactor and founder of Tall Timbers understood the importance of long-term studies for understanding ecological processes. It was to this end he and others established Tall Timbers. The first such study, The Tall Timbers Fire Ecology Plots, was begun in 1959 by Herbert Stoddard, Sr. Five of the original 13 treatments have been continued to present. These study plots known today as the Stoddard Fire Plots have given us great insight about plant community change, small mammal community change, pine regeneration adaptations, and ecological thresholds related to fire frequency. Mr. Stoddard noted that we already intuitively understood the progression of the plant community change that would occur, but that was not the entire point of the study. He suggested that perhaps the greatest benefit would be derived in studies of what happened below the ground – in the soil. As we have found fire frequency has an important influence on nutrient cycles and pathways. As important is its influence on carbon storage. Study on soil genesis in NB66, another long-term study, provides a companion effort. Long-term wildlife studies at Tall Timbers include the population demographics research on Northern bobwhite (*Colinus virginianus*), the longest running mark-recapture study on the species, studies on the Red-cockaded woodpecker (*Picoides borealis*), Bachman's sparrow (*Aimophila aestivalis*), brown-headed nuthatch (*Sitta pusilla*), and gopher tortoise (*Gopherus polyphemus*) among others. Dr. Bill Platt initiated several important long-term plant ecology studies that are still carried on including; the Wade Tract Longleaf Demographics Study, Woodyard Hammock Study and the St. Marks Fire Season study which was recently completed by Drs. Jeff Glitzenstein and Donna Streng.

Education Programs at the Joseph W. Jones Ecological Research Center

Kevin McIntyre

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Abstract

The Joseph W. Jones Ecological Research Center, founded in 1991, has programs in research, conservation, and education. Its mission is to understand, to demonstrate, and to promote excellence in natural resource management and conservation on the landscape of the southeastern coastal plain of the United States. The Center focuses its efforts in two areas; longleaf pine ecology, management and restoration, and water resources. The presentation today is intended to give an overview of the Jones Center education and outreach programs related to longleaf pine.

The Center's educational efforts began with its first cohort of graduate students in the mid 1990s. Today, this program represents one of the most significant contributions of the Center, with over 70 individuals receiving advanced degrees through this program and moving on to professional positions with natural resource management and conservation organizations throughout the Southeast. The educational mission of the Center expanded in 1998 with the hiring of dedicated staff and the establishment of a formal education and outreach program. The Center's longleaf pine programs are focused on practicing natural resource professionals and university students preparing for careers in natural resources. Highlighted examples of Center programs include university Maymester courses, ecological forestry workshops for professionals, and prescribed fire outreach.

The National Coalition of Prescribed Fire Councils: An Initiative to Nationally Address Key Management, Policy, and Regulatory Issues

Mark A. Melvin[1], Johnny Stowe[2] and Dale Wade[3]

[1]Joseph W. Jones Ecological Research Center, Newton, Georgia; [2]South Carolina Department of Natural Resources, Columbia, South Carolina and [3]The Rx Fire Doctor, Hayesville, NC

Abstract

Prescribed fire managers face new and increasingly complex challenges in the 21st century that limit or threaten the use of prescribed fire. Although prescribed fire is used to accomplish diverse resource benefits across the United States, most burners share a number of common concerns, including public safety/health, ecological stewardship, liability, public education, and air quality regulation. To assist in addressing these challenges, a diverse group of public and private leaders collaborated at the Longleaf Alliance's 2006 bi-annual conference to form a National Coalition of Prescribed Fire Councils (National Coalition). The mission of the National Coalition is to provide a forum for exchange of knowledge and ideas, and to serve as an umbrella organization to provide a more powerful voice through partnering with state and local prescribed fire councils. Since its formation, the National Coalition has reached out to embrace existing councils (extant in only five states in 2006), and provide guidance in the formation of new ones. Membership now includes active or developing councils in thirty states, British Columbia and Mexico, which represent 12 million acres of annual prescribed fire use. The acting Scoping Committee is pleased to announce the formation of the National Coalition's inaugural Governing Board. These members are recognized as leaders in the conservation and prescribed fire community that can build on the successes of the National Coalition and further develop the organization. Board members bring broad representation from across the country and will meet November 3-5, 2008 to take over the reins from the Scoping Committee. Their efforts will focus on organizational development and structure, funding sources, and staffing requirements to elevate the organization to its next level of national prominence. The National Coalition looks forward to expanding its efforts to ensure that the ecological values and other public benefits of prescribed fire are secure for the future.

New Conservation Opportunities for Longleaf Landowners - An Overview of Available Cost-share Programs, Conservation Agreements, and a Look at New Markets

Moderator: Julie H. Moore[1]

[1]U.S. Fish and Wildlife Service, Endangered Species Program, Washington DC, Julie_H_Moore@fws.gov

Several new opportunities that have the potential to benefit longleaf pine landowners are now in place through Federal and state agency programs. Panelists that work with these programs in the Gulf Coastal region will present useful practical information of how these programs work, who is eligible, and the associated economic incentives. The 2008 Farm Bill programs identify longleaf pine forests as a priority for assistance. Among the many Farm Bill programs, the Healthy Forests Reserve Program can provide landowners with habitat for listed and at-risk species with technical assistance, cost share funding to manage habitat and the purchase of permanent conservation easements. A new programmatic Fish and Wildlife Service Safe Harbor Agreement for the gopher tortoise and red-cockaded woodpecker will provide regulatory assurances and incidental take permits to cooperating landowners in Mississippi, Louisiana and Alabama. Conservation banking is a new tool in the southeast for private landowners to benefit financially from their conservation commitments for at-risk and listed species.

Incentive Programs for Longleaf Landowners in Florida and the Southeast - Erin Myers, Biologist, Natural Resource Conservation Service in Florida

NRCS's Healthy Forests Reserve Program - Shauna Ginger, US Fish and Wildlife Service, Jackson, MS, and Erin Myers, Biologist, Natural Resource Conservation Service in Florida

Opportunities in Alabama, Mississippi and Louisiana under the new regional Safe Harbor and Candidate Conservation Agreement for the gopher tortoise, black pine snake, and red-cockaded woodpecker - Shauna Ginger, US Fish and Wildlife Service, Jackson, MS

Use of Conservation Banking as a Tool in Longleaf Pine Habitat Preservation/Restoration, from a Banker's Perspective - John McGuire, Biologist, Westervelt Corporation

Opportunities for Gopher Tortoise Relocations to Private Lands - Deborah Burr, Gopher Tortoise Plan Coordinator, Florida Fish and Wildlife Conservation Commission and Todd Gartner, Center for Conservation Solutions, American Forest Foundation

The Healthy Forests Reserve Program: An Assurance and Incentive-Based Tool for Conserving Listed Species on Private Land: The Mississippi Pilot Program

Shauna M. Ginger

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Summary

Conservation programs have provided numerous opportunities for conserving habitat on a large scale. Indeed, with 75 percent of land in the Southeast privately owned, landowner incentive programs are vital to wildlife conservation, especially for federally listed species. Critical to recovery of the federally listed gopher tortoise (Gopherus polyphemus) is habitat restoration. We present a new and unique landowner incentive-based approach, the Healthy Forests Reserve Program (HFRP), administered by USDA Natural Resource Conservation Service (NRCS) in consultation with the U.S. Fish and Wildlife Service (Service). The voluntary program offers Safe Harbor like Landowner Protections and financial and technical assistance to restore and protect healthy forests and their listed or at-risk species through easements or restoration agreements.

In 2006, a pilot program began in Mississippi targeting longleaf pine habitat restoration for gopher tortoise, Mississippi gopher frog (Rana sevosa) and black pine snake (Pituophis melanoleucus ssp. lodingi). As of 2008, over 60 landowners have applied for HFRP in Mississippi (representing >16,000 acres). Two contracts have been signed and two more easements are near completion, resulting in over 2,500 acres that will be enrolled in the program in Mississippi as of 2008.

HFRP Program Benefits

- Conservation
    - Contributes to species recovery
    - Provides biodiversity

- o Improves environmental quality
- o Contributes to national economy

- Incentives= easement and cost-share
  - o 10-year cost-share agreement = 50% average cost of the approved conservation practices
  - o 30-year cost-share agreement (tribes) = 75% cost-share
  - o 30-year easement = 75% easement value plus 75% cost-share
  - o Permanent easement = 100% easement value plus 100% cost-share

- Landowner Protections - Avoid future ESA regulatory restrictions
  - o Landowners who enroll their private forestland in HFRP are eligible for Landowner Protections (LPs) from the ESA through a safe harbor-like agreement. LPs allow for incidental take of T&E species back to a baseline that will be determined upon acceptance into the HFRP. LPs are provided when a net conservation benefit to the species is likely and the landowner manages the property in compliance with the agreed-upon management plan.
  - o Baselines = Agreed upon population and/or habitat that exists at the time agreement entered in to. The purpose is to ensure that a species' status on enrolled land is no worse after HFRP participation than before enrollment (Net Conservation Benefit). Baselines can be species or habitat base and can be zero.

HFRP Enrollment Process in Mississippi
- Landowner submits application to local NRCS office
- NRCS ranks applications
- Owners of selected tracts sign Letter of Intent to Continue
- Appraisal completed (on easement applications)
- Landowner accepts or declines offer
- Landowner, NRCS and USFWS determine baseline conditions
- Habitat Restoration Plan (HRP) developed
- HRP and agreement/easement is signed by NRCS and the Landowner, accepted by USFWS, and then implemented and updated as necessary (at least every 10 years)
- NRCS monitors implementation of the effects of HFRP and use of Landowner Protections through an annual report to USFWS

Important Points
- NRCS and the Service will determine baseline conditions and prepare the management plan with the landowner's assistance
- The plan delivers the LPs and lays out the conservation measures needed to achieve a net conservation benefit
- NRCS annually monitors effects and use of LPs, plans are updated as often as needed (at least every 10 years)

For More Information
- Phone: Contact your local USDA Service Center or conservation district, listed in the telephone book under U.S. Department of Agriculture
- Web: http://www.nrcs.usda.gov/programs/HFRP/ProgInfo/Index.html
- In Mississippi: http://www.ms.nrcs.usda.gov/programs/HFRPFY09.HTML

Programmatic SHA/CCAA for Gopher Tortoise, Black Pine Snake and Red-cockaded Woodpecker in Louisiana, Mississippi, and Alabama

Shauna M. Ginger

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Summary

The gopher tortoise, black pine snake, and red-cockaded woodpecker (herein referred to as the "covered species") are closely associated with the longleaf pine ecosystem. There are a variety of actions that landowners can take to provide suitable habitat for these species, including thinning of dense pine stands, use of prescribed fire, restoration of longleaf pine, natural regeneration of pines, hardwood control, cogongrass control, re-introductions, and other activities. However, not only do landowners have little legal or economic incentive to undertake such actions, they have, in some respects, a disincentive to do so. The use (or increased use) of a landowner's land by listed species brings with it an Endangered Species Act (ESA) responsibility to avoid harming the species and its habitat. Some landowners may in fact be endeavoring to reduce the likelihood that their land will be used by listed species in the future by, for example, not using prescribed fire. Similarly, landowners with occupied or potential habitat for the candidate species may fear increased regulation of

their property should the species become federally listed as threatened or endangered. As such, landowners may manage their lands so as to reduce the likelihood that these species will occupy those lands.

Landowners within the range of the covered species may be willing to take actions that would benefit these species on their property if the possibility of future land use restrictions were reduced or eliminated, just as landowners in other parts of the country have done for other species under safe harbor agreements (SHA) and candidate conservation agreements with assurances (CCAA), voluntary conservation programs offered by the U.S. Fish and Wildlife Service (Service). Under this new, combined SHA/CCAA program, landowners in Alabama, Mississippi, and Louisiana may voluntarily enter into a PEMA (Pine Ecosystem Management Agreement) whereby they agree to undertake proactive management measures to enhance habitat for the gopher tortoise and black pine snake, and, if the landowner desires and the Service determines that the species would benefit, the RCW in Mississippi. In return, the landowner is relieved from any additional liability under the ESA beyond that which exists at the time the PEMA is signed.

Safe Harbor Agreements (SHA) and Candidate Conservation Agreement with Assurances (CCAA) - Programs offered by the U.S. Fish and Wildlife Service (Service) that create incentives for non-Federal landowners to voluntarily conserve listed and/or candidate species by providing regulatory certainty that future activities will not be constrained and result in ESA restrictions.

SHA

- For Listed species
- Landowner voluntarily agrees to implement management actions that will contribute to recovery of a listed species for a specified period of time. In return, they receive regulatory assurances that they can modify the enrolled property and return it to the originally agreed upon baseline conditions at the end of the agreement (even if this means incidentally taking the covered species). Incidental take authorization is also given for beneficial management during the agreement.
- The species benefits by gaining progress towards recovery

CCAA

- For candidate/at-risk species
- Landowner voluntarily agrees to implement specific conservation measures for candidate or at-risk species. In return, they receive regulatory assurances that if the species is later listed, they will not be required to do anything beyond what is specified in the agreement.
- The species benefits by having threats lessened, which may preclude the need to list the species.

History of the SHA/CCAA for the Covered Species

- Tortoise and black pine snake recovery depends on private lands in longleaf ecosystem. RCW has similar habitat requirements and is not covered by a state-wide SHA in Mississippi.
- Innovative conservation efforts require innovative partnerships and ideas and many programs exist to assist landowners in restoring native pine. Landowners interested in maintaining habitat conditions, but may have fear of endangered species issues.
- Thus, a programmatic or umbrella agreement with these three species would streamline the process for interested landowners and contribute to the conservation/recovery of the covered species.

Components of the SHA/CCAA

- Agreement = Between the partners (Agencies, NGOs, States, Etc.) who agree to implement the program
- PEMA (Pine Ecosystem Management Agreement) = Between the Service and Landowner. Spells out baseline conditions. Agreement to “do good things” in return for “assurances”.
- Permit - 10(a)(1)(A) = Between the Service and landowner. Allows for incidental take due to beneficial management activities and above baseline conditions (up to 5 years post-PEMA; renewable)
- Reporting = Between the landowner and Service and also between the Service and partners. Allows for monitoring of the program and adaptive management.

Process

- Finalize SHA/CCAA Agreement in 2009 = Add additional partners and/or MOUs with interested state agencies (first multi-state combined SHA/CCAA; new doors and issues); Complete internal paperwork (NEPA, Consultation, Solicitor review, Public Comment)
- Outreach/Assistance to landowners about the new program
- Landowner sign-up (Certificate of Intent to Continue)
- Develop PEMAs (any of the partners or their designated agents and the landowner) and apply for Permit (includes determining baseline and conservation measures needed)
- Service signs/accepts PEMA and Permit
- Landowner reports conservation measures, take, etc. annually
- Service reports to partners/public annually on the program

For More Information

Tools for Landowners on USFWS Website:
http://www.fws.gov/endangered/landowner/index.html

Opportunities for Gopher Tortoise Relocations to Private Lands

Deborah Burr

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The gopher tortoise was listed as a state threatened species in Florida November 2007 following the Commission's approval of the gopher tortoise management plan. Florida represents the largest portion of the total global range of the species. Gopher tortoises remain widely distributed in Florida, occurring in parts of all 67 counties.

The primary threat to gopher tortoises in Florida is habitat destruction, fragmentation, and degradation, particularly from urbanization and development, agriculture, and phosphate/heavy metals mining. Formerly large tortoise populations in the northern peninsula have been depleted by agriculture, human predation, and increasing development. Degradation of tortoise habitat on silvicultural lands occurs when the canopy of pine plantations becomes closed and little or no understory forage is available to tortoises. Site preparation associated with pine silviculture reduces native ground cover and lack of prescribed fire and natural fires also results in canopy closure and reduced tortoise forage plants. Local isolated populations of gopher tortoises may persist for decades in overgrown habitat, but recruitment of young into these populations declines as the canopy increases and habitat quality decreases.

The Gopher Tortoise Management Plan was developed with active participation and review by numerous interested stakeholders, including representatives of agriculture, forestry, mining and development, as well as conservation, research, animal advocacy, land owners and local governments. The overarching conservation goal of the Gopher Tortoise Management Plan is "to restore and maintain secure, viable populations of gopher tortoises throughout the species' current range in Florida by addressing habitat loss." The plan proposes four measurable objectives to achieve the goal:

- Optimize gopher tortoise carrying capacity by appropriate habitat management on protected lands.
- Increase protected gopher habitat by both State acquisition and voluntary private conservation easement.
- Restock tortoises to protected and managed habitat where they are depleted.
- Decrease tortoise mortality on lands proposed for development.

The plan outlines detailed provisions for permits required to relocate tortoises, coordination with local government, habitat preservation and management, monitoring, education and outreach, and research. As stewards of some of America's most treasured natural resources, private landowners also play a key role in conserving wildlife.

Several elements of the plan are of direct interest and application to forestry landowners. First, the plan integrates FWC's previous policy in regard to agriculture and forestry, specifying "Gopher tortoise or gopher tortoise burrow permits are not required to conduct agricultural activities, silvicultural activities, or activities intended to improve native wildlife habitat."

Second, landowners may elect to have their land certified as a gopher tortoise recipient site. Recipient sites are where tortoises displaced by development will be relocated under the new permitting guidelines. The objective of the (long-term protected) recipient site program is to provide the highest level of long-term security for the gopher tortoise and its habitat on certified recipient sites. These recipient sites will be evaluated based on tortoise habitat attributes, such as those containing well-drained soils, open or sparse tree canopy, or a healthy groundcover of herbaceous plants. Habitat criteria necessary for higher stocking densities are outlined in the recently approved gopher tortoise permitting guidelines.

The new permit system will require smaller mitigation contributions from permittees (donors) who relocate tortoises to protected lands. This economic incentive should help guide developers towards mitigation that provides long-term conservation benefits. The plan also incorporates a market-driven process where the relocation of tortoises will be a potential revenue source for land owners and an incentive to effective protection and management of upland green space.

The FWC administers or assists other agencies with the application of several landowner incentive programs to achieve wildlife conservation goals. Together, these programs make several million dollars available each year to landowners as cost share for specified expenditures associated with the landowner's voluntary participation in wildlife conservation and management on private lands. The FWC coordinates internally with its landowner assistance program to enhance the application of these programs on appropriate privately owned uplands for gopher tortoise conservation. This program will include technical advice and outreach to landowners on opportunities for establishment of reserves, revenue generation as gopher tortoise recipient sites, and technical and financial assistance with habitat management (e.g., prescribed burning, vegetation management). The FWC is currently creating improved outreach and evaluation of landowner needs and preferences to increase the effectiveness of this program. Gopher tortoise conservation goals and objectives will be integrated into this program.

If you are interested in applying to have your land certified as a gopher tortoise recipient site, or are interested in learning more about the gopher tortoise management plan, please contact Deborah Burr, Gopher Tortoise Plan Coordinator, Florida Fish and Wildlife Conservation Commission by phone at 850-410-0656 extension 17332 or by email Deborah.Burr@MyFWC.com. You may also download the new permitting guidelines that include the full description on gopher tortoise recipient sites at: MyFWC.com. Applications for recipient site permits are currently being accepted.

Developing and Implementing a Market-Based Habitat Credit Bank for the Gopher Tortoise (Gopherus polyphemus) on Family Forestlands

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Brief Project Description

Fire-maintained longleaf pine stands once covered 90 million acres in the Southeast but today have declined to roughly 3 million acres as a result of development, habitat conversion, and fire suppression. Lack of fire on the landscape has resulted in limited habitat for a variety of species dependent upon a more open canopy and diverse herbaceous ground cover. Consequently, many of the species have experienced population declines. With over 80% of land in private ownership in the Southeast, the greatest potential for restoration and management of pine habitat for declining species lies in the hands of family forest owners

The American Forest Foundation obtained a USDA NRCS Conservation Innovation Grant to develop and implement a habitat credit bank for the gopher tortoise on family forestlands. Project funds will be used to develop an innovative and flexible market-based framework that will help preclude the need to federally list the eastern population of the gopher tortoise. Under the program, interested family forest owners, within particular service areas, become eligible for habitat management assistance and conservation credit payments through a reverse auction process that considers the potential habitat contribution of the property in combination with the landowner's bid requirements. The landowners selected to participate during the pilot-phase will be issued credits for verifiable gopher tortoise habitat. These credits can then be voluntarily purchased by federal agencies (e.g., Department of Defense), state or county government, or private industry to offset unplanned impacts on gopher tortoise populations. These banked credits may also serve as "insurance" should the gopher tortoise become federally listed in the future. The bank will be designed to maximize a net gain for the species and the entire process will be monitored, evaluated and adapted. This is the first attempt at developing a market-based approach for a non-listed species.

The initial stages of the project will focus on bank development including the determination of criteria needed to value and rank habitat sites and assign credits, the identification of priority lands and extensive landowner outreach. The model would have applicability throughout the gopher tortoise range in the Southeast and potential transferability to other species experiencing declines in other forested ecosystems. A variety of agencies and organizations are interested in promoting increased gopher tortoise management on private lands. For example, in the case of the Department of Defense (DoD), the need for military readiness and training flexibility on installations in the Southeast are some of the forces driving the need for innovative solutions. DoD is expecting increased installation activity in the coming years and is interested in collaborating with fellow stakeholders to encourage active management on private lands to offset unplanned impacts to gopher tortoise populations.

A habitat credit bank will demonstrate measurable progress in gopher tortoise conservation while simultaneously creating new income streams for private landowners ensuring their lands remain as managed forests, providing valuable ecosystem services and timber products.

Fire, Big Animals, and Bad Weather: Origins and Maintenance of Southern Grasslands

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Abstract
The most highly imperiled ecosystems in the world, in terms of area converted to human land uses and low representation in protected areas, are temperate grasslands, savannas, and related communities. The grasslands of the southeastern United States ("the South") are the biologically richest grasslands in North America and are among the most diverse in the world. These grasslands are the cradle of evolution and the center of diversity for grassland taxa across eastern and central North America. They were probably the primary refugia within which grassland species persisted during glacial periods of the Pleistocene and from which they recolonized grasslands to the north. Why am I talking about grasslands to the Forest Guild? Many ecosystems, such as longleaf pine, which people often call forests, are more informatively recognized as grasslands. I focus on the factors that created and maintained southern grasslands over broad spans of time in order to provide the context for conservation, restoration, and management of these ecosystems into the future. These factors include (1) climate and weather; (2) substrate (edaphic factors) and landform; (3) fire (lightning or human-caused); (4) other disturbances (e.g., hurricanes, tornados, flooding) and combinations of these; (5) competitiveness of grasses over woody vegetation under particular conditions; (6) grazing and browsing by large herbivores; and (7) various interactions and synergisms among these factors. I suggest that protecting and managing ecosystems, such as the southern grasslands, will likely protect the majority of species associated with these systems (i.e., the "coarse filter" hypothesis) and is more cost-effective than a species-by-species approach. Focusing on ecosystems also allows direct consideration of abiotic factors and ecological processes in restoration and management. Nevertheless, certain individual species, as well as species composition at the community level, are often the best indicators of ecosystem quality and integrity. Hence, species-based and ecosystem-based conservation are complementary.

Fire Management of Coastal Pine Savannas in the Context of Rapid Global Climate Change

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Abstract
Restoration goals have often been focused on reassembly of historical ecological systems. Such goals may not be achievable where global climate change is producing rapid changes, such as along the Gulf of Mexico coastline. Restoration goals for what historically were coastal pine savannas might require a shift toward assembly of de novo functional savannas that withstand rapid ongoing environmental changes resulting from sea-level rise, intense hurricanes, and climate-induced changes in local environments. By incorporating historic fire regimes into the ecological processes operating during restoration, those functional ecological systems that result may vaguely resemble historical pine savannas in species composition and biodiversity, but they are likely to contain invasive species or those introduced from elsewhere via assisted migration. New types of savannas above elevations affected by sea level rise and hurricane storm surges potentially could be constrained to include longleaf pine if fire regimes are manipulated in ways that favor longleaf pine.

Using the Novel “Longleaf” to Teach Kids about Longleaf

Roger Reid and Mark Hainds

Abstract
Mark Hainds and Roger Reid have traveled to dozens of schools and spoken to thousands of school children about Longleaf and longleaf. During their travels they have been amazed and inspired by the kids’ fascination with the enchanted longleaf forest and its ecosystem. Teachers are enthusiastically embracing their mix of science and literature as a way of cross-curriculum teaching. Mark and Roger will share tales of their school adventures and show how they share the stage to bring the gospel of longleaf to a new generation.

Effects of Fire Regime on Fire Behavior in Southeastern U.S. Pine Forests

Kevin Robertson

Tall Timbers Research Station

Abstract
Long-term study plots have been managed by Tall Timbers Research Station to demonstrate the effects of different fire return intervals on upland pine forest habitat. These studies provide the opportunity to measure fire behavior among various fuel conditions, land use histories, and ignition techniques. The Tall Timbers Fire Ecology (Stoddard) Plots, representing old-field upland pine forest, are 0.2 ha (0.5 acre) in size and have been burned at 1, 2, and 3 year intervals in early spring with three replicates since 1960. The Pebble Hill Fire Plots, representing longleaf pine-wiregrass native upland pine forest, are approximately the same size and have been burned at 1, 2, and 3 year intervals in summer since their establishment in 2005. Fire behavior measurements, including flaming residence time, flame length, and rate of spread, have been made in each of these sets of plots from 2005 to 2008. In the Stoddard Plot old-field pinelands, fire return interval primarily influenced flame residence time, which increased with time since fire corresponding to fuel accumulation. However, flame length (an index of fireline intensity) was greatest in the 2 yr interval and decreased 3 yr post burn, reflecting a shift to broad-leave litter fuel beds, higher fuel moisture, and a more compact fuel matrix associated with greater hardwood cover and reduction of herbaceous fuel loads. In native pinelands of the Pebble Hill Fire Plots, flame residence time changed relatively little while flame length increased with time since previous fire, reflecting increasing depth of herbaceous fuels and suspended pine needles which provide a rapidly drying and readily combustible fuel matrix. As expected, heading fires had higher rates of spread and greater flame lengths than backing fires overall. However, residence time varied little between the two ignition techniques, in contrast to conventional expectations that backing fires would have longer residence times. These long-term research plots will continue to provide new insights into fire behavior with time and additional fire behavior measurements.

Effects of Fire Frequency on Ecosystem Carbon Storage in a Southeastern U.S. Coastal Plain Pineland

Kevin M. Robertson

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Abstract
Concerns about global warming and greenhouse gas emissions have placed high priority on measuring influences of land management practices on ecosystem carbon storage. Natural pine forests in the southeastern U.S. Coastal Plain represent a fire-maintained ecosystem, in which the herb-dominated native plant biodiversity depends on a median fire return interval of 2-3 years to prevent hardwood dominance. However, questions remain about the influence of frequent prescribed burning on CO_2 release and long-term forest productivity. We investigated the influence of fire frequency on carbon storage in an old-field upland pine (*Pinus taeda, P. echinata*) forest in northern Florida using experimental plots in a long-term fire frequency study (Tall Timbers Fire Ecology Plots). Replicated plots 0.2 ha in area were treated with 1, 2,

and 3-year fire return intervals since 1960, and additional plots were fire-excluded for 42-48 years. In each plot, we measured soil % total carbon (0-20 cm depth). Carbon stored in plants and detritus was estimated using diameter measurements and allometric equations for woody plants and destructive sampling otherwise. Total ecosystem carbon increased with length of fire return interval, with averages of 84, 120, 125, and 180 tonnes C/ha in plots with 1, 2, 3, and 42+ year fire-free intervals, respectively. Differences were mostly attributable to abundance of hardwood trees and saplings, which contributed 3.2-60.0 tonnes C/ha in 1-42+ year fire-free interval plots, respectively. Soil carbon storage was highest in the 3 year burn interval treatment (13.1 tonnes C/ha) compared to the remaining three treatments (10.1-10.8 tonnes C/ha). Herbaceous vegetation was all but eliminated in the 3 and 42+ year fire interval plots, attributable to increased competition with hardwood vegetation. Results suggest that frequent prescribed fire in this forest type does not deplete soil carbon, which is a key indicator of soil fertility and long-term forest productivity. Ecosystem total carbon storage may be increased through fire-exclusion, but at the cost of most plant biodiversity and wildlife habitat values. Frequent fire also greatly reduces the severity of subsequent fires, which otherwise might kill trees, release stored carbon, and reduce soil fertility and long-term forest productivity. We conclude that frequent (2-3 year average interval) prescribed burning in Coastal Plain upland pine promotes its function as a stable, ecologically-sustainable carbon sink.

The Center for Longleaf Pine Ecosystems

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Abstract

The new Center for Longleaf Pine Ecosystems (AU-CLPE) in the School of Forestry and Wildlife Sciences at Auburn University will formally house the accomplishments and expertise of the Longleaf Alliance (LLA) and will continue the outreach efforts of the LLA with additional emphasis on research. The Center will be a primary partner of the new non-profit 501(c)(3) organization, The Longleaf Alliance, Inc. The AU-CLPE will: (1) address important knowledge gaps in longleaf pine ecosystem management, (2) apply research knowledge for on the ground longleaf pine restoration and management activities, (3) provide the umbrella for SFWS faculty to pursue research and outreach efforts in longleaf pine, and (4) deliver a variety of ecological, social and economic services for the people in the Southeast. The Center will transfer information to a wide range of stakeholders and practitioners, and provide rapid and efficient dissemination of new knowledge as it becomes available.

The E.O. Wilson Biophilia Center's Educational Opportunities

Christy Scally

Director, The E.O. Wilson Biophilia Center

Abstract

- The E.O. Wilson Biophlia Center at Nokuse Plantation is an environmental education facility currently under construction, which will be open to the students of the Florida Panhandle. It is a 48,000-acre conservation restoration project purchased privately by MC Davis and Sam Shine. Nokuse Plantation consists of a Longleaf Pine Ecosystem. It is referred to as one of the most biologically diverse areas in the continental United States.
- As Nokuse Plantation is such a biodiverse area, it provides multiple opportunities for research, which makes it an ideal location for an environmental education facility.
- The area surrounding the Biophilia Center was converted to a slash pine plantation 24 years ago after being used for agriculture. One of the lessons the students will participate in is comparing the groundcover vegetation and longleaf pine regrowth in four experimental forest plots. Four different forest restoration and management treatments will be applied to these plots: one plot is left unthinned and will not be burned. This plot will demonstrate a typical mature slash pine plantation. The other thee plots have been thinned to 50 trees/acre,

will be replanted with containerized longleaf pine seedlings this winter, and three different burn treatments will be applied: one will be left unburned, one will be burned every 2 years in the summer, and one will be burned every 2 years in the winter. The unburned plot will probably revert to a hardwood forest, while the comparison of summer and winter burned plots will demonstrate the importance of seasonal burning on the native groundcover vegetation.

- When naming this educational facility, MC Davis asked world renowned scientist Dr. Edward O. Wilson if he would mind if we named the center in his honor. Dr. Wilson graciously consented as he has made education of the general public a key part of his life's work, and has spent his formative years and performed his earliest scientific investigations in NW Florida and SW Alabama. In doing so, Dr. Wilson developed "biophilia -- the connections that human beings subconsciously seek with the rest of life."
- The mission of the E.O. Wilson Biophilia Center is to assist the youth in developing their own Biophilia. As such, we have formed an agreement with the Walton County School System and are working on an agreement with Okaloosa County School system. All students will be welcome at our facility, but students in fourth, seventh and tenth grades will have an opportunity to visit our center for 5 days. As such, we are creating curriculum in line with the Florida Sunshine State Standards and FCAT for students. The facility will not be open to the general public except for special events, rather it is designed for students to learn about the environment.
- One of the many advantages our facility has includes our relationship with the Panhandle Area Educational Consortium (PAEC) located in Chipley, FL. PAEC represents the school systems of 17 counties in the Panhandle of Florida, in addition they have their own TV station called Florida Education Channel or FEC-TV which reaches over 32 million homes via satellite. PAEC and FEC-TV intend to take our programs at the EO Wilson Biophilia Center to a global level by teacher training, televising featured speakers at our facility, providing connectivity between students and scientists, webcasting animals in the LLP ecosystem, etc. Our educational opportunities are endless.

Artificial Regeneration of Longleaf Pine Stands in Central Louisiana

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Abstract

Container-grown seedlings have been used in most of the artificial regeneration efforts to restore longleaf pine (Pinus palustris P. Mill.) ecosystems in the southern U.S for the last two decades. In this study, 27-week-old longleaf pine seedlings, grown in containers of three cavity sizes (small (S), medium (M), and large (L)) and two types of chemical coating in the cavity (copper oxychloride (Cu) and none (No-Cu)), were outplanted in central Louisiana in November, 2004. The study was a randomized complete block with four replications. Each of the 24 plots had 144 seedlings. More than 88% of seedlings in all treatments survived after 4 years in field. One year after out-planting, six seedlings from each plot were excavated for dry weight allocation and lateral root distribution. The Cu seedlings had 33% more dry weight in lateral roots that extended into the upper 5 cm of soil than those from the No-Cu seedlings. Although within a cavity size, Cu coating did not affect the size of one-year-old seedlings, at the end of year 3, the Cu seedlings were greater in height and ground-line diameter than the No-Cu seedlings. Seedling height and diameter increased with cavity size in year 3. At least 90% of the Cu-L, No-L, and Cu-M seedlings had heights exceeding 12 cm and were considered as emerging out of the grass stage in year 3. More than 20% of the No-M, Cu-S, and No-S seedlings remained in the grass stage in year 3 and most of them emerged from the grass stage in year 4. Container treatments, however, did not affect photosynthetic rate or needle chlorophyll contents. Tall seedlings had more needles contributing to total photosynthate production for growth and reserve than the short seedlings. A second seedling excavation was conducted in November, 2007. The No-Cu seedlings had greater cumulative lengths in the portions of lateral roots that spiraled around the taproots or grew vertically compressed to the taproots than the Cu seedlings. With more lateral roots extending horizontally outward and fewer criss-crossing lateral roots, the Cu seedlings might help reduce sapling toppling in strong winds which has been reported more and more in the southern U.S. where container-grown seedlings are used to establish longleaf pine stands.

POSTERS

40,000 Acres and Counting: Restoring Longleaf Pine on Fort Benning, GA

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Abstract

Restoration of longleaf pine ecosystems is a goal of numerous land managers throughout the Southeastern U.S., including on Fort Benning, an 182,000 acre U.S. Army training installation located in west-central Georgia and eastern Alabama. Roughly 90,000 acres of Fort Benning consist of upland areas once dominated by fire-dependent longleaf pine communities. In the early 1990's, land management goals at Fort Benning began emphasizing restoration of longleaf pine and recovery of associated rare species, including the federally endangered red-cockaded woodpecker. Since that time, Fort Benning has instituted forest management practices to promote longleaf reestablishment, including selective thinning of undesirable timber, prescribed fire, and longleaf pine artificial regeneration. In total, longleaf acreage on Fort Benning has increased from 6,000 acres in the 1980's to over 40,000 acres currently. Here we describe Fort Benning's longleaf pine restoration program, including desired future conditions, current land management activities, ecological monitoring and research initiatives, and assessment techniques for adaptive management. Measures of success, additional needs and challenges, and bridging restoration goals with Army training requirements are also presented and discussed.

Longleaf Academies: Developing more Longleaf Expertise through Training Foresters and Biologist

JJ Bachant Brown

The Longleaf Alliance

Abstract

This poster will examine the need for additional longleaf expertise across the region and how the Longleaf Alliance is addressing that need with the development of Longleaf Academies. The goal of these academies is to educate foresters and biologists on specifics of longleaf management and restoration so that they can provide appropriate advice to landowners and land managers. The first two Academies held by the Longleaf Alliance, the Longleaf Stand Dynamics Lab and Auburn University will be showcased with a focus on the curriculum, structure, and exercises of each. In conclusion, the future direction of these academies and our ultimate goal of creating a "Certified Longleaf Manager" designation will be highlighted.

Loblolly Pine Decline on Ft. Benning: Will it Affect Longleaf Conversion Plans?

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Abstract

Ft. Benning, GA undergoes unique environmental impacts and the constraints imposed by federal requirements for restoring and maintaining red cockaded woodpecker habitat can limit mitigation efforts. Longleaf pine is an ecologically important tree species in Ft. Benning, GA, supporting federally mandated red-cockaded woodpecker populations in this installation. Another pine, the loblolly pine, is a prolific colonizer of abandoned agricultural sites and has been extensively planted and managed on many soil types from Texas through Virginia, including Ft. Benning. The current decline and mortality in existing mature loblolly pine stands threatens habitat restoration and endangered species recovery goals on this military base. Several interacting factors involving soil conditions, age class of existing loblolly pine stands, root disease causing fungi, insects, and silvicultural treatments are proposed as potential contributing agents. Given the involvement

Figure 1. Loblolly pine at Ft. Benning, GA showing severe decline symptoms

of these factors in loblolly pine mortality, and the current effort to restore longleaf pine ecosystems on the base, researchable questions regarding loblolly pine decline are also applicable to current and future restored longleaf pine ecosystems. We propose both short term and long term studies to determine whether the decline is statistically confirmable, and not just a perception of persons focused on the endangered species issues. It is also suggested that the highly degraded soils resulting from previous agricultural use may represent an environment so altered that historic growth patterns are no longer achievable, and lending some uncertainty to current longleaf pine restoration goals.

Background

Prior to Army land acquisition between 1918 and 1942, land use across this region of arid upland sandhills was characterized by a century of deforestation, subsistence farming and widespread soil erosion (USDA1988; Barrett 1995; Jose et al. 2005). Remaining forested stands in the newly acquired land included tracts of loblolly, longleaf, and shortleaf pines (P. taeda, P. palustris and P. echinata), often mixed with oaks and other upland hardwoods. After the Army purchases, many of the larger trees were harvested for timber; often to be used for immediate milling into construction lumber for troop barracks. There was little emphasis on long-term forest management. The loblolly pine became widely established on almost all upland sites through its aggressive natural regeneration capability. Starting approximately in the 1950s, loblolly pine was widely planted, even on sites not its preferred habitat, because of its value as pulpwood and timber (Hess et al. 1999, 2005a; Menard et al. 2006; Prestemon and Abt 2002; Trani 2002). Installation forestry practices mimicked the local forest industry in the period 1955 to 1975. In the 1980's, a new emphasis on recovering the endangered Red-cockaded Woodpecker (RCW) (Picoides borealis) resulted in modification of forest practices. Emphasis shifted to retaining cavity trees, and, later, to retaining those with potential to become cavity trees for the RCW. Thus, many of these loblolly pines were not harvested at about age 40-45 years, as would have been normal forestry practice in the region, but retained for improved RCW management capability.

The Problem

The majority of trees now seen either dying or of low vigor are the largest loblolly pines, which deprive the RCW of nesting cavities.

Objective

We are attempting to answer the following questions:

- What is the forest health/decline problem and how widespread is it?
- What are the underlying causes and do these differ across the region?
- Are there management actions that can be taken immediately that would help minimize the impact of a potential forest health problem?
- How would a significant forest health problem affect long term plans of restoring old growth longleaf pine and RCW habitat?

Presence of Decline

Since the 1980s, several observers have suggested an increase in the occurrence of local forest health problems in various southern pine systems (Eckhardt et al. 2007; Hess et al. 1999, 2005a, 2005b; Menard et al. 2006; Otrosina et al. 1999). Many of these reports have been specific to one site (e.g., Fort Benning, GA; Talladega National Forest, AL; Sumter National Forest, SC), but, when taken together, they suggest that problems may be more widespread, though possibly underreported. The majority of these reports involve mature loblolly pine and mixtures of mature loblolly and shortleaf pine near the ecological interface between the Piedmont and Coastal Plain, as well as in the Fall-line Sandhills interface between these regions. Loblolly pine is considered "off-site" at many of these locations, where conditions are more comparable to the needs of longleaf pine (Hess et al. 1999, 2005a; Menard et al. 2006). Recent evidence further suggests that this forest health problem may also affect younger forest types including planted longleaf pine forests (Menard et al. 2006). Evidence of pine decline in the southeastern United States has been reported by the U.S. Department of Agriculture (USDA), Forest Service, Forest Inventory Analysis (FIA), although no clear causal factors have been identified (Bechtold et al. 1991; Gadbury et al. 2004).

Loblolly pine decline has been reported from Alabama since 1968, when the first report and preliminary evaluation of causes was published (Brown and McDowell 1968). This report described the decline of loblolly pine from the Talladega National Forest in Alabama as having been observed for ten years. The symptoms were seen mostly in sawtimber stands greater than 50 years old. Generally, these trees exhibit symptoms not unlike littleleaf disease of shortleaf pine, i.e., progressively thinning crowns, shortening needle length, and off color needles (Campbell and Copeland 1954). Since 1968, at least two other reports have examined decline on National Forests in Alabama

(Hess et al. 1999; Eckhardt et al. 2003). Crown symptoms generally appear at about age 40 while stands older than 50 to 60 years may sustain severe mortality (Figure 1). Trees reportedly die some years after the initial onset of symptoms. This age, of course, is well beyond that normally used as final harvest age in commercial plantings of this species on most sites.

Other reports (Conner et al. 2004; Johnson and Wells 2005; Atkinson 2006; Thomas 2006; Crawford 2007) suggest pine decline may be a localized problem rather than a widespread, generalized condition. This decline appears to be seen more when the more resource-demanding loblolly and shortleaf pine are planted on sites that originally supported the less resource-demanding longleaf (Hess et al. 1990, 2005b). More importantly for the current concern, these symptoms appear more prevalent on sites with one or more soil resource limitations, which may be inherent or anthropogenic (Otrosina et al. 1999; Menard et al. 2006). Collectively, the reported occurrences are often associated with one or more of three forest conditions: (1) "off-site" plantings and/or under-managed settings, (2) forest ages above 50 years, and (3) high densities that lead to overstocking (Conner and Hartsell 2002). At least the first two conditions seem to apply to many of the observed problem sites on these Federally-managed lands.

Contributing Factors

The symptoms of pine decline at Fort Benning are the same as those in the region. Tree death rates differ among species, with the majority of trees either dying or of low vigor being loblolly and shortleaf pine. The progression from poor vigor to mortality may be a function of the severity of stand conditions, pathogenic root fungi that destroy root vascular tissue or cause decay, or insect pests that either kill trees directly or vector root pathogens. Weather and climate also may be implicated in decline. At the turn of the 21st century this area suffered a period of high temperatures and low precipitation (Lozar 2004), and the stress and resultant loss of a substantial portion of the annual increment of root growth for three years in a row may have weakened many loblolly pine trees. Conditions at Fort Benning do not appear to be atypical for 60 to 70-year old loblolly and shortleaf pine in this part of the species range –given its land use history (detrimental long-term agricultural practices, accelerated prescribed burning program, intensive military training). Many sites on Fort Benning supporting stands of loblolly pine may not have suitable soils for long-term productivity of this species. The species is managed on a short rotation and only rarely will stands be maintained beyond 50 years, or 30 to 35 cm stem diameter, except stands dedicated to support of the RCW. These larger sizes are those being used for RCW management, and the expectation that healthy life will continue much beyond this age does not appear to be realistic when all the above factors (soil degradation, land use history, and climate irregularities) are taken into account.

Fire

Prescribed fire, applied with care, is an important tool for management and control of hardwood competition and understory in loblolly pine stands (Schultz 1997). A majority of the pine and mixed forest stands on Fort Benning have been prescribed burned for 15 to 20 years, largely on a 3-year return cycle. The role of fire in the present decline is unknown, though it has been reported that fuel buildup in duff layers and infrequent fire regime for this species can contribute to stress by damaging fine roots. Otrosina et al. (2002) describe a mechanism that explains a delayed decline and mortality following prescribed burning in longleaf pine. They hypothesize that duff buildup in an established stand, concurrent with 7 (or more) years of fire absence contributes to excessive stress following fire reintroduction. Mortality of fine roots present in this organic layer, followed by fire reintroduction exacerbates stress levels and contributes to further root colonization by fungi such as Leptographium sp. Root disease caused by the fungus Heterobasidion annosum (Fr.) Bref. was also a factor in the decline of longleaf pine on these sites. A relationship between fire severity and the number of root feeding bark beetles was observed within the first weeks post burn (Sullivan et al. 2003). Direct heat effects such as cambial damage from excessive fire temperatures and heat pulse duration are also stressors. This would be much more likely a cause if the affected stands had been without fire for lengthy periods, but this does not appear to be the case.

Our case study aims to identify the specific reason(s) for this decline, and propose means to slow or reverse the trend. The desired condition for the RCW, as for other southern pine-dependent species, is one of open, mature stands, ideally longleaf pine, with regular, low-intensity fires, a sparse hardwood midstory, and a rich groundcover of forbs and grasses. Pine plantation forestry, however, effectively suppresses all strata below the canopy, providing no useful habitat for the RCW. It is not the type of pine forest desired here.

Role of Fungi and Insects

The roles fungi play in the overall decline syndrome are not clear, but most are opportunistic pathogens attacking already compromised trees (Harrington and Cobb 1988). Trees weakened by abiotic stressors (e.g., drought, high temperatures, or nutrient deficiencies) or by fungi are subsequently more susceptible to pathogens and insects. In the present case, however, the decline apparently does not move to adjacent trees, as do insect outbreaks. Root pathogens, particularly those affecting woody roots, may be primary causes or secondary consequences of disturbance (Otrosina 2005; Otrosina and Ferrell 1995), depending on a host of pathological, ecological, and environmental factors. Some pathogens are intimately associated with insects for dispersal and thus the factors that influence disease impact in these cases become very complex. For example, root feeding bark beetles such as

Hylastes sp. and Hylurgops sp. (Coleoptera: Scolytidae), are likely vectors for the Leptographium/ Ophiostomatiod fungi (Eckhardt et al. 2004). Ophiostomatoid fungi have been found to be associated with some trees, both declining and asymptomatic. Leptographium sp. is associated with declining trees, though it is not clear if the infection is the cause of any observed decline. The spores of these fungi are ideally suited to transport by root-feeding beetles. Another pathogen, Heterobasidion annosum, is not now associated with decline, though there has not been a systematic survey. The question here must be, are fungi entering tree roots following a decline in the tree health, caused perhaps by the numerous other stresses noted here, including climatic stress, or are they the cause of the decline? Can or does it affect longleaf pine? We will not know without systematic data collection among affected and unaffected pines in good and bad habitats across the range. Root diseases are cryptic, and often not identified without much effort. Thus they are often overlooked in assessments of stand health. At this time, the relationship is best described as "not-proven."

Conclusions

Substantiating the extent and severity of pine decline will provide useful information to understanding its cause. Presently, the scope of decline appears broad, but regional surveys of the extent of symptoms, and creative and inferred mathematical and statistical approaches can narrow the scope of the issue. Survey information should incorporate species' requirements for sustained productivity, the occurrence of soil resource limitations, climate and silvicultural activities that affect the soil resource, forest management practices, and other anthropogenic patterns that exceed acceptable and natural patterns. Assessments of overlap between pine decline and forest management activities such as site preparation, fertilization, and prescribed burning may provide insight regarding the cause of pine decline.

Future climate change may alter the growing conditions for loblolly pine and longleaf pine on Fort Benning, and on similar previously-abused sites across the region, making them unsustainable for long-term growth of these species. The conditions on these sites may not be simply comparable to those on sites where growth potential for loblolly pine was originally observed. Rather, they are different with respect to soil fertility, compaction, and disturbance. The decline of loblolly pine at this age and size on these sites may thus be entirely predictable and normal, with few proven measures available to prevent it. The lack of information on long-term impacts of these factors on longleaf pine adds to the uncertainty.

Recommendations for Further Studies

At present, pine decline described here appears to affect public land managed for multiple objectives that include but do not emphasize timber production. Commercial forest management may be avoiding the problem simply by harvesting younger age classes at which the trees are not affected. Information is insufficient to determine whether this problem is approaching threat status or even has the potential to become a regional forest health threat. Even if it is not a severe region-wide problem, it remains a significant concern to RCW management, especially on the military installations reviewed here. Mitigating the negative effects of pine decline first requires a better knowledge of the scope and cause of the problem. A rigorous review of affected and unaffected stands across the region would be appropriate. Some of these studies could logically be rather short term, and would not require massive efforts to acquire relevant data. Immediate funding of appropriate studies would help provide data for many of these factors. Resolution of the problem in the long term will require a multidisciplinary approach utilizing regional comparisons among ecosystems

References

Atkinson, K. 2006. Fiscal Year 2005 Monitoring and Evaluation Report: Chattahoochee-Oconee National Forests. Atlanta, GA: USDA Forest Service, Southern Region.

Barrett, J.W. 1995. Regional Silviculture of the United States. Third Edition. New York: John Wiley and Sons.

Bechtold, W.A., G.A. Ruark and F.T. Lloyd. 1991. Changing stand structure and regional growth reductions in Georgia's natural pine stands. For. Sci. 37: 703-717.

Brown, H.D. and W.E. McDowell. 1968. Status of loblolly pine die-off on the Oakmulgee District, Talladega National Forest, Alabama. USDA Forest Service. Report 69-2-28.

Campbell, W.A. and O.L. Copeland, Jr. 1954. Littleleaf disease of shortleaf and loblolly pines. Circ. 940. Washington, DC: U.S. Department of Agriculture.

Conner, R.C. and A.J. Hartsell. 2002. Forest area conditions. In: Wear D. N., and J. G. Greis (eds). Southern Forest Resource Assessment, pp 357–401. Asheville, NC: USDA Forest Service, Southern Research Station.

Conner, R.C., T. Adams, B. Butler, W.A. Bechtold, T.G. Johnson, S.N. Oswalt, G. Smith, S. Will-Wolf and C.W. Woodall. 2004. The state of South Carolina's forests, 2001. Resource Bulletin. SRS-96. Asheville, NC: USDA, Forest Service, Southern Research Station.

Crawford, M.B. 2007. Annual Monitoring and Evolution Report: National Forests in Alabama, Fiscal Year 2001-2003. Atlanta, GA: USDA Forest Service, Southern Region.

Eckhardt, L.G., N.J. Hess, R. Menard and A.J. Goddard. 2003. Assessment of loblolly pine decline on the Oakmulgee Ranger District, Talladega National Forest, AL. USDA Forest Service, Southern Region, Forest Health

Report No. 2004-02-01

Eckhardt, L.G., J.P. Jones and K.D. Klepzig. 2004. Pathogenicity of Leptographium species associated with loblolly pine decline. Plant Dis. 88:1174-1178.

Eckhardt, L.G., A.M. Weber, R.D. Menard, J.P. Jones and N.J. Hess. 2007. Insect-fungal complex associated with loblolly pine decline in central Alabama. For. Sci. 53:84-92.

Gadbury, G.L., M.S. Williams and H.T. Schreuder. 2004. Revisiting the southern pine growth decline: where are we 10 years later? Gen. Tech. Rep. RMRS-GTR-124. Fort Collins, CO: U.S. Dep. Agric., For. Serv., RMRS.

Harrington, T.C. and F.W. Cobb, Jr. 1988. Leptographium root diseases on conifers. American Phytopathological Society, St. Paul, MN.

Hess, N.J., A. Mangini, D. Starkey and R.C. Kertz. 1990. Evaluation of mortality in unthinned loblolly plantations on the Bankhead Ranger District. Report No. 90-2-13. Pineville, LA: Alexandria Field Office, USDA Forest Service, Southern Region, State and Private Forestry.

Hess, N.J., W.J. Otrosina, J.P. Jones, A.J. Goddard and C.H. Walkinshaw. 1999. Reassessment of loblolly pine decline on the Oakmulgee District, Talladega National Forest, Alabama. Report No. 99-2-03, USDA Forest Service, Forest Health Protection, Pineville, LA.

Hess, N.J., L.E. Eckhardt, R.D. Menard and A.J. Goddard. 2005a. Assessment of loblolly pine decline on the Oakmulgee Ranger District, Talladega National Forest, Alabama (Revised). Report No. 2005-02-04. Pineville, LA: Alexandria Field Office, USDA Forest Service, Forest Health Protection. 31 p.

Hess, N.J., L.E. Eckhardt, R.D. Menard, A.J. Goddard and E.A. Carter. 2005b. Assessment of loblolly pine decline on the Shoal Creek/Talladega Ranger Districts, Talladega National Forest, Alabama and Choccolocca State Forest. Report No. 2005-02-05. Pineville, LA: Alexandria Field Office, USA Forest Service, Forest Health Protection.

Johnson, T.G. and J.L. Wells. 2005. Georgia's timber industry–an assessment of timber product output and use, 2003. Resour. Bull. SRS-104. Asheville, NC: USDA Forest Service, Southern Research Station.

Jose, S., E.J. Jokela and D.L. Miller. 2005. The longleaf pine ecosystem: An overview. Pg 3–8 In: Jose, S., E.J. Jokela and D.L. Miller (eds). The Longleaf Pine Ecosystem, Ecology, Silviculture, and Restoration. New York: Springer Science + Business Media, Inc.

Lozar, R.C. 2004. SEMP Historical Meteorology Evaluation for the Area Near Fort Benning, GA: 1999 – 2001. Technical Note Number ERDC/CERL TN-04-1. Champaign, IL: U.S. Army Engineer Research and Development Center.

Menard, R.D., L.G. Eckhardt and N.J. Hess. 2006. Assessment of loblolly pine decline on Fort Benning Military Reservation, Fort Benning, Georgia. Report No. 2006-02-01. Pineville, LA: U.S. Dep. Agric., For. Serv. FHP.

Otrosina, W.J., D. Bannwart and R.W. Roncadori. 1999. Root-infecting fungi associated with a decline of longleaf pine in the southeastern United states. Plant and Soil 217: 145-150.

Otrosina, W.J., C.H. Walkinshaw, S.J. Zarnoch, S.J. Sung and B.T. Sullivan. 2002. Root disease, longleaf pine mortality, and prescribed burning. Proc. 11th biennial southern silvicultural research conference. (Outcalt, K.W. ed.) Gen. Tech. Rep. SRS-48. Ashville, NC: U.S. Dep. Agric., For. Serv., SRS: 551-557.

Otrosina, W.J. 2005. Exotic ecosystems: where root disease is not a beneficial component of temperate conifer forests. Pp 121-126 In: Lundquist, J.E. and R.C. Hamelin (eds). Forest Pathology—From Genetics to Landscapes. St. Paul. MN: APS Press.

Otrosina, W.J. and G.T. Ferrell. 1995. Root diseases: Primary agents and secondary consequences of disturbance. Pp 87–92 In: Eskew, L., Compiler. Forest Health Through Silviculture. Proc. 1995 National Silviculture Workshop, May 8-11, 1995; Mescalero, NM. USDA Forest Service Gen. Tech. Rept. RM-GTR-267, Fort Collins, CO.

Prestemon, J.P. and R.C. Abt. 2002. Timber products supply and demand. Pp 299–325 In: Wear, D.N. and J.G. Greis (eds). Southern Forest Resource Assessment. Asheville, NC: USDA Forest Service, Southern Research Station.

Schultz, R.P. 1997. Loblolly pine: The ecology and culture of loblolly pine. USDA Forest Service, Agriculture Handbook 713. Washington DC.

Sullivan, B.T., C.J. Fettig, W.J. Otrosina, M.J. Dalusky and C.W. Berisford. 2003. Association between severity of prescribed burns and subsequent activity of conifer-infesting beetles in stands of longleaf pine. For. Ecol. Mgt. 185: 327-340.

Thomas, J. 2006. Monitoring and Evolution Annual Report for the Revised Land and Resource Management Plan: Sumter National Forest. Atlanta, GA: USDA Forest Service, Southern Region.

Trani (Griep), M.K. 2002. Maintaining species in the

South. Pp 113–150 In: Wear, D.N. and J.G. Greis (eds). Southern Forest Resource Assessment. Asheville, NC: USDA Forest Service, Southern Research Station.

U.S. Department of Agriculture (USDA). 1988. The South's Fourth Forest. Forest Resource Report No. 24. Washington, DC: USDA Forest Service.

Impacts of Different Fire Return Intervals on Longleaf Pine Stand Dynamics

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Abstract

Longleaf pine *(Pinus palustris* Mill.) was the dominant tree species across an estimated 60% of the Southeastern USA landscape at the time of European settlement. These ecosystems were maintained by frequent, low-intensity ground fires which eliminated woody competition and allowed longleaf pine to regenerate itself in canopy openings. Several studies have examined the effects of different fire return intervals and season of burns on ecosystem components, i.e., understory and ground cover vegetation but impacts to longleaf pine have been virtually ignored. A study was established in 1984 to determine the comparative impact of both winter and spring prescribed fires at several intervals on the growth of a longleaf pine overstory and development of a hardwood understory. The study was established in young, naturally regenerated longleaf pine stands (trees were 9 years old) located in south-central Alabama, USA. Treatments include both winter and spring burns repeated at intervals of 2, 3, or 5 years plus an unburned check. Fire type, flame length, air temperature, relative humidity, fire-line intensity, and crown scorch were measured and recorded to provide data on the prescribed burns due to the variable nature of fire depending on the environmental and weather conditions of a particular day.

For the first six years of the study there were no treatment effects on longleaf pine. The first treatment effects on longleaf pine growth appeared when the trees were 17-20 years old and have become more apparent with time. Mortality has been minimal with longleaf pine survival running from 91% on the spring 2- and 3-year burns to 99% on the no burn, winter burns and spring 5-year burn treatment. While there have been no significant differences in DBH and total height, there has been a significant difference in basal area. By 1994, the no burn and 5-year spring burn were different from the other burn treatments. By 1999, the 3-year spring burn joined the no burn and 5-year spring burn as being significant from the other treatments. Both season and fire return intervals had an early and significant effect on understory hardwoods. There has been an increase in number, basal area, and volume in understory hardwoods with winter burns. Hardwood volume and number of stems have declined over the previous 15 years with both 2- and 3-year spring burns and increased only slightly with the 5-year spring burn.

Protecting Longleaf Pine – Native Groundcover Communities Using Working Forest Conservation Easements

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Abstract

Southern pine ecosystems once consisted of vast savannas of mature longleaf pine (*Pinus palustris*) ranging throughout the coastal plain from Virginia to east Texas. These forests were associated with diverse native groundcover dominated by perennial grasses and forbs, most notably three-awn wiregrass (*Aristida stricta*). Compared to other temperate ecosystems, longleaf pine – native groundcover hosts an exceptionally large number of plant species. This diverse flora is confined to groundcover and can support as many as 50 species per square meter. However, this ecosystem is now imperiled throughout its historic range due primarily to agricultural / silvicultural land conversion. Previously covering some 90 million acres, today less than 2% remains. This drastic decline makes it one of the most critically endangered ecosystems worldwide. Tall Timbers Land Conservancy (TTLC) is actively protecting this globally endangered ecosystem through working forest conservation easements. In 2007 TTLC completed 10 Conservation Easements with intact longleaf pine – native groundcover on privately owned lands in North Florida and Southwest Georgia. Of these 21,152 acres conserved

in perpetuity, 14.15% (2,992.68 acres) were designated as high quality longleaf pine – native groundcover Special Natural Areas. Utilizing maps generated by a geographic information system, these working forest easements incorporated a comprehensive Conservation Management Plan and Legal Easement. These documents provided the foundation for perpetual protection through specific management provisions and land use restrictions. This poster outlines the easement process from survey to signature necessary to conserve this critically important pine upland ecosystem.

Current Trends for the Planting of Longleaf Pine in Virginia

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Abstract
We contacted federal, state, and private land managers and owners to determine current trends for the planting of longleaf pine via location, year planted, provenance, and acreage in Virginia. Longleaf pine was only found on 4 sites comprising less than 800 acres in a 1998 census but now can be found on an additional 547.6 acres. Plantings occurred in Brunswick (50.7 acres), Greensville (1 acre), Isle of Wight (66.2 acres), Prince George (5 acres), Suffolk (68.7acres), and Sussex Counties (356 acres). While this additional acreage is small compared to other states, this still represents a 68% increase in acreage within the state of Virginia. Efforts are also being made to raise and plant more indigenous native Virginia longleaf pine and more plantings are planned for 2009, continuing the trend for gains in acreage for longleaf pine in Virginia.

Herbaceous Plants and Grasses of the Berry College Longleaf Management Area: A Preliminary Survey

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Abstract
The Berry College Longleaf Pine Management Area consists of relict fire-suppressed montane longleaf pine (Pinus palustris) stands embedded within encroaching matrix of mixed hardwood forest. Since 2001, portions of the management area have been subjected to restoration efforts involving clear- and selective-logging followed by burning, herbicide application and planting, and prescribed burning and hardwood control using herbicides in old growth stands. An important question is the impact of these management practices on understory plants and grasses. To begin to address this question, from May through October 2008, understory flowering plants specimens were collected in managed and unmanaged stands. The principal goal was to establish species inventories for areas differing in recent management history (cover data were not collected). So far, we have found more than 150 species in about 30 different families; 10 species in an unmanaged old growth reference stand, 6 to 22 species in managed old growth stands, and 23 to 50 species in clear- and selective-cut areas. Examples of species found in nearly all stands include Atlantic Pigeonwings (Clitoria mariana), Scented Goldenrod (Solidago odora), Carolina Horsenettle (Solanum carolinense), several species of Bush Clovers (Lespedeza spp.), and Greater Coreopsis (Coreopsis major). Species that only inhabited specific areas included the Azure Bluet (Houstonia caerulea) and Thymeleaf Bluet (H. serpyllifolia) in one or two locations within managed old growth stands, and Cheerful Sunflower (Helianthus divaricatus) in one selective-cut. Grass-like diversity recorded so far includes 28 species in the Poaceae (mostly Dichanthelium) and 5 species in the Cyperaceae. Although grass cover was obviously higher in selective- and clear-cut areas, many grass species and all sedge and rush species were collected in managed old growth stands. These preliminary results suggest that management activities that have reduced tree canopy density have resulted in greater herbaceous and grass species diversity. The extent to which the original understory plant diversity can be recovered in managed old growth stands remains an important question. Progress toward that goal can be addressed by comparing current species list to historical species lists and to lists of diagnostic species present at other mountain longleaf pine sites.

Background

In 2001, Berry College established a project to begin restoring its relict Montane Longleaf Pine forests on Lavender Mountain, Floyd County, Georgia. The longleaf forests of the Berry College campus represent an ecologically significant landscape type with a paucity of knowledge about it. Most information on longleaf forests comes from rolling hills or coastal plain landscape types, i.e., wiregrass country. Wiregrass, gopher tortoises, and many of the scrub oaks considered characteristic of the better-known longleaf ecosystems are far outside the range of Berry's longleaf stands. Berry's campus has a number of very old trees, some in excess of 200 years old. There are very few tracts of old longleaf left in the south, and almost none left within mountainous areas. As with most sites, stands at Berry had been long fire-suppressed prior to recent restoration efforts. Of particular relevance to this study, much of the steep hillsides of Lavender Mountain have never been plowed and thus the potential exists to recover groundcover species characteristic of fire maintained Montane Longleaf Pine forests. Andrews (1917) and Jones (1940) both conducted general surveys of the plant communities on the Berry Campus. These historical surveys as well as surveys conducted recently at fire-managed and fire-suppressed mountain longleaf pine sites in Georgia and Alabama (Varner et al., 2000; Carter and Londo 2006) serve as sources for determining potential or "target" plant communities of the restored longleaf system.

This study focused on areas under various management regimes (Table 1). In general, old growth fire-suppressed longleaf pine stands have been managed by Arsenal herbicide injection to decrease hardwoods, and with controlled burns conducted to begin the process of fuel reduction, hardwood control, and understory recovery. Other areas (clear-cut and selective-cut areas) were subjected to recent intensive management following efforts to control Southern Pine Beetle damage to existing loblolly and shortleaf pines. In these areas, prescribed burns and various types of herbicide application (Arsenal injection, Garlon 3A foliar spray, Garlon 4 basal spray) were followed by planting of longleaf pine seedlings. These areas were also treated following planting via foliar spray applications of Garlon 3A to target hardwoods, blackberries, and invasive species. The purpose of this project was to initiate a baseline study of the understory plant community in areas undergoing restoration, with reference to unmanaged or minimally managed (no burn) old growth areas. One of the goals of the current project is the restoration of the historical understory plant community and this study represents the first major initiative to document recent changes in that community.

Methods

Monthly from June through October 2008, specimens of all flowering plant species in all study areas were collected and tentatively identified in the field using Newcomb's Wildflower Guide. Latitude and longitude coordinates were recorded and the specimens were pressed, dried and added to Berry College's herbarium. Tentative identifications were cross-referenced with Redford's Manual of the Vascular Flora of the Carolinas and a species checklist for the Flora of Floyd County (Ware and Ware, unpublished data). The USDA PLANTS (2008) database was then utilized to further cross-check each specimen and to assign accepted species names. As this project is in its preliminary phases, many plant identifications remain tentative and censuses in spring months have yet to be completed. Additionally, rigorous quantitative comparisons are not yet possible. Nevertheless, early results can be used to assess the degree to which overall species diversity is being affected by various management practices.

The current species list was compared with a list of plants considered diagnostic of upland longleaf pine habitats on Lavender Mountain when it was still being naturally fire-maintained (Andrews, 1917) and for upland habitats soon after fire suppression efforts began at this site (Jones, 1940). Current species lists were also compared to a list of diagnostic species for recently fire-maintained mountain longleaf pine areas of Fort McClellan, Alabama (Varner, et al., 2000) and for fire-suppressed mountain longleaf pine areas of Thunder Mountain, Upson County, Georgia (Carter and Londo, 2006). Together, these lists serve to help identify species that are likely to be encountered within managed longleaf pine stands on Lavender Mountain, but have not yet been recorded in our current study. Planned censuses in April and May 2009 will help round out the species list for the managed areas. We also used our current species list to compare overall species diversity in areas on Lavender Mountain with contrasting recent management histories.

Results & Conclusion

Of the 172 species collected, 41 percent were found in the Asteraceae (71 species), followed by Poaceae with 29 and Fabacea with 16 species (Table 2). The 29 Poaceae were dominated by Dichanthelium spp. grasses, in particular Bosc's panicgrass (Dichanthelium boscii). Some of the major flowering plants encountered were Atlantic Pigeonwings (Clitoria mariana), Greater Coreopsis (Coreopsis major), Sweet Goldenrod (Solidago odora), and Shrubby Lespedeza (Lespedeza frutescens) all of which are indicators of a healthy longleaf ecosystem (Varner et al. 2000). The only invasive species found in the longleaf stands was Sorghum halapense and Lonicera japonica. The former species was not documented in the other surveys with which we compared our results. Evidence suggests that prescribed burning is advantageous to this species; controlled burns will not eliminate this species from the managed areas. To what degree this species represents a problem in these project areas will be determined by quantitative species surveys planned for the summer of 2009.

After cross-referencing the species collected with those previously identified in montane longleaf ecosystems, multiple species that had been encountered on Lavender Mountain in the early 1900s are missing from our species collection (Table 3). Many of the species not encountered so far in our study are spring-flowering species or species encountered elsewhere in Floyd County and are thus likely to be encountered during surveys planned for the spring and early summer of 2009. The results of final surveys should allow us to identify obviously missing components of the flora for more intensively focused searches and ultimately the formulation of plans for reintroduction if these species cannot be found anywhere within the managed areas.

Preliminary comparisons show managed areas to have higher species diversity in comparison to the less-managed plots. Despite the use of broadcast and targeted herbiciding, intensively managed clear cut areas yielded the highest number of species (over 90 species). This is likely due to a combination of pioneering (weedy) species and plants favoring open canopy conditions. In comparison, managed old growth stands yielded about 80 species, and minimally and unmanaged stands yielded from 10 – 25 species. As a preliminary investigation into the effectiveness of management for biodiversity, there is a clear correlation between the management practices being used so far in these restoration areas and the diversity of the understory.

References

Andrews, F.F. 1917. Agency of fire in propagation of longleaf pines. Botanical Gazette. 64: 497-508.

Carter, R. and A. Londo. 2003. Remnant Fire Disturbed Mountain Longleaf Pine Forest in West Central Georgia.

Jones, H.C. 1940. Plant ecology of the Berry Schools property, Floyd County, Georgia. PhD. Dissertation, George Peobody College, Nashville, TN.

Newcomb, L. 1977. Newcomb's Wildflower Guide. New York: Little, Brown and Company.

Radford, A.E., H.E. Ahles and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press.

USDA, NRCS. 2008. The PLANTS Database (http://plants.usda.gov, 1 December 2008). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Varner, J.M., J.S. Kush and R.S. Meldahl. 2000. The mountain longleaf pine resources of Fort McClellan, Alabama: Final report on their status, ecology, and management needs. Longleaf Pine Stand Dynamics Laboratory, Auburn University School of Forestry and Wildlife Sciences, Auburn, AL.

Ware, R. and T. Ware. Flora of Floyd County. Unpublished.

Table 1. Summary of major recent management activities in each of five contrasting areas sampled in this study.

Recent Management History	Total Area (acres)
Clear cut, burned, foliar/basal spray herbicide, planted 2003-2007	31.3
Mixed pine/hardwood forest, hack and squirt herbicide, burned, planted 2001-2007	22.0
Mature longleaf pine, hack and squirt herbicide, burned 2003-2007	55.7
Selective cut, planted 2006-2007	5.2
Mature longleaf pine unmanaged	5.6

Table 2. Summary of plant families encountered in managed and unmanaged longleaf pine habitats on Lavender Mountain May - October 2008.

Family	# of Species	% of Total
Asteraceae	71	41.28
Poaceae	29	16.86
Fabacea	16	9.30
Rubiaceae	6	3.49
Cyperaceae	5	2.91
Lamiaceae	5	2.91
Clusiaceae	3	1.74
Euphorbiaceae	3	1.74
Verbenaceae	3	1.74
Liliaceae	2	1.16
Linaceae	2	1.16
Melastomataceae	2	1.16
Onagraceae	2	1.16
Oxalidaceae	2	1.16
Polygalaceae	2	1.16
Polygonaceae	2	1.16
Vitaceae	2	1.16
Apiaceae	1	0.58
Apocynaceae	1	0.58
Campanulaceae	1	0.58
Chenopodiaceae	1	0.58
Ericaceae	1	0.58
Hypericaceae	1	0.58
Juncaceae	1	0.58
Labiatae	1	0.58
Menispermaceae	1	0.58
Passifloraceae	1	0.58
Phytolaccaceae	1	0.58
Plantaginaceae	1	0.58
Pteridaceae	1	0.58
Rosaceae	1	0.58
Solanacea	1	0.58
Total	**172**	

Table 3. Characteristic species of Lavender Mountain and other mountain longleaf pine habitats in comparison with species documented on Lavender Mountain in 2008.

Genus	**Species**	**Lavender Mountain 1917[1]**	**Lavender Mountain 1940[2]**	**Fort McClellan 2000[3]**	**Thunder Mountain 2006[4]**	**Lavender Mountain 2008**
Andropogon	gerardii	Y				Y
Andropogon	ternarius			Y		
Andropogon	virginicus	Y		Y		Y
Angelica	venenosa		Y			
Antennaria	plantaginifolia		Y			Y
Aristida	stricta	Y	Y			
Asclepias	amplexicaulis			Y		
Asclepias	tuberosa		Y			
Asclepiodora	viridis		Y			
Baptisia	tinctoria				Y	
Campsis	radicans		Y			Y
Chamaecrista	fasciculate		Y			
Chimaphila	maculate		Y			Y
Clitoria	mariana		Y	Y	Y	Y
Cnidoscolus	stimulosus				Y	Y
Coreopsis	lanceolata		Y			
Coreopsis	major		Y	Y		Y
Coreopsis	verticillata		Y			
Cyperus	retrofractus	Y				
Daucus	carota		Y			
Desmodium	paniculatum		Y			
Dichanthelium	commutatum			Y		Y
Dichanthelium	sphaerocarpon		Y			Y
Dichanthelium	villosissimum		Y			Y
Eleocharis	obtuse		Y			
Elephantopus	tomentosus		Y			Y
Erigeron	strigosus		Y			Y
Eupatorium	perfoliatum		Y			Y
Euphorbia	corollata			Y		Y
Euphorbia	pubentissima				Y	Y
Fragaria	virginica		Y			
Galactia	volubilis		Y	Y		
Galium	aparine		Y			
Galium	pilosum		Y			
Gillenia	stipulata		Y			
Helianthus	atrorubens		Y			
Helianthus	hirsutus		Y			
Helianthus	microcephalus			Y		
Helianthus	mollis			Y		
Hexastylis	arifolia		Y			
Hexastylis	shuttleworthii				Y	Y
Hieracium	venosum		Y			Y

Genus	Species	Lavender Mountain 1917[1]	Lavender Mountain 1940[2]	Fort McClellan 2000[3]	Thunder Mountain 2006[4]	Lavender Mountain 2008
Houstonia	caerulea		Y			Y
Lespedeza	procumbens			Y		Y
Lespedeza	virginica		Y			Y
Liatris	graminifolia			Y		Y
Linum	medium		Y			
Lonicera	japonica		Y			Y
Malaxis	unifolia		Y			
Marshallia	obovata		Y			
Monarda	clinopodia		Y			Y
Oenothera	fruticosa		Y			
Oxalis	corniculata		Y			Y
Oxalis	dillenii			Y		
Oxalis	stricta		Y			Y
Packera	anonyma		Y			Y
Panicum	virgatum			Y		Y
Passiflora	incarnata		Y			Y
Phlox	pilosa		Y			
Piptochaetium	avenaceum		Y		Y	Y
Pityopsis	graminifolia			Y	Y	Y
Poa	autumnalis		Y			
Polygonatum	biflorum		Y			
Polystichum	acrostichoides		Y			Y
Potentilla	canadensis		Y			
Potentilla	simplex		Y			
Prunella	vulgaris		Y			Y
Pycnanthemum	incanum		Y			Y
Rhynchosia	tomentosa			Y		
Rudbeckia	hirta		Y			Y
Rumex	acetosella		Y			Y
Salvia	lyrata		Y			
Salvia	urticifolia			Y		
Sanicula	trifoliata		Y			
Schizachyrium	scoparium	Y		Y		Y
Scleria	triglomerata	Y				Y
Scutellaria	integrifolia		Y			Y
Scutellaria	elliptica		Y			Y
Senna	marilandica			Y		
Sisyrhyncium	angustifolium			Y		
Sisyrhinchium	atlanticum		Y			
Solidago	arguta		Y			
Solidago	erecta			Y		
Solidago	nemoralis		Y			Y
Solidago	odora			Y	Y	Y
Spigelia	marilandica		Y			

Genus	Species	Lavender Mountain 1917[1]	Lavender Mountain 1940[2]	Fort McClellan 2000[3]	Thunder Mountain 2006[4]	Lavender Mountain 2008
Stylosanthes	calcicola		Y			
Symphyotrichum	dumosum		Y		Y	Y
Symphyotrichum	laeve		Y			Y
Symphyotrichum	patens		Y	Y	Y	Y
Symphyotrichum	undulatum			Y	Y	
Tephrosia	mohrii		Y			
Tephrosia	virginiana	Y		Y	Y	Y
Thalictrum	thalictroides		Y			
Trifolium	hybridum		Y			
Vernonia	flaccidifolia		Y			
Vicia	caroliniana		Y			
Viola	affinis		Y			
Viola	pedata		Y			Y
Viola	sagittata		Y			
Viola	sororia		Y			

[1]Species diagnostic of longleaf pine habitats on Lavender Mountain (Andrew 1917)
[2]Species found in upland habitats on Lavender Mountain (Jones 1940)
[3]Species diagnostic of frequently burned mountain longleaf pine habitats (Varner et al., 2000)
[4]Species diagnostic of longleaf pine dominated fire-suppressed habitats (Carter and Londo 2006)

Longleaf Pine Seed and Orchard Resources Across the South

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Abstract

The longleaf pine restoration initiative in the south has been underway for several decades. Various governmental, non-governmental, public and private landowners are proactive in restoring longleaf pine ecosystems. A longleaf pine conservation plan has been drafted to facilitate these efforts. The Longleaf Alliance has played a major leadership role in guiding these activities.

Artificial regeneration of longleaf pine ecosystems is a large part of restoration activities. Approximately 5 million acres over the next decade are projected to be planted in longleaf pine. Do we have enough longleaf pine seed resources to support these large scale planting efforts? Calculations show that if planting 500 trees per acre then subsequent seed needs will be 357,000 pounds over the next decade. How much longleaf pine seed is currently in inventory? What is the storage capacity and seed longevity? What is the capacity to process and clean longleaf pine cones and seed?

How many productive longleaf seed orchards and/or seed production areas exist in the south? If we assume 0.7 pounds of seed per bushel, 60 cones per bushel and 1000 cones per acre, we would need 3,060 acres of seed production. What is the genetic composition of these orchards and are all the various seed zones represented in the orchards? What is the ownership of these resources?

What economic and conservation strategies do we need to approach to protect these resources? Current longleaf pine resources across the southern region need to be evaluated to answer these questions.

Bottomline: will there be enough longleaf pine seed to support the longleaf pine restoration initiative? Without the seed, artificial regeneration will be compromised.

Forest Ecosystem Conservation for Rare and Declining Species in South Carolina

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In South Carolina, pine forests with an open understory and isolated wetlands are home to a number of rare and declining bird species, plants and reptiles. With nearly three-quarters, or 9 million acres, of the state's forestland held by family forest owners (also referred to as non-industrial private forest owners), the actions by these landowners can have significant impacts on wildlife habitat. These forest lands are under increased pressure to provide commodities such as paper and lumber to meet the ever-increasing needs of society. As a result, more emphasis has been placed on intensive plantation forest management in order to maximize timber production on fewer acres. Intensive forestry practices include short-rotations, use of herbicides to control competing vegetation and often the exclusion of fire from pine stands. This places many species of wildlife that depend on the fire-maintained, open understories of pine stands at risk of becoming listed as threatened or endangered because of habitat loss.

Many landowners are not aware of opportunities that exist for managing their land for both economic and ecological gains. To address this, the American Forest Foundation, Clemson Extension Service, South Carolina Department of Natural Resources, South Carolina Forestry Commission, The Nature Conservancy and the U.S. Fish and Wildlife Service partnered together to offer a four-pronged, proactive educational outreach effort to family forest owners to improve and protect wildlife habitat for declining species by integrating conservation priorities and economic realities. The effort consisted of a series of conservation forestry field days; a conservation forestry recognition program, a conservation forestry cost-share program and development of a management handbook. These efforts encouraged landowners to practice conservation forestry that creates and restores habitat for declining species and at the same time generate income from timber and other uses.

Field Days

Between June 2005 and May 2008, five conservation forestry field days were held at Coastal Plain locations in South Carolina. Area landowners and members of the South Carolina Tree Farm program were invited to learn about practices that would benefit habitat for fox squirrels, Northern bobwhite quail, Bachman's sparrows, the gopher tortoise, Eastern diamondback rattlesnakes and a host of other rare and declining species dependant on habitats in fire-maintained longleaf pine forests. Field days were held on family forest properties in Aiken, Colleton, Georgetown, Hampton and Williamsburg counties. More than 280 family forest owners who owned 160,273 acres of land attended the programs. These landowners were taught how to transition loblolly pine plantation to longleaf pine forests; how to use both dormant and growing season prescribed fire to improve wildlife habitat, how to manage their pine forests for timber and wildlife, how to manage their lands for songbirds and other nongame wildlife and how selectively applied herbicides could be used to improve wildlife habitat. Management practices implemented by family forest owners as a result of the field days are shown in Table 1.

Table 1. Acreage impacts as result of conservation forestry field days.

Percentage of Participants	Conservation Forestry Practice	Acres Impacted
55%	Convert loblolly to longleaf	7,364
67%	Dormant or Growing Season Fire	37,921
59%	Herbicide to Control Midstory	13,195
67%	Manage Wildlife	28,659
59%	Manage Songbirds	9,629
89%	Manage Gamebirds	3,770
	Total Acreage for all Practices	**100,593**

Field day participants were asked if the knowledge they gained from the programs would help them save or earn more money in the future in their land management activities. Forty-three percent of the participants indicated they would save a total of $117,000 and twenty-seven percent said they would earn $331,000 in the future in their forest management activities. In addition, the landowners who attended the field days planned on sharing their knowledge with at least 409 other landowners.

Conservation Forestry Sign Recognition Program

To recognize those landowners utilizing conservation forestry practices on their lands, a special recognition sign was developed for qualifying landowners to post on their property. These signs raised the visibility of conservation forestry efforts. If a landowner had a current, written management plan and used at least two of the listed practices, they qualified and were issued a sign. Most of the participants in the recognition program were using five or more of the listed practices. Table 2 lists the practices and acres impacted. To date, 185 landowners who own 196,220 acres have received signs. In addition, they have shared information on conservation forestry to 9,175 other landowners.

Direct Cost-Share Assistance

Twelve landowners qualified for cost-share assistance for one of two practices: planting (including underplanting of existing pine stands) of longleaf pine and midstory hardwood control to assist with restoring the understory in burned pine stands. Under the cost –share program 72 acres of longleaf pine have been planted and 566 acres of hardwood midstory in pine stands have been sprayed.

Forest Ecosystem Conservation Handbook for Conservation-Reliant Species in South Carolina

Printed in December of 2007, this 100-page, landowner-friendly guide outlined forest management practices that benefit conservation-reliant species in South Carolina. It provided family forest owners with practical information on establishing pine stands, prescribed burns, utilizing herbicides for hardwood midstory and invasive species control, cost-share assistance, and regulatory assurances for landowners. The handbook was developed and distributed to consulting foresters and over 2,000 landowners who hold roughly 820,000 acres. These landowners were provided with 2 copies and encouraged to distribute the additional copy to a family forest owner not on the distribution list.

Table 2. Management practices and acres in conservation forestry sign recognition program.

Management Practice	Acres Impacted
Prescribed Fire	39,291
Selective Thinning	24,885
Tree Planting less than 550/acre	12,278
Herbicides for Hardwood Control	12,123
Herbicides for Invasive Species Control	2,352
Converted from loblolly or slash to longleaf pine	2,721
Switched from even-aged to uneven-aged management	4,389
Improvements to Bottomland Hardwoods	5,466
Total Acres	**103,505**

Santa Cruz/Embudo Creek Watershed Multi-jurisdictional Restoration and Protection Project

Michael DeBonis

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Abstract

The Santa Cruz/Embudo Creek Watershed Multi-jurisdictional Restoration and Protection Project is a Collaborative Forest Restoration Program CFRP grant awarded to the Forest Guild in 2007 that is aimed at reducing the threat of catastrophic wildfire to a number of small communities in northern New Mexico through forest restoration in nearby watersheds.

The watersheds are classified as high priority for restoration due to their current ecological conditions and their close proximity to a number of small, forest-dependent communities. The Forest Guild worked with various land management agencies in the area, including the Camino Real District of the Carson National Forest, the Taos Field office of the BLM, and the Board of the Truchas Land Grant, to identify treatments sites. Specific silvicultural prescriptions were then developed through a collaborative process involving independent scientists and professionals representing industry, conservation organizations, and land management agencies.

The Collaborative Forest Restoration Program (CFRP) originated with the Community Forest Restoration Act of 2000 (Title VI, Public Law 106-393). It provides cost-share grants for public land forest restoration projects that involve numerous stakeholders in their design and implementation.

Project Objectives

- Restore ecosystem structure and function on 575 acres of ponderosa pine and piñon-juniper forests through watershed-scale collaboration
- Protect large and old trees in the treatment areas
- Train, safety certify and employ local workers to perform restoration work
- Educate, train, and employ local youth through participation in ecological restoration, multiparty monitoring, and wood utilization marketing.

Longleaf Pine Seedling Growth in Response to Light and Moisture under varying Canopy Densities

David S. Dyson, Edward F. Loewenstein, Steven B. Jack, Dale G. Brockway, and Dean H. Gjerstad

Abstract

The longleaf pine (*Pinus palustris* Mill.) ecosystem's decline has resulted in the loss of 97 percent of the 60-90 million acres it covered prior to European settlement, but interest in longleaf pine restoration and management has increased in recent decades. This project seeks to determine what level of residual overstory in selection silviculture promotes adequate longleaf pine seedling recruitment. Six hundred containerized longleaf pine seedlings were planted on two sites, one xeric and one mesic, in December, 2007, and February, 2008, respectively. Half of the seedlings at each site were randomly selected for understory removal (with herbicide) in order to differentiate overstory from understory influences. Each seedling's canopy gap fraction was determined using hemispherical photography, and average soil moisture was determined from four time domain reflectometer (TDR) measurements at each seedling from May to August, 2008. Seedling groundline diameter (GLD) was measured in August, 2008. First year results indicate that mean moisture was not significantly different between herbicide and control treatments at either site. Both treatments at the xeric site showed significantly greater growth than the same treatments at the mesic site ($p<0.0001$). Regression analyses indicate loosely positive relationships between moisture and seedling growth for both treatments at both sites. At the mesic site, gap fraction was a significant predictor for growth only within the control treatment ($p=0.015$). At the xeric site, a significant regression existed only within the herbicide treatment; gap fraction was not significant in either treatment. Second year results are expected to show clearer relationships.

Surfing the Koehler Curve: Revisiting a Method for the Identification of Longleaf Pine Stumps and Logs

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Abstract
Measurements of pith and second growth ring diameters were used by Koehler in 1932 to separate longleaf pine (Pinus palustris Mill.) timbers from those of several southern pines (e.g., loblolly, shortleaf). In the current study, measurements were taken from plantation-grown longleaf, loblolly and shortleaf pine trees, as well as old growth longleaf pine, lightwood, and turpentine stumps, to evaluate the method. Results presented here demonstrate that the Koehler method provides an effective means to identify longleaf pine timbers and stumps with applications in the conservation and forest products fields.

Introduction
Turpentine stumps have been discovered in Caroline County, central Virginia, outside the historical range for longleaf pine in southeastern Virginia (Figure 1). Longleaf pine is very rare in Virginia and the ability to correctly identify the taxon of these stumps, and nearby lightwood stumps, would assist conservation biologists with their longleaf pine restoration efforts. A method for longleaf pine timber identification was developed by Koehler (1932). We revisited this technique to determine its robustness and to assess its potential for the possible identification of the above-mentioned turpentine and lightwood stumps as longleaf pine. Confirmation of longleaf pine requires a pith diameter of at least 2.0 mm and successful plotting of the second annual ring measurement above the Koehler curve. Measurements must be made at stump height. An additional benefit of the Koehler method, once validated, is that it could be used to authenticate the identity of salvaged old growth timbers harvested from river bottoms.

Materials and Methods
The Koehler method of identification involves the measurement of pith and second growth ring diameters at stump height. Points appearing above the curve are consistent with longleaf pine whereas those below the curve are likely from one of the other southern pines (Figure 2). Any pith measurement under 2 mm does not belong to longleaf pine and so the measurement of the second growth ring is unnecessary.

Using a digital caliper, measurements were taken from disks cut from plantation-grown longleaf, loblolly and shortleaf pine trees in several southeastern states (Arkansas, Mississippi, Louisiana, South Carolina) and old growth longleaf pine, lightwood, and turpentine stumps in Virginia. Fine sandpaper was used as necessary to smooth the surface of each tree section near the pith to better identify pith edges. Elliptical growth rings were addressed by using an average of the maximum and minimum diameters.

Results and Discussion
All of our longleaf pine measurements fit above the curve delimited by Koehler thus identifying them as longleaf pine and suggesting that a false negative identification of longleaf pine timbers with the Koehler method is highly unlikely (Figure 3). The central Virginia turpentine stump was identified as not belonging to longleaf pine and did not support a range extension for longleaf pine into Caroline County, Virginia. One loblolly pine specimen was plotted as longleaf pine on the Koehler plot giving us a 3% error rate for a false positive longleaf pine identification of a non-longleaf pine timber. Koehler had false positive longleaf pine identification error rates of 3% for shortleaf pine (n=112), 2% for loblolly pine (n=50), and 4% for slash pine (n=82). All of Koehler's longleaf pine samples (n=505), save one with a deformed pith, plotted out as longleaf pine on the Koehler curve. Our measurements therefore validate the work of Koehler and demonstrate that longleaf pine timbers and stumps can be successfully identified with a potential false positive error rate of 2-4%. The method requires that measurements be made at stump height since this captures the unique coarse shoots of the grass and rocket stage of longleaf pine manifested in the large pith in the wood specimen (Fig. 4). Distorted pith may present measurement problems and one must be careful to avoid measuring false rings.

Conclusion
All longleaf pine timber and stump measurements clustered in the zone identified by Koehler as confirming longleaf pine while only one non-longleaf timber barely crossed the curve into the longleaf pine zone. Thus, a false negative assignment of longleaf pine as belonging to any of the other southern pines was shown to be highly unlikely. Koehler noted that other southern pines can rarely be erroneously identified as belonging to longleaf pine (false positive). However, the margin of error for a false positive is less than 5% and well within accepted error rates in the biological sciences. The Koehler method is therefore an effective means of identifying longleaf pine timbers and stumps with applications in the conservation and forest products fields.

Reference
Koehler, A. 1932. The Identification of Longleaf Pine Timbers, The Southern Lumberman, Volume 145, Pages 36-37.

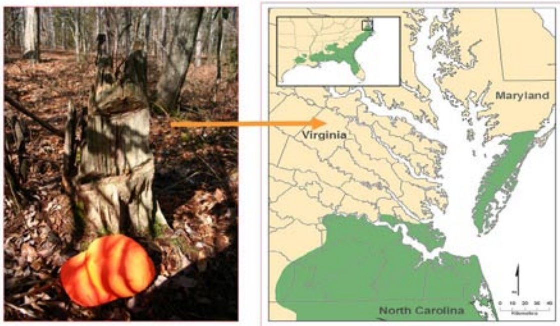

Figure 1. Caroline County turpentine stump and its location in relation to the historical range (shaded area) of longleaf pine in Virginia.

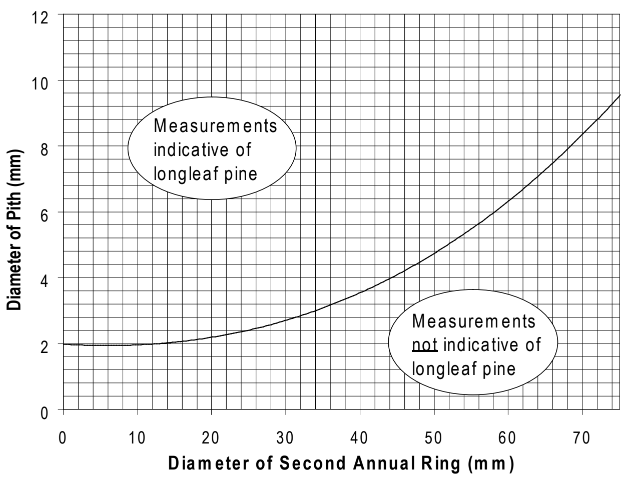

Figure 2. Koehler's plot for identifying longleaf pine timbers.

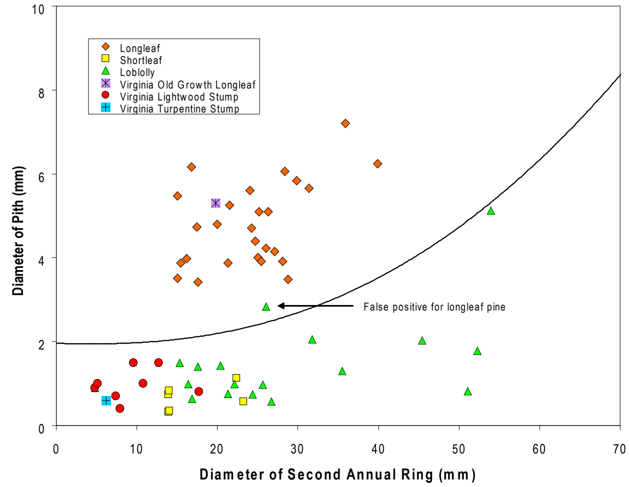

Figure 3. Measurements from plantation-grown loblolly, slash and longleaf pines along with old growth longleaf, lightwood and turpentine stump specimens.

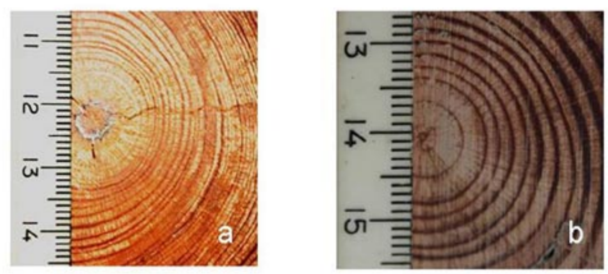

Figure 4. Longleaf pine (a) has a much larger pith (over 2 mm) than other southern pines (b) at stump height.

Woodland Grazing in the Southeastern United States: From Cracker Culture to Present

Bob Franklin[1] and Johnny Stowe[2]

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Abstract
Raising livestock on longleaf pine grasslands in the Southeastern United States is a practice steeped in traditions running back to the Old World, and though circumstances have changed since the frontier days of free range in the region, the natural and cultural heritage of savanna and woodland grazing remains relevant and the practice is regaining popularity. We discuss the dynamics of this phenomenon from its advent in early settlement days, and throughout the centuries as it rose and fell in popularity, setting the foundation for what we view as its potential role in natural resource and livestock management in contemporary times and the future.

Longleaf pine forests in the South have a long history of use by cattle grazing native forages. Livestock were first brought into the region over 450 years ago by the Spanish in Florida. Supplemented by later imports by the colonists who settled Georgia and the Carolinas, these animals formed the nucleus of a grazing industry that thrived in the South from colonial times into the 20th century. The industry had a major influence on the culture of the Coastal Plain South.

Range management of longleaf pine woodlands in the Deep South was minimal. Settlers adopted the Native American custom of "burning off" the woods to drive game and to freshen-up grass to provide early spring grazing for their cattle. Management consisted of year-round grazing in the Piney Woods, no supplemental feeding, and survival of the fittest. Literally, it was "Root hog (or cow), or die." Calf crops were less than 50%, weaning weights were less than 300 pounds. It often took five years to grow cattle to marketable size.

While it is well-known that Appalachia was settled primarily by folks of Scots-Irish descent, less well-known is the fact that much of the Deep South was settled by such Celtic folks. And although the plantation cotton economy is what the antebellum South is perhaps best known for -- in his book "Cracker Culture: Celtic Ways in the Old South," scholar Grady McWhiney notes that "In 1860 … southern livestock [was] worth half a billion dollars – more than twice the value of that year's cotton crop and approximately equal to the value of all southern crops combined" [authors' emphasis]. He adds that in the fifteen years before the war, Texas marketed about 280,000 cattle per year, while during a similar timeframe (the twenty years before 1850) in a much smaller area of the Deep South -- southern Mississippi, eastern Louisiana and western Alabama – 1,000,000 cattle were raised for market! McWhiney concludes that open-range herding was not just a result of folks living on the frontier, but was "the continuation in the Old South of traditions practiced for centuries by Celts.

After the War Between the States, large timber companies moved South and began clearcutting virgin longleaf pine forests, leaving extensive treeless landscapes. As a result, the understory grasses flourished and grazing conditions were at their all-time high for native range. Cattle production increased dramatically and the Deep South became known as cattle country.

In the 1930s, conditions began to change. Large, timber companies and the federal government began buying up much of this cut-over land and replanting pines. At about the same time, the federal government began a propaganda campaign -- pogrom is not too strong a word -- against the Southern heritage of woods-burning. Powerful forces and many taxpayer dollars were used to proselytize a culturally-ignorant and condescending message of fire suppression in the South. Felix Salten's novel Bambi was translated into English in 1929; then Walt Disney got a-hold of it, Disney switched the chief threat to Bambi and his companions from poachers to fire. Bambi was for a time used in a fire prevention poster.

In the 1920s, 30s and 40s -- our country's fire suppression movement became entrenched in government and forest policy. Starting in 1924, federal funds were withheld from state forestry agencies if they even tolerated prescribed burning. Then the American Forestry Association undertook a massive propaganda campaign, the Southern Forestry Education Project, from 1927-1930. Teams of men known as the Dixie Crusaders were sent into the rural South with trucks equipped with generators, movie projectors, films, radio broadcasts, posters, and pamphlets. They traveled 300,000 miles and passed out 2 million pieces of literature along the way. They presented more than 5,200 motion picture programs and lectures to 3 million people, many of whom likely had never seen a film. One of the main themes of this mis-information campaign was fire's purported destructive effect on wildlife.

In 1945, Smokey the Bear came along. His slogan, *"Remember, Only You Can Prevent Forest Fires"* was the theme of one of the most successful advertising campaigns ever. In ways, the advent of Smokey was a death blow to ecosystem integrity on many wildlands in the SE. Of course, Smokey has done some good, and the part of his message about not being careless with fire will always be right-on, but one can argue that Smokey did more harm than good in the SE by disintegrating fire-dependent ecosystems and fostering fuel build-ups that eventually resulted in catastrophic wildfires. Smokey and his cohorts could also be labeled culturally-insensitive, for they ignored not just the ecological, but also the cultural value of woods burning, which was such an integral part of Southern life.

Interest in woodland grazing began to change with the start of World War II. The war increased the demand for beef, and research was initiated to develop proper management methods to coordinate cattle and timber production in southern pine forests.

Native Range Management

Most natural longleaf forests in the South today are considered to be either longleaf-wiregrass or longleaf-bluestem range. Wiregrass range is found primarily on the coastal plain east of south central Alabama. Bluestem grasses generally dominate westward into Louisiana and Texas, as well as Upper Coastal Plain sites throughout the region. The wiregrass type is dominated by grasses in the genus Aristida. Other important grasses include Curtis dropseed and native bluestems, as well as species of paspalums and panic grasses. Forbs in the legume and aster families are common.

Longleaf-bluestem range is dominated by bunchgrasses in the genera Andropogon and Schizachyrium, including little bluestem, pinehill bluestem, big bluestem, creeping bluestem, pineywoods dropseed, cutover muhly, and Indiangrass. Panicums and paspalums are also present. Plants in the legume and aster families are common.

Livestock management for woodland grazing should be limited to grazing by cattle. Hogs have no place in longleaf forests because of the damage they cause by rooting-up and eating young seedlings. Hogs should be excluded from longleaf range.

Management strategies to improve grazing are thin pine forests early and often and to use prescribed fire. As pine stands grow, grass yields decline due to shading. Frequent thinning of the timber is vital to maintain forage yields throughout the rotation. Stands should be thinned as early as practical and often. Where grass production priorities are high, pines should be thinned to residual basal areas of 50 to 70 square feet per acre or less.

Prescribed fire is considered by many to be the most effective tool in maintaining forage beneath pine forests. Fire improves forage quality and can be used to concentrate and rotate grazing. Ranges burned on a 3 year rotation get their highest use by cattle the first year and correspondingly less use each year until the area is burned again. For longleaf-wiregrass ranges, it's best to burn using a late winter or early spring prescribed fire on a two-year rotation. On bluestem range, burn on a three-year rotation in late winter or early spring.

The sometimes problematic propensity of winter burning to only top-kill hardwoods, which then resprout prolifically, can be a boon in woodland grazing, since cattle can benefit from browsing these sprouts.

When reforesting cut-over pine stands with grazing or wildlife values in mind, use minimal levels of site preparation. In general, longleaf stands with a history of prescribed fire often need no more site preparation than a good prescribed burn during the growing season prior to seedfall or planting. This will benefit the grazing resource.

Intensive site preparation, especially if mechanical methods or broadcast herbicides are used, can eliminate native grasses. One pass with a drum-chopper in conjunction with prescribed fire will damage the forage resource less than shearing or root-raking with disking. Spot applications, individual stem treatments or herbicides applied in bands will be less damaging to herbaceous vegetation than broadcast applications. Also, use herbicides to which grasses are resistant.

Grazing Management

Native forages in the South are most nutritious during the spring and summer. Grazing should be timed to take advantage of this. Wiregrass is most nutritious and palatable for cattle when resprouting after a late winter or early spring burn. Range dominated by wiregrass can be best utilized from early spring to mid-summer. Utilization of wiregrass should be no greater than 50 percent and cattle should be stocked only in relation to the amount of forage available. Bluestem ranges can best be utilized by from early spring through late summer. Bluestem grasses can be grazed year-round without damage if supplemental feed is provided during the fall and winter. Regardless of the range type, cattle and the range itself do better when grazed during spring and summer, supplemented with periods of pasture grazing from mid-summer into autumn and supplemental feeding of hay, protein supplement, or grazing of winter annual grasses during the winter and early spring.

Wildlife and Fuel Load Considerations

The key to compatible management of wildlife and cattle is being able to adjust cattle stocking to available forage while reserving a portion for wildlife. One rule of thumb used on Louisiana ranges for combined deer and cattle management is to reserve 15 percent of the total livestock carrying capacity for deer. The amount reserved will depend on objectives and must be accounted for when developing grazing plans. Failure to allow for wildlife use when grazing in longleaf pine woodlands can cause forages to be overgrazed and cause habitat degradation.

Grazing can also be used to improve wildlife habitat. Research in Florida found that woodlands grazed in a short-duration grazing system, forage values are improved for both cattle and wildlife. In this study, wiregrass range was grazed by cattle to a 50% utilization and rested for

4 months. As a result, wiregrass, saw palmetto, and brush were reduced while other grasses and legumes increased, improving habitat for some wildlife species and grazing values for cattle.

Livestock grazing may have potential for improving understory conditions on lands where prescribed burning may be difficult due to adjacent, incompatible land use. Using one of the heritage breeds of cattle (e.g. longhorn cattle, cracker cattle or pineywoods cattle) along with a high-intensity, short duration grazing system may control encroaching brush where periodic application of fire is a challenge. This idea also has implications for public safety (reducing fuel loads) and rare species management (e.g maintaining open conditions required for species such as the red-cockaded woodpecker and many species of pineywoods plants), and needs more research. One advantage of controlling vegetation by "running it through a cow" rather than merely treating it with mechanical (cutting) methods is that the cattle not only change the vegetative structure, but they also process the biomass and convert it via their waste to a form that degrades quickly into the soil, and so the "treated" vegetation is no longer flammable. Cutting changes the structure but the result is usually that the cut stems then lie, dried and volatile, on the ground several years, posing potential wildfire hazards.

Heritage, Culture and Tradition

While "paying the bills" is important to all land management enterprises, woodland grazing and the woods-burning that is so closely aligned with it have more than just strict utilitarian value; they are a vital part of Southern culture, having helped shape the distinct, multi-cultural southern character.

A Case for Synergism

Southerner E.O. Wilson avows that "If we can't combine regional pride with conservation science, all is at peril." Woodland grazing has the potential to pull together folks with wide interests -- to serve as both substrate and process, as a means as well as an end, and to synergize values and outcomes -- in a way few other practices can. With proper support and energy, using a bottom-up approach such as the one the Longleaf Alliance innovated and implemented so well, woodland grazing could serve many roles in the southern Pineywoods -- conserving at once – precious land, and a diverse market of "products" ranging from timber to hunting leases to beef and ecotourism, all while enhancing public safety, and restoring and protecting a unique natural and cultural heritage. It is a concept whose time has come.

Suggested Readings

Byrd, N.A., C.E. Lewis and H.A. Pearson. 1984. Management of southern pine forest for cattle production. Gen. Tech. Report R8-GR4. Atlanta, GA: USDA Forest Service, Southern Region. 22p.

Grelen, H.E. 1978. Forest grazing in the South. Journal of Range Management 34: 244-250.

McWhiney, G. 1988. Cracker culture: Celtic ways in the Old South. The University of Alabama Press. Tuscaloosa, AL. 290 pp.

Moore, G. and W.S. Terry. 1979. Short-duration grazing may improve wildlife habitat in southeastern pinelands. In: Proceedings of the annual conference of the southeastern association of fish and wildlife agencies. 33: 279-287.

Paisley, C. 1981. From cotton to quail: An agricultural chronicle of Leon county, FL, 1860-1967. University Presses of Florida. Tallahassee. 162 pp.

Reid, V.H. 1954. Multiple land use: Timber, cattle and bobwhite quail. Journal of Forestry 52:575-578.

A Landscape Level Tool to Assess Longleaf Pine Extent: Connecting the Dots

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Abstract

Over the past decade, a ground swell of interest has formed around restoring functional longleaf pine ecosystems. In many instances, the goals in restoring longleaf pine forests have been to enhance regional biodiversity and to increase the abundance of target species such as the red-cockaded woodpecker, gopher tortoise, eastern indigo snake, flatwoods salamander, etc. Restoration of longleaf ecosystems is needed adjacent to focal areas of existing longleaf ecosystems to enhance acreage and sustainability which provides threatened and endangered species habitat, thereby increasing the possibility of delisting some species. However, without proper conservation planning tools in place, the allocation of restoration dollars continues in a shot gun approach, and thus adding little to the restoration of a functioning (landscape scale) longleaf pine ecosystem.

The Longleaf Alliance is working in coordination with numerous partners on an effort to develop a GIS database of existing longleaf pine stand data. While the longleaf pine ecosystem now covers only a fraction of the millions of acres it once occupied, efforts to protect and restore this ecological system must focus on specific geographic areas that historically supported this forest type. This database will include: public lands within historic range of longleaf pine, known populations of RCWs and gopher tortoises, extent of existing longleaf pine forests on both public and private lands (using best available technology), and newly planted longleaf pine plantations. The database will help assess the current extent of available spatial data on longleaf pine forests and provide a building block in the restoration of the longleaf pine ecosystem. The database will serve as an effective conservation tool by targeting areas of high ecological potential and thereby maximizing the impact of restoration dollars. Among the various utilities of this database will be to develop potential ways to prioritize likely restoration focal areas and/or corridors.

The Healthy Forests Reserve Program: An Assurance and Incentive-Based Tool for Conserving Listed Species on Private Land

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Abstract

Conservation programs have provided numerous opportunities for conserving habitat on a large scale. Indeed, with 75 percent of land in the Southeast privately owned, landowner incentive programs are vital to wildlife conservation, especially for federally listed species. Critical to recovery of the federally listed gopher tortoise (*Gopherus polyphemus*) is habitat restoration. We present a new and unique landowner incentive-based approach, the Healthy Forests Reserve Program (HFRP), administered by USDA Natural Resource Conservation Service (NRCS) in consultation with the U.S. Fish and Wildlife Service (Service). The voluntary program offers Safe Harbor like Landowner Protections and financial and technical assistance to restore and protect healthy forests and their listed or at-risk species through easements or restoration agreements. In 2006, a pilot program began in Mississippi targeting longleaf pine habitat restoration for gopher tortoise, Mississippi gopher frog and black pine snake. We present information and preliminary results of this program, which will be open for proposals nationwide in 2008.

Sag Ponds: Rare and Unique Wetlands of Mountain Longleaf Pine Woodlands, Northwest Georgia, USA

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Abstract

Sag ponds are rare and unique freshwater wetlands scattered in parts of the ridge and valley physiographic province of Northwest Georgia. Greear, in his seminal work on these habitats, noted that they contain plants having both coastal plain affinities as well as those representing relics of northern populations, most likely as a result of climate fluctuations during the late Quarternary. Many of these karst wetlands have been destroyed or altered compositionally, structurally, hydrologically, and/or by fire-suppression, leaving the remaining few among the most critically imperiled community types in the world. While the threat to longleaf pine ecosystems regionwide, and to certain isolated, freshwater depressions (limestone sinks, Grady ponds, Carolina Bays, and depression meadows) embedded within longleaf pinelands has been recognized, much less is known about montane longleaf pine woodlands and their associated wetlands. Montane longleaf ecosystems are particularly imperiled and in need of immediate conservation action because of their proximity to major metropolitan areas (Atlanta and Birmingham) that are metastasizing at alarming rates. We highlight recent partnerships to conserve and protect montane longleaf pine woodland and sag pond wetland complexes on two privately owned tracts in Bartow and Floyd counties, Georgia. We call for quick action to assess, inventory, and prioritize for conservation the remaining sag ponds, especially those identified by Greear, and their associated

upland habitats.

Introduction

While the threat to longleaf pine ecosystems regionwide, and to certain isolated, freshwater depressions (limestone sinks, Grady ponds, Carolina Bays, and depression meadows) embedded within longleaf pinelands has been recognized, much less is known about montane longleaf pine woodlands and their associated wetlands. Sag ponds are rare and unique isolated freshwater wetlands scattered in parts of the ridge and valley physiographic province of Northwest Georgia. Many of these wetlands are found in areas formerly known to contain montane longleaf pine habitats.

Geology

Sag ponds occur in the Knox Group formation that differs from typical lime sink areas mainly in the great thickness of residuum overlying the assumed parent dolomite (Greear 1967). Extensive underground solution caverns caused by circulating artesian water may become extensive enough to permit the slumping of the surface residuum, resulting in sag pond formation (Watts 1970; Greear 1967). Ponding results as silt and organic debris accumulates over time and overlying soils become less and less permeable to the down flow of surface water.

Hydrology

The hydroperiod of sag ponds is influenced by climate, water table and accumulated rainfall, position in the watershed, evapotranspiration potential of surrounding vegetation, impermeability of soils, and surface drainage (Greear 1967). Greear (1967) identified four levels of development of sag ponds based on age: 1) The dry type, which rarely retains water for more than a few hours after rain; 2) the young pond type fills with rain water in winter and spring, and water in this pond recedes rapidly after spring rains end and the water table recedes; 3) the mature pond type varies in water-holding ability depending on the thickness of the organic silt deposit, which effectively prevents drainage through the depression and through which water flows throughout much of the year in drainage channels; and, 4) the extinct pond type, which includes depressions which have filled with sediments to a level almost as high as the floor of the drainage channel.

Vegetation and Zonation

Greear (1967) assumed riparian zonation in sag ponds was primarily a consequence of hydroperiod influences, with zonation apparent in all sag ponds except the dry sag type. Decades of fire suppression likely played an important role in altering dominant vegetation in sag pond zones with, perhaps, the exception of the mature pond type. Watts (1970) simplistically separated vegetation zones for mature sag ponds into an outer Acer rubrum-Lyonia lucida (red maple-fetterbush) zone, a middle Nyssa biflora (black gum) zone, and, in the water itself, an inner Cephalanthus occidentalis (buttonbush) zone.

Climate fluctuations and associated cyclic variations in water levels provide an environment to which plants associated with coastal plain flora and, in some cases, northern semi-aquatic flora are adapted (Greear 1967). Greear (1967) identified 49 plant species from sag ponds not previously recorded outside the Coastal Plain or in the Ridge and Valley Physiographic Province, and six species related to vegetation of northern provinces. The Georgia Natural Heritage Program lists a number of plants of Special Concern associated with sag ponds, including several sedges (brown bog sedge/Carex buxbaumii [G5/SH]; and tussock sedge/C. stricta [G5/S1]); spikerush/Eleocharis erythropoda [G5/S1?]; several grasses (sharp-scaled manna-grass/Glyceria acutiflora [G5/S1?], and pale manna-grass/G. pallida [G5/SH]); featherfoil/Hottonia inflata [G4/S1]; and pin oak/Quercus palustris [G5/SH].

Conservation Need for Sag Ponds and Associated Montane Longleaf Pine Ecosystems

Montane longleaf pine forests in Georgia and Alabama are globally imperiled (G2) habitats whose survival depends on frequent, low-intensity, growing-season fires to control understory vegetation and for the reproduction of Pinus palustris (NatureServe 2008). Human-induced influences have resulted in a dramatic reduction of montane longleaf pine forest from its presettlement range, making it the most imperiled of the longleaf pine ecosystems in the U.S., comprising only two percent of the remaining longleaf stands nationwide (Stowe et al. 2002). Many sag pond wetlands have been destroyed or altered compositionally, structurally, hydrologically, and/or by fire-suppression, leaving the remaining few among the most critically imperiled community types in the world. The importance of sag ponds to amphibians should not be understated. These fishless ponds provide breeding and rearing habitat to amphibians (frogs, toads and salamanders). Both of these ecosystems are particularly imperiled and in need of immediate conservation action because of their proximity to major metropolitan areas (Atlanta, Birmingham, and Chattanooga) that are metastasizing at alarming rates. In partnership with private landowners, Chestatee-Chattahoochee RC&D, Georgia Department of Natural Resources, Natural Resources Conservation Service, and Georgia Forestry Commission, montane longleaf and sag pond wetland complex restoration is in progress on two tracts in Bartow and Floyd Counties, Georgia. We urge quick action to assess, inventory, and prioritize for conservation the remaining sag ponds, especially those identified by Greear, and their associated upland habitats.

Acknowledgments

We thank Riverside Farm, LLC and Anheuser-Busch Company for their efforts to conserve sag ponds and montane longleaf pine on their properties in Floyd and Bartow Counties, Georgia (respectively).

For further information please contact anita_goetz@fws.

gov or StoweJ@dnr.sc.gov. More information on this and related projects can be obtained at ecos.fws.gov/habits (Project numbers 43910, Riverside Farm; and 49220, Anheuser-Busch, Resource Recovery Farm).

References

Georgia Department of Natural Resources. 2005. A comprehensive wildlife conservation strategy for Georgia. Wildlife Resources Division. Available from: http://www.gadnr.org/cwcs/Documents/strategy.html

Greear, PF-C. 1967. Composition, diversity, and structure of the vegetation of some natural ponds in northwest Georgia. Ph.D. Thesis. University of Georgia. Athens, GA. 184 p. with Appendices.

NatureServe EXPLORER. 2008. An Online Encyclopedia of Life, Ecological Association Comprehensive Report. Montane mixed longleaf woodland. Available from: http://www.natureserve.org/explorer/

NatureServe EXPLORER. 2008. An Online Encyclopedia of Life, Ecological Association Comprehensive Report. Central interior highlands and Appalachian sinkhole and depression pond. Available from: http://www.natureserve.org/explorer/

Schiff, AL. 1962. Fire and water; scientific heresy in the Forest Service. Cambridge, MA. Harvard University Press. 225 p.

Structural Characteristics of an Old-growth Longleaf Pine Stand on Horn Mountain, Alabama

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Abstract

Descriptions of forest structure are critical to assessing current forest condition as well as providing guidance for ecological restoration and future management activities. Tree species, age, and size and size are metric frequently used to describe forests. In addition, relative measures such as importance values are useful in comparing different forest stands. We apply these approaches to examine a poorly understood region of longleaf pine (Pinus palustris Mill.) in the montane (northern) portion of its range. Stand and age structure were evaluated in a fire-excluded old-growth longleaf pine montane forest on Horn Mountain in the Talladega National Forest located in north-central Alabama and compared to two frequently burned old-growth stands. The recently discovered 10 ha Horn Mountain stand is thought to be the largest remaining old-growth longleaf stand in the montane region and contains several age classes ranging from 35 to 200+ years old. However there is pronounced lack of trees in younger/smaller size classes, an indication of fire exclusion. Age class distributions of frequently burned longleaf stands often resemble a reverse J-shape curve, the result of relatively consistent recruitment. Preliminary data from Horn Mountain suggests that recruitment in montane areas like the Coastal Plain, likely suffers under fire exclusion. However unlike previously studied Coastal Plain fire excluded stands, Horn Mountain support some juveniles, perhaps as a result of increased slope that contributes to maintaining some openings in the ground layer. In addition, there several individuals of not only longleaf pine but also two hardwood species are over 100 years, indicating that they were present prior to fire exclusion. Presently the Horn Mountain stand also contains fire intolerant hardwood and non-longleaf species as unnatural components of the canopy layer as the result of decades of fire exclusion.

Project Orianne: The Indigo Snake Initiative

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Abstract

Project Orianne Ltd.: The Indigo Snake Initiative is a newly formed conservation organization focused on the range wide conservation of eastern indigo snakes (*Drymarchon couperi*). Despite being on the United States Endangered Species List indigo snakes have received little attention relative to many other listed species (i.e., charismatic mega-fauna). The Indigo Snake Initiative is turning attention to this snake by providing expertise and resources to create one of the largest snake conservation efforts in the world. To achieve conservation outcomes, we are currently working on land acquisition, land management, reintroduction, inventory, monitoring, and research programs. We have two primary approaches to indigo snake conservation. First, to purchase, protect, and manage land in areas where indigo snake populations remain strong. Second, to conduct research to understand the cause of snake declines, mitigate the factors that have caused the declines, conduct land management to restore habitats, and reintroduce snakes into areas where they have been extirpated. Our plan is to use the indigo snake as a model and change the way conservation is achieved. The Indigo Snake initiative is a collaborative effort including over 15 partners working together as a coalition.

Increasing the Resiliency and Carbon Sequestration Potential of Gulf Coast Forests in the United States

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Abstract

The gulf coast of the United States is highly prone to frequent and severe hurricanes such as the devastating Hurricane Katrina (August 2005) which damaged over 5.5 million acres of forest. This damage may have been exacerbated by large-scale exploitation of native longleaf pine forests over the past centuries followed by the conversion of these sites largely to loblolly pine plantations. We are revisiting an experiment established in 1960 at the Harrison Experimental Forest in Saucier, Mississippi. Longleaf, loblolly and slash pine (local origin, unimproved) were planted under different intensities of management. Although longleaf pine initially grew slower, it had matched loblolly pine growth after 25 years and due to increased mid-rotation growth rate along with lower mortality had the highest volume of timber after 48 years. We are now quantifying the impacts of stand culture, species, and hurricane damage on productivity and above- and below-ground carbon sequestration. Preliminary results indicate that the longleaf pine stands now contain more than twice the amount of total carbon than the loblolly pine stands. Increased carbon sequestration provided by the more hurricane resistant longleaf pine may provide a co-benefit that provides further incentives for landowners to restore the species across the region. A new companion study using state-of-the-art genetically improved stocks as well as fire treatments, as suggested by Region 8 representatives, is in the planning stage.

Fire in Alabama – A Brief History

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Abstract
H.H. Chapman, Professor of Forestry at Yale University, had these thoughts that need to be understood when thinking about fire: "It must be emphasized that a forest type is the form of vegetation which is best adapted to survive not merely a few selected conditions like soil and climate, but all the conditions which will arise over the entire period or span of life of the individual trees of which it is composed."

"In the longleaf pine type of the South (and nowhere else in North America to the writer's knowledge) fire at frequent but not necessarily annual intervals is as dependable a factor of site as is climate or soil. The conception of a climax type as one which has reached a stage of permanent equilibrium or perfect adaptation to these constant factors of site should include the longleaf pine type of the South, which represents by far the greatest area and most permanent characteristics of any climax to be found in the United States." *(1932) Is the longleaf type a climax? Ecology 13:328-334*

This poster will provide a brief history of fire in Alabama through the use of photographs.

In Memory of the Flomaton Natural Area: or Another Trailer Park Comes to Alabama

John S. Kush

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Abstract
In 1931, B.W. Wells and I.V. Shunk wrote: "In its pristine condition with millions of trees measuring a yard or more in basal diameter, the Pinus palustris consocies unquestionably presented one of the most wonderful forests in the world. And today hardly an acre is left in North Carolina to give its citizens a conception of what nature had wrought in an earlier day. **The complete destruction of this forest constitutes one of the major social crimes of American history**." *1931. The vegetation and habitat factors of the coarser sands of the North Carolina Coastal Plain: an ecological study. Ecological Monographs 1:465-520.*

History is there to teach us but too often we fail to learn from history. This poster pays tribute to the Flomaton Natural Area. It withstood nature's test of time but could not withstand the apathy of many.

Longleaf Pine Management Plan for Fort Rucker

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Abstract
To-date, 18,557 acres on Fort Rucker, Training Areas 1 through 20, have been cruised. Using these data, an integrated forest management plan will be developed based on: 1. natural regeneration of existing natural stands of longleaf pine; 2. establish longleaf pine plantations where possible and where needed; and 3. create prescribed burning regimes and/or patterns that will benefit military training (especially S.E.R.E. Training), longleaf pine restoration and wildfire prevention.

To achieve these goals, using the existing stand inventory and stand description data, along with some site visits by forest scientists and land managers, options for timber harvesting plans and silvicultural methods will be discussed for Training Areas 1 through 20. This will include prescribed burning plans and what may need to be considered for wildfire prevention.

A critical portion for this plan is to get input from S.E.R.E. Trainers. This may be facilitated by presenting the above-developed prescriptions to the Trainers for a selected

training area inside the S.E.R.E. area and breaking them down into smaller units (both harvest and burn) for their input. This could require adjustments to better meet the military mission. The other critical portion for this effort is the involvement and close coordination with the forestry and environmental staff at Fort Rucker.

Stand Dynamics for Even-age Longleaf Pine: A Nexus between Red-Cockaded Woodpecker Recovery, Savanna Conservation and Habitat Restoration

John S. Kush, Becky Barlow, Don Imm[1], Pete Johnston[2], John Blake[2]

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Abstract

A strong negative relationship exists between southern pine overstory stocking levels and the biomass and richness of savanna understory plant species and the occurrence of characteristic animal species. Typically the thresholds for the negative effects of the overstory on plant biomass and richness are at very low stocking levels (10-20 sq-ft basal area/ac). Group fitness (group size, reproduction, etc.) for the red-cockaded woodpecker is hypothesized to be a function of the understory grasses and forb cover, hardwood density, and the diameter distribution of the overstory pine. These relationships suggest that stand dynamics of longleaf pine creates a nexus between the recovery of the red-cockaded woodpecker and the conservation and restoration of fire savanna habitat. The concurrent vegetation conditions set by the USFWS "Recovery Standard" require plot data that is not available from regional longleaf datasets or published inventory strategies. An analysis of longleaf pine stand dynamics was conducted relative to minimum thresholds required to restore nesting and foraging habitat since the data is available.

Stand Dynamics of Two Old-growth Montane Longleaf Pine Stands on the Mountain Longleaf National Wildlife Refuge

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Abstract

The structure of longleaf pine (*Pinus palustris* Mill.) forests of the southeastern United States coastal plains has been the focus of numerous studies. By comparison, the longleaf pine forests in the mountains of Alabama and Georgia are not well-understood. Much of what little work conducted in these areas occurred prior to the mid 20th-century. It is estimated that less than 0.004% of the remaining longleaf pine stands are considered to be old-growth, trees greater than 100-120 years old. Of this total, less than 1% of the old-growth stands are found in the montane portion of longleaf pine's range. Several of these old-growth longleaf pine stands occur on the Mountain Longleaf National Wildlife Refuge located in northeastern Alabama, USA. A 1998 study documented the conditions in two old-growth longleaf pine stands on the Refuge. The purpose of that study was to describe the age and stand structure and shed light on the past disturbance and replacement patterns of two remnant old-growth longleaf pine stands. In 2006 and again in 2008, these two stands were re-measured to document what changes had occurred in the following years. One stand was subjected to a relatively intense prescribed fire in the interim between 1998 and 2006 while the second stand was burned in early 2008. Both stands suffered a decline in tree density, but only the stand burned prior to experienced a loss in basal area. This finding was a surprise given that fire is needed to maintain longleaf pine ecosystems. The changes in stand dynamics for these two stands will be presented and discussed.

The Solon Dixon Forestry Education Center: An Applied Learning Opportunity

Joel Martin, Mark Hainds, JJ Bachant-Brown and Rhett Johnson

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Abstract

This poster will provide historic information on the Dixon Forestry Center as well current efforts related to education and management of longleaf pine, forestry & wildlife in general, and many other related natural communities and features. Established in 1978 and opened in 1980, this 5350 acre tract was donated by Solon & Martha Dixon with goals of providing natural resources education opportunities to Auburn University and other visitors, providing a base of support for research, serving as a source of information transfer from the scientific community to the general public and to manage its natural resources wisely and economically to financially support the Center's operations. For 30 years the Center has functioned as a working forest and has been used as a classroom by groups ranging from professional organizations to universities to elementary students. Comfortable accommodations, good food, affordable costs, a diverse forest & land base, a diversity of wildlife, and the close proximity to many other landholdings and production facilities all function to create a truly unique learning experience.

Financial Performance of Loblolly and Longleaf Pine Plantations

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Introduction

The past decade has seen significant shifts in timberland ownership, particularly in the southern United States. Integrated forest product companies have sold many of their land assets, which have subsequently been acquired by institutional investors. Many of these investments act as closed-end funds, meaning a key aspect to the investment is a short-time horizon relative to integrated forest product companies. Along with shifts in forest ownership, the past decade has also seen increased interest in longleaf pine management. Various organizations have encouraged longleaf plantation establishment with much of their effort directed at private landowners whose objectives include wildlife habitat and aesthetics in addition to economics. Little work has been done examining the economic viability of longleaf pine management on investment properties. Although it is a commonly-held belief that loblolly pine economically outperforms longleaf pine, improvements in nursery techniques and silvicultural practices indicate that longleaf may be more financially viable than previously believed. This study compares the financial performance of selected management regimes for loblolly and longleaf pine plantations for four cases, each with low and high site productivity levels and each evaluated using 5% and 7% real discount rates. In all cases, longleaf pine was considered both with and without pine straw harvesting as part of the management regime. This analysis focuses solely on the economics of plantation management.

Methods

The financial performance of loblolly and longleaf pine plantations were compared for the cases including both low and high site productivity levels. For the comparison, loblolly pine site index values (60 and 80 feet at base age 25) were converted to equivalent longleaf pine site index values (85 and 110 feet at base age 50). Discounted cash flows were generated for 5% and 7% real discount rates. In all cases, longleaf pine was considered both with and without pine straw raking. Planting density and first year survival were assumed to be identical for both species. Management activity timing was limited to biologically reasonable and operationally feasible levels, and treatment intensity was based on regionally-accepted values. Loblolly pine plantations were projected using the Forest Nutrition Cooperative Decision Support System (LobDSS), and longleaf pine plantations were projected using the FORSim Longleaf Pine Growth Simulator (LPGS). Merchandizing specifications and associated prices along with revenues and costs also followed regionally-accepted values. Regimes that maximized land expectation value (LEV) for each discount rate/site index combination were chosen for further analysis. Financial comparisons were based on LEV and first rotation present net worth (PNW).

Results

In all but the high site (SI 80/100) and 7% discount rate case, the chosen regimes for longleaf with pine straw raking have two thinning treatments and two rakings. This indicates that at the high discount rate, the revenues generated by a second thin and raking cannot offset the holding costs of maintaining the stand. The intensive loblolly pine regimes produce higher LEV than longleaf except for the high site and 7% discount rate case. It is worthwhile noting, however, that the longleaf regimes do not represent a substantial LEV loss. Longleaf regimes that include pine straw raking produce positive cash flows sooner than those without raking. For all loblolly regimes, positive cash flows were not achieved until final harvest. Longleaf plantations with straw harvests and longer rotations produced a higher percentage of sawable wood compared to loblolly plantations. As the discount rate increased from 5% to 7%, rotations decreased and there was a shift towards regimes that produced more pulpwood and chip-n-saw. Research reported at Auburn University indicates greater pole production in 39-year-old longleaf stands (72%) than in loblolly stands (<8%) of the same age. With as little as 25% of the sawtimber volume classified as poles, longleaf pine with straw raking financially outperformed loblolly at all site and discount rate combinations. Note that the chosen regimes for the four cases may produce sub-optimal LEV values when pole production is considered. As a result, the comparison may be even more favorable.

Conclusions

Results indicate that longleaf pine regimes failing to incorporate pine straw raking yield financially inferior results to those from intensive loblolly management. With the addition of pine straw raking, however, longleaf management can yield returns comparable to typical loblolly regimes (-16% to +3%). In fact, longleaf management with pine straw raking produced greater LEV than loblolly plantations on lands with high site index (SI 80/110) with a 7% discount rate. Furthermore, there may be additional upside potential for longleaf when pole production is considered. At the lower discount rate, longleaf pine regimes with pine straw raking produced positive cash flows sooner than loblolly. It should be noted, however, that no regime produced positive cash flows prior to age 23. A lack of positive cash flow is noteworthy since 23 years is greater than the land tenure of most closed-end funded investments, indicating that direct return on reforestation investment is unlikely. A logical consequence may be the minimization of reforestation costs. Given the 25% lower initial investment and the favorable LEV/PNW comparisons, longleaf pine may be an attractive alternative for some landowners.

Prescribed Fire Planning and Implementation at Eglin AFB, FL

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Abstract

Eglin AFB, totaling approximately 464,000 acres, is the largest Air Force base in the U.S. Located in the panhandle of northwest Florida, over 362,000 acres of this area consist of fire-dependent longleaf pine sandhills, flatwoods, and uplands. Eglin's longleaf pine forest is the largest contiguous tract of the world's remaining old growth longleaf pine and is home to 77 state and federally listed species, including the 4th largest population of red cockaded woodpeckers. The prescribed fire planning and implementation process on Eglin AFB begins with the running of the burn prioritization model which predicts the highest priority burn blocks across the reservation. Once the map has been created, pre-burn preparation begins in earnest with the preparation/protection of values at risk from fire including RCW trees, power poles, structures, erosion control devices, etc. Concurrently burn packets are created for each block to include all of the necessary paperwork to conduct the burn. As far in advance as possible, the planning team views planned mission activity to provide early deconfliction with smoke-sensitive military missions. After an area has been chosen, more detailed coordination occurs with Range Operations Control Center (ROCC) including a predicted smoke plume based on the weather for the day. Once the burn has been approved by ROCC, the burn boss will conduct a briefing detailing duties and assignments for all personnel during the burn, the expected weather and other information about the burn. All mission personnel and the media are notified prior to each burn.

Think Locally, Act Neighborly: An Updated Approach for Managing Invasive Species in Florida

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Abstract
Invasive species know no boundaries and continue to degrade Florida's declining habitats. If landowners and land managers wish to achieve long term success, it is critical for them to reach out and collaborate with all stakeholders. The Florida Invasive Species Partnerships (FISP), originally formed in 2006, is striving to focus statewide efforts on prevention as well as treatment. By working together, we hope to encourage development of innovative management approaches, provide new tools, decrease implementation costs, and ultimately increase effectiveness. During 2006 and 2007, FISP developed the dynamic "Incentive Program Matrix" of existing federal, state and local funding sources, incentive programs and technical assistance for private landowners in Florida. The interactive matrix database will allow both private and public land managers to determine what current technical and financial assistance is available to best suit their specific needs and coordinate control efforts across boundaries. In 2007, FISP began promoting the concept of Cooperative Invasive Species Management Areas in Florida. The goal of this effort is to encourage development of local partnerships between federal, state, and local government agencies, tribes, individuals and various interested groups to manage invasive species in a defined area. To date, there are 11 CISMAs developing across Florida from Walton County to the Florida Key's Invasive Task Force. In 2008, FISP developed the FloridaInvasives.org website which expands invasive species management efforts across the landscape and builds community awareness by providing the "Incentive Program Matrix" and CISMA information on line.

Treatments for Restoration Gulf Coastal Plain Longleaf Forests

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Abstract
The southern region of the United States has numerous thunderstorm days each year and therefore considerable lightning activity that can and does ignite fires (Komarek, 1964). Native Americans used fire regularly to manipulate and manage the environment around them (see Robbins and Myers 1992, Anderson 1996), thus augmenting these natural fires. Historically, prior to fragmentation of the landscape, fire was a frequent natural occurrence (every two to eight years) across much of the South (Christensen 1981; Abrahamson & Hartnett 1990; Ware et al. 1993). These fires regulated plant composition and favored those species that survived frequent burning, like longleaf pine (*Pinus palustris* Mill.).

These longleaf pine communities that once dominated much of the Gulf Coastal Plain burned every 2 to 4 years with low intensity fires (Frost 2006), which maintained open stands with a herbaceous dominated understory. This burning also kept fuel loads low, thereby reducing the probability of more severe wildfires. Reduced fire frequency during the latter portion of the 20th century allowed hardwoods to increase in the mid and overstory layers while woody shrubs gained understory dominance. Redjustment of the structure and composition would improve the health of this ecosystem. We know that repeated burning at very frequent intervals, i.e. annually or biennially, will readjust the composition of the understory to favor grasses and forbs over woody shrubs and will reduce the density of midstory hardwoods (Waldrop et al. 1987). Unfortunately, we often do not have time to wait and there are numerous areas that are very difficult to burn. Thus, there is a need for fire surrogates to augment fire as a fuel reduction and restoration treatment or as a replacement for fire on hard to burn areas. The objective of this study was to compare management options for readjusting the structure and composition of longleaf communities.

This cooperative research study with Auburn University was initiated at the Solon Dixon Forestry and Education Center near Andalusia, Alabama in 2001. Treatments included an untreated control (no fire or other disturbance), prescribed burning only, thinning of selected trees, a combination thinning plus prescribed burning, and herbicide plus prescribed burning. These were applied utilizing a randomized block design with three blocks and five treatment units in each, to stands with longleaf dominated overstories. A treatment unit consisted of a core area of about 12 ha and a surrounding 20 m buffer. All units had been prescribed burned during the dormant season 2 or 3 years prior to initiation of the study.

Trees in selected units were marked for thinning during late 2001 targeting hardwoods, pines other than longleaf, and longleaf with defects or in dense clumps with a desired basal area after thinning of 11.5 to 13.5 m^2/ha. Thinning was done by a commercial logger from February to April 2002 followed by prescribed burning on burn only and thin plus burn units in April and May 2002. Prior to burning thin units, piles of limbs were moved from around the base of remaining pines into adjacent areas between trees. Herbicide units were treated with 4.5% tryclopyr solution in water plus a surfactant applied with backpack sprayers in September 2002 targeting woody understory vegetation up to 2 m tall. These units were prescribe burned about 7 months later in April and May 2003. Burn only and thin plus burn units were burned a second time in April and May 2004. Herbicide plus burn units received their second burn in June 2005. Thin only units were given a mastication treatment with a front mounted horizontal rotating drum in May and June 2005.

There was some variation in stand composition prior to treatments but longleaf pine was the most prevalent species on all sites except stand 15 where it was a co-dominant with loblolly pine (*Pinus taeda*). Most stands also contained a considerable amount of hardwood, especially oaks. Thinning was most effective for reducing overstory hardwoods removing 55 percent of oak basal area and 58 percent of other hardwoods. There was also a 15 to 20 percent mortality rate for hardwoods on burn units from the two growing season burns. Burning killed some overstory pines also, with 5 percent mortality over 5 years in burn only stands and about 10 percent when burning was combined with thinning or herbicide.

Thinning removed some of the larger midstory hardwoods, while additional stems were killed by hotter burns in combination treatments. Burning alone however, did not reduce the density of midstory hardwoods. Thinning operations knocked down many small diameter hardwood stems. However, they soon recovered and a second mechanical chipping operation was needed on thin only units. Burning was very effective at reducing these small hardwood stems and keeping them at low densities. Both thinning and burning significantly reduced the cover of tall shrubs in the understory but burning was needed to keep them from recovering. The understory forbs responded to all disturbances but fire was needed to maintain the increased cover. Grass cover increased about 14% from fire and 14% from thinning with a 28% gain in the combination treatment.

Prescribed burning is an accepted practice for reducing fuels and wildfire hazards across the southern United States. It served as the standard treatment in this study where it did slightly increase pine mortality, but overstory and midstory hardwoods also appeared to be reduced with repeated burns. Understory shrubs and trees were kept in check by burning while grasses and forbs increased in cover. Overall, prescribed burning is a good treatment for controlling fuel levels and restoration of similar longleaf stands in the region.

Thinning has the advantage of producing income plus directly targeting removal of specific species and trees. Thus, it more quickly restores the overstory structure and composition of longleaf stands leaving larger more fire resistant trees. Where possible, it will often be preferable to remove excess hardwoods from the overstory and midstory by thinning with a commercial timber sale rather than killing them in place with prescribed burns. A follow up prescribed burn is needed to reduce activity fuels, keep woody sprouts from proliferating, and reduce wildfire risk. Although there can be some extra pine mortality the cumulative effect from burning will aid in restoration by favoring grasses and forbs over woody species. This treatment provided the most beneficial change toward community of open pine with a herbaceous dominated understory over the 5 year study, i.e. it gave the most positive change in the shortest time. Herbicide application followed by burning was superior for reducing the live woody understory, but this benefit must be weighed against the extra cost incurred.

Literature Cited

Abrahamson, W.G. and D.C. Hartnett. 1990. Pine flatwoods and dry prairies. P. 103-149 in Ecosystems of Florida, Myers R.L., and J.J. Ewel (eds.). University of Central Florida Press, Orlando.

Anderson, K.M. 1996. Tending the wilderness. Restor. Manage. Notes 14(2):154-166.

Christensen, N.L. 1981. Fire regimes in southeastern ecosystems. P. 112-135 in Proc. of Fire Regimes and Ecosystem Properties, Mooney H.A., T.M. Bonnicksen, N.L. Christensen, J.E. Lotan, and W.A. Reiners (tech. coords.). USDA For. Serv. Gen. Tech. Rep. GTR- WO-26

Frost, C.C. 2006. History and Future of the Longleaf Pine Ecosystem. In: Jose, S.; Jokela, E.J.; Miller, D.L., eds. The Longleaf Pine Ecosystem: Ecology, Silviculture, and Restoration. New York: Springer: 9-42.

Komarek, E.V., Sr. 1964. The natural history of lightning. P. 139-183 in Proc. 3rd Annual Tall Timbers Fire Ecology Conf., Tall Timbers Research Station, Tallahassee, FL.

Robins, L.E. and R.L. Myers. 1992. Seasonal effects of prescribed burning in Florida: A review. Miscellaneous Publication No. 8, Tall Timbers Research Station, Tallahassee, Florida.

Ware, S., C. Frost and P.D. Doerr. 1993. Southern mixed hardwood forest: The former longleaf pine forest. P. 447-493 in Biodiversity of the Southeastern United States: Lowland Terrestrial Communities. Martin, W.H., S.G. Boyce, and A.C. Echternacht. (eds.). Wiley, NY.

Waldrop, T.A., D.H. van Lear, F.T. Lloyd and W.R. Harms. 1987. Long-term studies of prescribed burning in loblolly pin forests of the Southeastern Coastal Plain. USDA For. Serv. Gen. Tech. Rep. GTR-SE-45. 22 p.

Arthropod Population Survey of a Mountain Longleaf Pine Stand on the Talladega National Forest, AL

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Introduction

Once covering a large portion of the Southeastern United States, the longleaf pine (*Pinus palustris*) ecosystem has become one of the most endangered ecosystems n the northern hemisphere (Boyer, 1990).

Arthropods are of great ecological importance due to their sheer numbers and diversity, role as pollinators, and as a source of food for many organisms (Milne, 2000; Borror, 1970). Although plant and vertebrate communities associated with longleaf pine have been well documented, few studies have focused on invertebrate populations (Folkerts et al. 1993). Entomological research that has been conducted in longleaf ecosystems has focused on the abundance and diversity of the arboreal populations, primarily the understory and overstory (Taylor, 2003; Hanula, et al., 2000). Recent studies have shown that the arthropod communities of herbaceous plants and shrubs have some impact on arboreal populations (Taylor, 2003). This study focuses on surveying the groundcover arthropod communities of a mountain longleaf pine stand.

Materials and Methods

The study was conducted on the Shoal Creek Ranger District of the Talladega National Forest, Cleburne County, Alabama. Three survey points were randomly chosen within a longleaf pine stand. Four transects were established at each point by pacing 25m in each cardinal direction from the base of a longleaf pine (Ministry of Environment, 1998; Buffington, 1998; Taylor, 2003).

Thirty-six samples were collected during the course of the study. One sample was defined as a collection obtained within a transect at a survey point. Four samples were obtained once a month for each survey point during the months of February, April, and June of 2008. All specimens were collected by one individual utilizing sweep netting with a 15 inch diameter mulsin net. Collection began at point center and proceeded in each cardinal direction. A series of sweeps were conducted approximately 1m lateral to the collector every other pace while moving at a constant speed through the vegetation (Sutherland, 1996). Net contents were placed in individually labeled acetone kill jars corresponding to the point collected and the respective cardinal direction of sampling (North 1, South 1, etc.). Specimens were identified (Capinera *et al.*, 2005; Eaton and Kaufman, 2007; Iowa State University; Myers *et al.* 2006) at Jacksonville State University.

Results

Analysis of the thirty-six samples revealed 965 individual specimens belonging to eight orders, thirty-eight families, forty-nine genera, and sixty-one species. The most abundant species collected were *Xysticus trigutlatas*, Thrice-banded Crab Spider, and *Oecanthus niveus*, the Narrow-winged Tree Cricket (Table 1). The Family Gryllidae (True Crickets) had the largest number of individuals, 141 specimens in 5 species. The overall species diversity was 3.66 for Shannon-Wiener and 0.97 for Simpson.

Sweep netting is biased to an extent towards smaller, non-flying arthropods (Buffington, 1998). This can account for low number of flying insects, such as *Schistocerca americana*, and ground dwelling insects, such as *Phanaeus vindex*. Use of other techniques in conjunction with sweep netting, such as aspiration and trap funneling could yield more precise estimates of arthropod populations in longleaf pine ecosystems (Buffington, 1998; Sutherland, 1996).

Arthropods are the dominant and most diverse component of terrestrial ecosystems. Changes in ecosystems can first be detected by changes in the population structure of their species (Rosenberg, 1986). However, studies focusing on arthropod populations in longleaf pine ecosystems are negligible except for those related to the diet of the red-cockaded woodpecker (Hanula *et al.*, 2000; Taylor, 2003; Hooper, 1996). Research efforts should be focused on this key component of the food web.

Literature Cited

Borror, D.J. and R. White. 1970 Peterson Field Guide: Insects of America north of Mexico. Houghton Mifflin. New York, NY.

Buffington, M.L. and R. Redak. 1998. A comparison of vacuum sampling versus sweep-netting for arthropod biodiversity measurements in California coastal sage scrub. Journal of Insect Conservation 2: 99-106.

Boyer, W.D. 1990. *Pinus palustris*, Mill. longleaf pine.

Pages 405-412 *in* R. M. Burns, editor. Silvics of North America - Conifers. U.S. Department of Agriculture, U.S. Forest Service, Washington, D.C.

Capinera, J., R. Scott and T. Walker. 2005. Field Guide to Grasshoppers, Katydids, and Crickets of the United States. Cornell University. Ithaca, NY

Eaton, E.R. and K. Kaufman. 2007. Kaufman Field Guide to Insects of North America. Houghton Mifflin, New York, NY.

Folkerts, G.W., M.A. Deyrup and D.C. Sisson. 1993. Arthropods associated with xeric longleaf pine habitats in the Southeastern United States: a brief overview. Proceedings of the Tall Timbers Fire Ecology Conference 18:159:192.

Hanula, J.L., K.E. Franzreb and W.D. Pepper. 2000. Longleaf pine characteristics associated with arthropods available for red-cockaded woodpeckers. Journal of Wildlife Management 64:60-70.

Hooper. R.G. 1996. Arthropod biomass in winter and the age of longleaf pines. Forest Ecology Management 82:115-131.

Iowa State University Department of Entomology: BugGuide http://buggide.net

Milne, L. and M. Milne. 2000. National Audubon Society: Field Guide to North American Insects and Spiders. Chanticleer Press. New York, NY

Ministry of Environment, Lands and Parks Resources Inventory Branch for the Terrestrial Ecosystems Task Force Resources Inventory Committee, British Columbia. 1998. Biodiversity Inventory Methods: Terrestrial Arthropods. (http://www.for.gov.bc.ca/ric)

Myers, P., R. Espinosa, C.S. Parr, T. Jones, G.S. Hammond and T.A. Dewey. 2006. The Animal Diversity Web (online). http://animaldiversity.org.

Rosenberg, D.M., H.V. Danks and D.M. Lehmkuhl. 1986. Importance of insects in environmental impact assessment. Environmental Management 10: 773-783.

Sutherland, W.J. 1996, Ecological Census Techniques: A Handbook. Cambridge University Press , New York. 336 pp.

Taylor, T. Brandon. 2003. Arthropod assemblages on longleaf pines: a possible link between the red-cockaded woodpecker and groundcover vegetation. MS Thesis, Virginia Tech University.

Table 1. Groundcover insect abundance in a mountain longleaf stand, Talladega National Forest, AL.

Scientific Name	Common Name	Site 1	Site 2	Site 3	Total
Lasius alienus	Field Ant	11	14	9	34
Monomorium minimum	Little Black Ant	3	13	7	23
Hippodamia convergens	Convergent Ladybug Beetle	5	3	8	16
Chloealtis aspasma	Broad-winged Grasshopper	0	1	1	2
Oecanthus exclamationis	Davis's Tree Cricket	12	19	17	48
Oecanthus fultoni	Snowy tree cricket	7	1	12	20
Oecanthus niveus	Narrow-Winged Tree Cricket	19	24	16	59
Orocharis saltator	Jumping Bush Cricket	3	0	0	3
Eunemobius carolinus	Carolina Ground Cricket	1	6	4	11
Psilopyga histrina	Black Stinkhorn Beetle	0	3	1	4
Glischrochilas fasciatus	Picnic Beetle	3	7	0	10
Promachus rufipes	Red-Footed Robber Fly	0	0	1	1
Scudderia furcata	Forked-tailed Bush Katidid	1	0	3	4
Hoplitimyia constans	Soldier Fly	12	9	14	35
Neogriphoneusa sordida	Orange Fly	9	2	4	15
Chrysopilus quadratus	Snipe Flies	4	1	0	5
Arilus cristatus	Wheel bug	0	0	1	1
Melanoplus gracillis	Slender Grasshopper	1	0	1	2
Melanoplus differentialis	Differential Grasshopper	3	0	0	3
Schistocerca americana	American Bird Grasshopper	0	1	1	2
Emesa brevipennis	Thread-legged bug	0	7	3	10
Coccinella novemnotata	9-spotted Ladybud Beetle	7	8	0	15
Schistocerca damnifica	Mischievous Bird Grasshopper	6	4	9	19
Neandra brunnea	Pole Borer	12	9	13	34
Solenopsis geminata	Fire Ant	0	0	13	13
Acanthocephala declivis	Leaf-footed bug	1	0	0	1
Cucujus clavipes	Red Flat Bark Beetle	1	3	0	4
Euphoria inda	Brown Fuit Chafer	5	7	3	15
Homalodisca vitripennis	Glassy-winged Sharpshooter	7	12	12	31
Epalpus Signifer	Early Tachnid	7	1	1	9
Aphrophora gelida	Pine Spittlebug	4	9	0	13
Toxomerus geminatus	Hover Fly	11	7	19	37
Elasmucha lateralis	Sheild Bug	8	7	4	19
Lygus lineolaris	Tarnished Plant Bug	19	11	21	51
Sinea spinipes	Spiney Assasin Bug	0	5	2	7
Phanaeus vindex	Rainbow Scarab	2	0	0	2
Anormenis septentrionalis	Northern Flatid Planthopper	11	7	9	27
Paraphlepsius irroratus	Bespeckled Leafhopper	12	19	7	38
Vespula maculifrons	Eastern Yellow Jacket	6	14	2	22
Acanalonia conica	Planthopper	7	1	2	10
Phlaeothripidae spp.	Thrips	17	8	0	25
Sarcophaga haemorrhoidalis	Flesh Fly	0	2	0	2
Bombus impatiens	Common Eastern Bumblebee	1	1	0	2
Sciara sp	Dark-winked Fungus Gnat	16	7	9	32
Dasymutilla aureola	Velvet Ant	1	0	0	1
Hister spp.	Hister Beetles	0	4	1	5
Megachile policaris	Leafcutter Bee	0	4	1	5
Prociphilus traxinitolii	Wooly Ash Aphid	0	30	0	30
Polistes fuscatus	Northern Paper Wasp	4	0	1	5
Scolia dubia	Digger Wasp / Blue Winged	0	1	0	1
Xysticus trigutlatus	Thrice-banded Crab Spider	26	17	21	64
Peucetia viridans	Green Lynx	13	1	18	32
Araniella displicata	Six-spotted Orb Weaver	11	3	9	23
Maevia inclemens	Dimorphic Jumping Spiders	7	4	6	17
Leucauge venusta	Orchard Orb Weaver	0	0	1	1
Phidippus otiosus	Canopy Jumping Spider	2	0	5	7
Phidippus audax	Bold Jumping Spider	0	3	0	3
Schizocosa mccooki	Wolf Spider	2	3	1	6
Gasteracantha cancriformis	Crablike Orb Weaver	0	1	0	1
Eris floridana		11	5	8	24
Eris militaris		1	0	3	4
SUM		**332**	**329**	**304**	**965**

An Investigation of the Avian Cavity-Nesting Community at Marine Corps Base Camp Lejeune

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Abstract

Cavity-nesting birds account for at least one fourth of all birds that breed within the fire-maintained longleaf pine (Pinus palustris) ecosystem. Consequently, the creation of and competition for cavities as nest-sites may play an important role in structuring avian communities in southeastern pine forests. Previous studies have investigated cavity nesting bird community structure, by examining the flow of cavity creation and use in an old-growth longleaf pine forest at Eglin Air Force Base, Florida. This study examines cavity-nesting bird community interactions within an older second growth longleaf pine forest at Marine Corps Base Camp Lejeune, North Carolina using protocols adapted from the Eglin study. Data were collected on nesting attempts, nest success, nest-site selection, and snag availability. Species were identified as associated with Red-cockaded Woodpecker (Picoides borealis) cavities, pine snags, and hardwood snags. Direct comparisons between the cavity-nesting bird communities of Marine Corps Base Camp Lejeune and Eglin Air Force Base will enable us to identify similarities and differences in cavity-nesting bird community structure across longleaf pine forests of different age classes. Results may allow for more informed decisions for snag management within the longleaf pine ecosystem, which may indirectly affect the endangered Red-cockaded Woodpecker.

Introduction

This paper describes a pilot study investigating cavity-nesting birds in the longleaf pine (Pinus palustris) ecosystem on Marine Corps Base Camp Lejeune along the North Carolina coast. It is increasingly recognized that woodpeckers, members of the cavity-nesting bird community, play a major role in forest ecosystems (reviewed by Mikusinski 2006, Virkkala 2006). Blanc (2007) extensively studied the cavity-nesting bird community on Eglin Air Force Base in northwest Florida.

At least one fourth of all birds that breed in this system are cavity-nesting birds, and cavities may be a limiting resource (Blanc and Walters 2008). Standing dead trees (snags) provide the necessary substrate for many cavity excavators in the longleaf system. Another potential source of cavities is the red-cockaded woodpecker (Picoides borealis), which is the only woodpecker in this system capable of excavating cavities in living pines (Conner et al. 2001). The goal of the full-scale study is to describe the cavity-nesting bird community in the longleaf pine ecosystem on Camp Lejeune with a focus on 1) determining the relationship between other cavity-nesting birds and red-cockaded woodpeckers, 2) determining the effects of snag density and red-cockaded woodpecker cavity availability on cavity-nester abundance, and 3) directly compare the cavity-nesting bird communities and snag densities of Camp Lejeune and Eglin.

Methods

From April – July 2008, nest searches were conducted on ten 9-ha plots (Figure 1). Searches were conducted between 9am and 2pm daily, and each plot was searched twice during the field season. Search order of the plots was pre-determined and randomized into two rounds and when possible two plots were searched in a single day. During each round of nest searching, two field technicians started at opposite corners of the plot and loosely walked transects for two hours until they met in the middle. Data collected for each nest found included diameter at breast height (dbh), species of tree and bird, cavity height and direction, and location. Nest trees were assigned a tree number and tagged for future reference. The number of snags and Red-cockaded Woodpecker cavity trees were estimated using 25m radius vegetation plots. Snags were classified into structural classes, depending on the presence of branches, amount of bark and stage of decay. For more detail on these protocols, which were adapted from a previous study at Eglin Air Force Base, FL, see Blanc and Walters (2008).

Preliminary Results

Nest searches resulted in 45 nests representing 10 avian species, including northern flicker (Colaptes auratus), pileated woodpecker (Dryocopus pileatus), red-cockaded woodpecker, red-headed woodpecker (Melanerpes erythrocephalus), brown-headed nuthatch (Sitta pusilla), Carolina chickadee (Parus carolinensis), eastern bluebird (Sialia sialis), eastern screech-owl (Otus asio), great-crested flycatcher (Myiarchus crinitus), and tufted titmouse (Parus bicolor; Figure 2). The majority of nests occurred in pine snags (n=36; 80%), followed by red-cockaded woodpecker cavities in living pine (n=5; 11%), then hardwood snags (n=4; 9%). The nesting density (# nests / ha) at Camp Lejeune was 0.49 nests per ha. Vegetation surveys indicated that pine snags were more prevalent than hardwood snags (Table 1).

Discussion

The results of this pilot study indicate that the cavity-nesting bird community at MCB Camp Lejeune is similar to Eglin AFB in terms of species composition and nest-site selection. The distribution of nest-site selection across cavity resource type at Camp Lejeune was similar to the Eglin study, with pine snags used most frequently (Eglin was 64%), followed by Red-cockaded Woodpecker cavities in living pine (Eglin was 26%), then hardwood snags (Eglin was 9%) (Blanc 2007).

Notable differences between the Camp Lejeune and Eglin studies included community richness and nesting density. The cavity-nesting bird species recorded at Lejeune were fewer species than at Eglin, and this was reflected primarily in fewer excavating species (woodpeckers). However, many cavity-nesting species that are known to nest on Camp Lejeune were not detected in this pilot study, but likely will be in future field seasons. These include: red-bellied woodpecker (Melanerpes carolinus), downy woodpecker (Picoides pubescens), hairy woodpecker (P. villosus), white-breasted nuthatch (Sitta carolinensis), wood duck (Aix sponsa), and european starling (Sturnus vulgaris). American kestrels (Falco sparverius) nest at Eglin, but are only present on Camp Lejeune during the non-breeding season.

The Lejeune study results also differed from Eglin in that nesting density (# nests / ha) was approximately four times higher at Lejeune (0.49) than at Eglin (0.13; Blanc and Walters 2008). One potential explanation for the higher densities of nests found at Camp Lejeune is a difference in protocols. Although protocols were adapted from the Eglin study; key differences included plot size, number of plots, and search effort per plot. The results presented here reflect a pilot study conducted over only one breeding season, with 1/3 of the 30 planned plots, but more than three times the search effort than the Eglin study. Thus, whether the differences between the two sites are a function of differences in search effort or actual nesting ecology is unknown at this time and should become clear as the Lejeune study is expanded to a full-scale, multi-year study.

Land management history differs between the two sites, in that Eglin has old-growth longleaf forests while Lejeune's longleaf is second growth (McWhite et al. 1999, Camp Lejeune 2006). Pine snag availability was comparable across the two sites; however hardwood snag density was lower at Lejeune (Blanc 2007). The difference in hardwood densities is likely a function of differences in habitat management between the two sites. For example, at Eglin, hardwood midstory reduction was conducted using herbicidal application, which resulted high densities of standing dead hardwood trees (Provencher et al. 2001). In contrast, Camp Lejeune conducts mechanical hardwood midstory removal using timber harvests, a drum chopper or Hydro-ax mower (Camp Lejeune 2006).

An expansion of this study is underway and will enable us to further identify similarities and differences in cavity-nesting bird community structure across longleaf pine forests of different age classes and in different regions of the Southeast. Results may allow for more informed decisions for snag management within the longleaf pine ecosystem, and a better understanding of how the cavity resource base affects cavity-nesting bird community dynamics.

References

Blanc, L.A. 2007. Experimental study of an avian cavity-nesting community: nest webs, nesting ecology, and interspecific interactions. Ph.D. dissertation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA.

Blanc, L.A. and J.R. Walters. 2008. Cavity-nest webs in a longleaf pine ecosystem. Condor, 110: 80-92.

Camp Lejeune. 2006. Integrated natural resources management plan (2007-2011). Environmental Management Division. Marine Corps Base Camp Lejeune. November 2006. http://www.lejeune.usmc.mil/emd/INRMP%202007/table_of_contents.htm.

Conner, R.N., D.C. Rudolph and J.R. Walters. 2001. The Red-cockaded woodpecker: Surviving in a fire-maintained ecosystem. Austin, TX: University of Texas Press.

McWhite, R.W., J. Furman, C.J. Petrick and S.M. Sieber. 1999. Integrated natural resources transitional plan, Eglin Air Force Base, 1998–2001. Eglin Air Force Base, Jackson Guard, Niceville, FL.

Mikusinski, G. 2006. Woodpeckers: distribution, conservation and research in a global perspective. Annales Zoologici Fennici 43:86-95.

Provencher, L., B.J. Herring, D.R. Gordon, H.L. Rodgers, G.W. Tanner, J.L. Hardesty, L.A. Brennan, and A.R. Litt. 2001. Longleaf pine and oak responses to hardwood reduction techniques in fire-suppressed sandhills in northwest Florida. Forest Ecology and Management 148:63–77.

Virkkala, R. 2006. Why study woodpeckers? The significance of woodpeckers in forest systems. Annales Zoologici Fennici 43:82-85.

Table 1. Snag densities at MCB Camp Lejeune (snags / ha). DBH class n/a represents snags with un-measurable DBH due to fire damage or decay.

DBH Class (cm)	Pine	Hardwood
n/a	1.08	0.23
10.2-12.6	1.24	0.34
12.7-24.9	1.87	1.08
25-38	1.75	0.11
38.1-48	1.02	0.00
48.1-59.9	0.11	0.00
60+	0.06	0.00
>12.7	4.81	1.19
Total overall	**5.89**	**1.41**

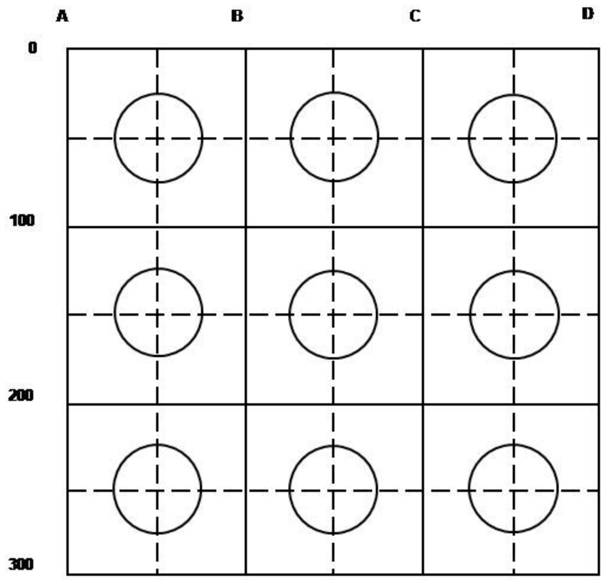

Figure 1. 300m x 300m study plot from the cavity-nester study at MCB Camp Lejeune. Lines, solid and dotted, indicate transects. Circles indicate 25m radius vegetation plots.

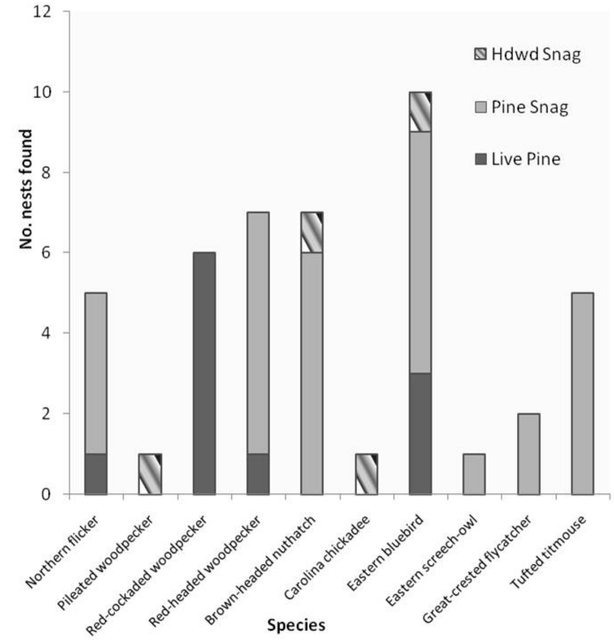

Figure 2. Nests found April-July 2008 at MCB Camp Lejeune by nesting substrate.

Influence of Fire and Hardwood Control on Forest Structure of Longleaf Pine Communities in the Mountain Longleaf National Wildlife Refuge

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Abstract
The Mountain Longleaf National Wildlife Refuge (MLNWR) is unique in that it holds significant acreages of young and old growth mountain longleaf pine (*Pinus palustris* Mill.). Protection and restoration of longleaf pine communities are the primary missions of the MLNWR. Because of a lack of historical information, data are needed on forest structure and fuel loads in the Refuge. Our objectives were to: (1) establish permanent monitoring plots in the Refuge, (2) document herbaceous and woody vegetation, and (3) measure biodiversity, forest structure, and fuel loads in longleaf communities with varying fire and management histories. We established 48 plots, 0.25 acres in area, in winter 2008 and measured all plots in summer 2008. The MLNWR has incorporated prescribed burning in their managements plans, and each plot was categorized by the year it was burned (2008, 2006, 2004, no burn) and by hardwood control (HC, no HC). Species diversity and richness were measured in both the overstory and understory, and ground cover and fuel loads were measured in the understory. We identified 23 and 22 different woody species in the overstory and understory, respectively. The percent of longleaf pine basal area was highest in the 2006 and 2004 burned stands and in HC plots. The importance value of longleaf pine in the understory was greatest in stands burned in 2006. Data from this research provide a baseline for subsequent management protocols for the MLNWR to ensure that they are meeting their mission of protection and restoration of longleaf pine communities.

Introduction
Mountain longleaf pine forests are a diminishing component of the once vast longleaf pine forests of the Southeast maintained by fire. From what was perhaps once the largest temperate forest type dominated by a single species of tree in the U.S. to occupying about 3% of its former range, mature longleaf pine forests are now considered rare. Within remnant longleaf pine forests, a few dozen species that wholly depend on the structure of longleaf stands are now imperiled with global extinction. Furthermore, many scientists have begun to discover that high species richness (found mainly in the groundcover) accounts for longleaf pine forests being considered as regional hotspots of biodiversity. Several small pockets of this once vast forest remain in the Coastal Plain, but in the mountain region only a small national wildlife refuge in northeastern Alabama contains a forest that approaches the landscape witnessed by European settlers, the Mountain

Longleaf National Wildlife Refuge (MLNWR).

On what was once Fort McClellan, the MLNWR holds significant acreages of mountain longleaf pine forests, at least 10 old-growth tracts and lush herbaceous communities on areas which experienced significant fire. Prescribed burning is a necessary element of any effort in longleaf pine ecosystem management and history of burning should be considered when evaluating biodiversity in these systems. Because of lack of historical information on the MLNWR, complex fuel conditions, differing community types, and variable topography, it is critical to acquire current information on forest structure and fuel loads. Results from this study will provide important knowledge for the Refuge and its mission in the restoration and protection of longleaf pine.

Specific objectives of this research were to: (1) establish permanent monitoring plots in the Refuge, (2) document herbaceous and woody vegetation, and (3) measure biodiversity, forest structure, and fuel loads in longleaf communities with varying fire and management histories.

Methods

This study was conducted at the Mountain Longleaf National Wildlife Refuge (MLNWR) near Anniston, AL. The MLNWR is located in the Southern Appalachian Mountain Range and is comprised of 9016 acres. Within the MLNWR is believed to be the only remaining stands of old growth mountain longleaf pine forest.

We established 48 plots, 0.25 acres in area, with a circular 0.10 acre measurement plot in the center. Each plot was categorized by the year they were last burned (2008, 2006, 2004, and no burn) and by whether or not they were controlled for hardwoods (HC and no HC). In HC plots, all hardwoods 4 inches or less in DBH were cut and stems > 4 inches in DBH were hacked and squirted in 2006. All stems > 1 inch at DBH were measured and identified by species. Within each measurement plot, 5 subplots, 39 x 12 inches were sampled by random azimuth and distance from plot center. Within each subplot, all woody species were identified by species and number of stems were counted. Percent cover was visually estimated by vegetation type (i.e. woody, shrubs, grass, herbaceous, vine, and fern). Species diversity indices were calculated for both the overstory and understory. We calculated species richness which is the number of species per plot, importance value (IV200) based on relative density and dominance in overstory and relative frequency and density in understory, and the Shannon Diversity Index (H') which is diversity based on richness and abundance.

Because the amount of fuel also directly impacts forest structure and biodiversity, fuel loads defined by litter and duff mass were measured in a 12 x 12 inch square adjacent to 4 of the 5 subplots. Within these fuel load sampling points, litter layer, decomposing layer, and duff layer samples were collected then dried and weighed. Relationships among forest structure, biodiversity indices, fuel loads and stand classification were explored.

Results

A total of 23 and 22 woody species were found in the overstory and understory respectively (Table 1). In the overstory, longleaf basal area ranged from 23 to 44 ft2 ac-1 (Figure 1). Percent of basal area in longleaf was as high as 80% and was significantly higher in stands burned in 2004 and 2006 and with HC (Figure 1). Longleaf regeneration ranged from 0 to 9,755 stems ac-1 and was highest in stands burned in 2004 and 2006 and with HC (Figure 2). Longleaf pine importance value (IV200) in the overstory ranged from 65 to 142 and was increased in stands burned in 2004 and 2006 and with HC treatments (Table 1). IV200 for longleaf regeneration was increased in stands burned in 2006.

There was a burn year by HC treatment interaction for H' and species richness. Without hardwood control, higher diversity and species richness in the overstory of stands burned in 2008 and stands which have not been burned (Figure 3) indicate greater diversity and number of hardwood species, many of which are not typically found in fire maintained longleaf pine ecosystems. These species include red maple, pignut hickory, common persimmon, sweetgum, and black cherry (Table 1). Stands without HC resulted in greater litter mass (Figure 5) and in general, the high decomposition and duff layers in all treatments indicate lack of regular fire intervals.

Conclusions

This study indicates the importance of fire or hardwood control in maintaining existing longleaf pine and in longleaf pine regeneration and that future monitoring of fire management impacts on mountain longleaf ecosystems is needed. The establishment of permanent monitoring plots will enable the Refuge to devise management plans for longleaf pine protection and restoration.

Acknowledgements

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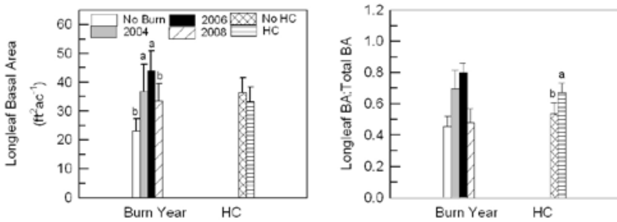

Figure 1. Longleaf pine basal area and % longleaf pine basal area by burn year and hardwood control treatment. Different letters indicate significant differences.

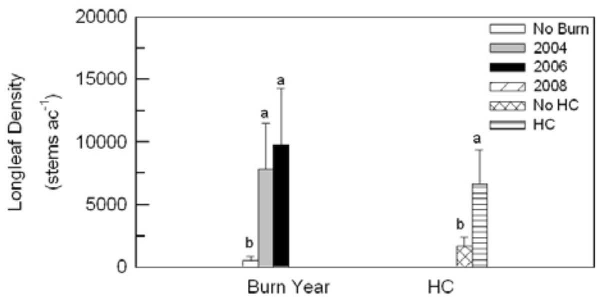

Figure 2. Longleaf pine regeneration in the understory by burn year and hardwood control treatment. Different letters indicate significant differences.

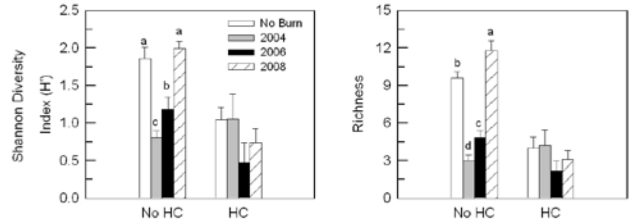

Figure 3. Shannon Diversity Index (H') and species richness in the overstory for burn years by hardwood control treatments. Different letters indicate significant differences.

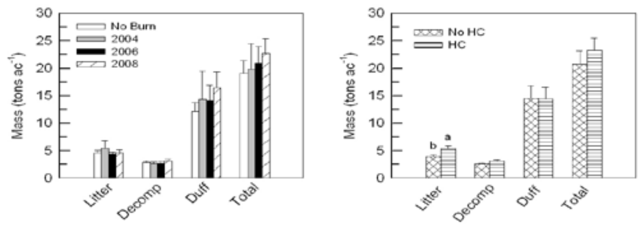

Figure 4. Fuel load mass by layer by burn year and hardwood control treatments. Different letters indicate significant differences.

Table 1. Mean importance values (IV200) for woody species found in the overstory and understory. Different letters for longleaf pine indicate significant differences.

	Overstory						Understory					
	Burn Year				Treatment		Burn Year				Treatment	
Species	**No Burn**	**2004**	**2006**	**2008**	**No HC**	**HC**	**No Burn**	**2004**	**2006**	**2008**	**No HC**	**HC**
longleaf pine*	**65.01^{b}**	**117.01^{a}**	**141.99^{a}**	**75.33^{b}**	**83.15^{b}**	**114.10^{a}**	**14.00^{bc}**	**38.73^{b}**	**70.15^{a}**	**0^{c}**	**26.91**	**32.59**
Blackjack oak	31.97	38.02	9.74	9.90	32.04	10.39	0	13.93	0	22.44	3.60	15.26
shortleaf pine	23.14	1.80	6.01	31.73	1.55	29.58	0	0	0.87	2.44	0	1.84
Black tupelo	15.97	1.26	5.18	13.86	17.75	1.86	10	2.54	14.33	6	9.38	7.52
sourwood	14.98	0	0	6.42	7.29	3.05	0	2.54	0	0	0	0.98
sparkleberry	14.25	0	0.77	4.32	9.71	0	0	0	0	0	0	0
Chestnut oak	8.04	5.99	6.54	18.11	11.72	8.76	15.83	0	9.11	12.86	8.77	10.65
Red maple	7.11	0	0	7.89	7.22	0.87	47.5	0	21.18	75.14	31.84	45.27
Black oad	6.79	2.25	1.30	10.26	5.12	5.36	2.67	0	2.20	0	1.30	1.03
Sand hickory	6.07	3.97	4.35	1.81	7.20	1.33	21.33	6.83	19.68	0	10.40	11.87
Common persimmon	2.72	0	0.42	0.13	0.35	1.04	9.33	41.42	0	0	5.34	15.01
Virginia pine	1.53	0	5.31	0.83	3.53	1.06	0	0	0	0	0	0
Post oak	0.93	5.90	2.05	0	0.69	3.15	0	5.83	0	6.67	0	6.09
Pignut hickory	0.49	2.46	3.82	2.95	4.53	0.95	10.67	8.33	1.75	6.67	4.09	13.57
Flowering dogwood	0.32	0	0	1.88	1.34	0	0	0	0	0	0	0
American chestnut	0.31	0	0	0	0.14	0	0	0	0	0	0	0
Black cherry	0.12	1.52	0.81	7.05	2.67	2.60	0	0	0	0	0	0
sassafras	0.10	0	0	0.52	0.37	0	39.33	59.76	5.26	25.56	52.26	11.27
Downy serviceberry	0	0	0	0	0	0	0	0	0	4	0	2.31
loblolly pine	0	15.57	7.72	9.65	0	15.34	0	1.67	3.59	0	0	2.44
mockernut hickory	0	0	0	1.52	0	0.82	0	0	0	6.67	0	3.85
Northern red oak	0	0	0	3.95	2.51	0	0	0	0	8.06	5.49	0
pawpaw	0	0	0	0	0	0	0	0	2.20	2.50	3.00	0
rhododendron	0	0	0	0	0	0	0	5.08	3.25	0	1.91	1.95
Scarlet oak	0	0	0.97	1.01	1.26	0	0	0	0	0	0	0
Southern crabapple	0	0	0	0	0	0	0	0	4.37	14.33	0	10.46
Sweetgum	0	4.26	0	0.35	0.23	1.64	0	0	0	6.67	0	3.85
Winged sumac	0	0	0	0	0	0	9.33	59.76	5.26	25.56	52.26	11.27

Carolina Grasslands: Waltzing with Fire

Johnny Stowe, Elizabeth Renedo and Greg Lucas

South Carolina Department of Natural Resources

Abstract

The Carolinas have changed over the millennia, but grasslands, now much less prominent than they once were, have always played a vital role in the region. Maintained for generations by the Southeast's first Amerindian residents and frequently described by early explorers of the region, fire-dependent grasslands once covered vast swaths of the landscape in the modern-day Carolinas. Today, these grasslands, characterized by a unique inter-dependent and diverse array of plant and animal life are a true rarity, existing only in intensively managed preserves. In this paper, we take a look at the history of Carolina grasslands, tracing the ecosystem from its prehistoric origins through its years of Amerindian-maintained dominance, to its post-settlement decline. In-depth side bars highlight the relationship between grasslands and human culture, resources available for those interested in restoring grasslands and a listing of grasslands readers can visit throughout the Carolinas.

Anywhere you stand in today's rural Carolina piedmont, you find yourself surrounded by trees and thickets, making it quite a stretch to imagine the vast, open piedmont described by the European explorers of the 1500s through 1800s. Try to picture yourself in the York County landscape described by J.H. Logan, writing in 1859: "In the cane brakes of the [rivers and streams] . . . and on the extensive prairie ridges, the early pioneers and hunters found large herds of buffaloes and elks . . . The trees were generally larger [than today] and stood so wide apart that a deer or a buffalo could easily be seen at a long distance—there being nothing to obstruct the view but the rolling surface . . . The pea-vine and grasses occupied the place of the bushes and young forest that render the woods of the present time so gloomy and intricate." Well, that's certainly a sharp contrast to the forested landscape you'd see there now.

Today, only on a very few intensively managed preserves can one get a glimpse of the landscape described by Logan, and even there, the scene is incomplete—there are no bison or elk, and the postage-stamp-size acreage brings to mind the term meadow more than it does prairie. So what are we to make of the detailed accounts of Logan and his cohorts who describe so well a land more reminiscent of the American Great Plains than of our contemporary Carolina piedmont?

Historical documents and present-day knowledge of ecology support the claims by early explorers like Logan—believe it or not, their descriptions most likely reflect what they really saw on their travels—and also offer clues as to what caused the unique grassland ecosystems they described to disappear. To understand the rise and fall of the vast Carolina grasslands, let's step back in time and walk forward through the years, gaining a clearer perspective on the Palmetto State's ever-changing landscape.

Toward the end of the last major glaciation, 10,000 to 20,000 years ago, most of the species common in the Carolinas today lived farther south, in present day Florida and other areas, some now under the sea. Analysis of pollen in undisturbed, isolated freshwater wetlands from sites such as White Pond, near Elgin, indicate that about 13,000 years before present (BP), the climate of South Carolina's midlands caused a dramatic shift from boreal species now found in Canada—spruce and jack pine, for example—to deciduous species such as oak, hickory, beech, birch, elm, maple and ironwood. These findings, coupled with the study of fossils from places such as Edisto Island of about the same time, show that in the late Pleistocene Epoch the area that is now South Carolina was made up of three distinct faunal zones that were much like today's East African Serengeti in terms of megafauna (vertebrates weighing 220 lb or more).

The upper part of the state, from about Columbia northward, was in the boreal zone, characterized by tundra with a few scattered trees. The notable megafauna of the boreal zone included walruses, horses, bison and caribou, and its chief grazer, the wooly mammoth. Below the boreal zone southward to the Charleston area lay the temperate zone, a highly diverse region of mixed temperate forests and grasslands. his area contained both wooly and Columbian mammoths, as well as other grazers, and the paramount browsing species of the temperate zone was the American mastodon. Since grazers like mammoths mostly use grasslands and browsers such as mastodons mostly use woodlands, we can gain some idea of the ratio of open land to forest by looking at the ratio of mammoth-to-mastodon fossil finds. This ratio suggests that the coastal plain was dominated by grasslands and the piedmont contained more woodlands.

Below the temperate zone was the subtropical zone, with its mixture of aquatic (for example, muskrats, giant beavers, alligators) and terrestrial fauna (grazers and browsers), which indicates a mosaic of grassland savanna and deciduous woodlands interlaced by large, meandering streams. The White Pond site shows, too, that about 9,500 years BP the oak/hickory forest was replaced by "Southern" pines and oaks, with oak dominating until about 7,000 years BP, when pine took over and led to the forest we have today.

So what? Well, consider these changes, largely the results of climatic shifts, and then factor in the arrival of the first Americans and their impact on the landscape. Scientists differ in their views of how long humans have been in the New World, with estimations ranging from more than 40,000 years ago to as recently as 12,000 years ago. Though the human-habitation timeline is hotly debated, evidence strongly suggests that the Amerindians of the Southeast began intensive and purposeful manipulation of the land 3,000 to 5,000 years BP, and that fire was their primary tool. Through the use of fire, Native Americans gave rise to the South's most recent grasslands.

Like many of today's remaining Carolina grasslands, the grassland landscape of that time included native warm-season grasses, which grow during the spring and summer, rather than in the fall and winter, when invasive exotic species like fescue grow. These native grasses include Indiangrass (South Carolina's state grass), switchgrass, big and little bluestems and other "broomsedges," and Eastern gammagrass. Growing alongside grass species are forbs, or non-grasslike herbaceous plants, which play a vital role in grassland ecology. Legumes, ecologically vital forbs that "fix" nitrogen, are one important example. They harbor in their roots bacteria that transfer nitrogen, an important nutrient for grass species, from the atmosphere to the soil.

Grasses pay back their fire-tolerant legume neighbors by carrying fire, which keeps trees and other competitors at bay, so their relationship is mutually beneficial. (See "Grasslands and Humans: The ancient and inextricable link" for more on how grasses and legumes complement each other.)

This land of six-foot grasses is where, according to historian David Ramsay writing in his 1858 book, The History of South-Carolina from its First Settlement in1670, to the Year 1808, Volume II, "In the year 1750, when the settlement of the upper country [South Carolina piedmont] began, there were so many buffaloes, which have long disappeared, that three or four men with their dogs could kill from ten to twenty in a day." Buffalo and elk were much less common in the pre-Columbian Southeast, but they moved in quickly and their populations exploded after native people were violently depopulated by diseases introduced by Europeans. Fewer people meant less human predation pressure and the abandoned agricultural fields became ideal habitat for these big grazers. However, the buffalo's tenure in the Carolinas was short; settlers wiped them out by 1775. These vast lands would no doubt have been a small-game hunter's and birdwatcher's paradise, as well. Bobwhite quail and rabbits would have flourished alongside nongame species such as loggerhead shrikes, meadowlarks and many species of grassland sparrows.

Grasslands—largely maintained by fire and/or grazing, direct sunlight and soils—must have all of these elements or they will be overtaken by forests. Fire and grazing, of course, suppress tree growth, allowing sunlight to reach the land surface. Prairie species require this full sunlight to flourish; they cannot prosper under the shade of trees. Soil characteristics, including chemistry, density and texture, are also a major factor in keeping trees in their place. Some piedmont soils shrink and bake brick-hard when dry and swell to mush when wet. This seems to benefit certain grassland-associated herbaceous plants and discourage tree growth.

Prairie species also tend to have extensive, very deep root systems that help them out-compete trees, especially during droughts. The roots of big bluestem, for example, often reach deeper than the plant is tall! Chemical warfare, or allelopathy, is another factor that plays a vital role in determining what grows where. Allelopathic plants exude chemicals through their roots and other tissues that act as selective "herbicides" to inhibit the growth of competitors. Thanks in part to these unique characteristics, individual clumps of some grass species may live for decades, and may be older than the much larger trees around them!

These days, intact temperate grasslands, savannas and shrublands are the most endangered ecosystems in North America and the world. They are more imperiled, in fact, than the tropical rainforests that capture so much attention. Fire suppression and other habitat destruction are primarily responsible for the decline of these ecosystems. Fortunately, in the Southeast, there is a rapidly growing movement to slow or reverse this trend.

Increasingly, land-grant universities, extension services, natural resource agencies and private landowners are restoring and managing grasslands for wildlife habitat, livestock forage and aesthetic values. Because they are disturbance-dependent ecosystems, grasslands require active management in the form of burning, grazing or mowing. Carefully timed and regulated grazing by livestock can mimic the periodic feeding patterns of the long-gone buffalo and elk, making it a good management option for some grassland sites. Fire, the tool of our Amerindian predecessors, and mowing also provide the type of tree-preventing, soil-enriching disturbance required by delicate grassland ecosystems.

With wise use of our knowledge and the tools we have to manage them, we can restore Carolina grasslands to at least a little bit of their former glory.

So You Want To Restore Grasslands?

If you're interested in restoring and managing grasslands on your land, check out Native Warm Season Grasses: Identification, Establishment, and Management for Wildlife and Forage Production in the Mid-South by Harper et al., which is available from the University of Tennessee Extension Web site. Access the land manager version at: www.utextension.utk.edu/publications/fee-based/pb1752.htm. Access the landowner version at: www.utextension.utk.edu/publications/pbfiles/PB1746.pdf.

Financial assistance to restore grasslands is available from several sources, including the U.S. Fish and Wildlife Service's Partners for Wildlife program and the Natural Resources Conservation Service's Environmental Quality Incentives Program, helping to bring grassland restoration within grasp of landowners of all economic levels.

One key thing to remember when restoring grassland is that it's always best to use local seed or other plant material sources rather than bringing them in from more distant areas. A local population of a species can become genetically distinct from a distant population of the same species as it adapts over time to a specific geographic location and set of ecological conditions. So, seed from a local population will be better suited to a nearby location than seed from a faraway locale. Plus, bringing in genetically unique stock from a distant location can lead to swamping and degradation of the local stock.

Get Out and Explore the Grasslands

You can check out modern Carolina grasslands at these S.C. Department of Natural Resources properties: Rock Hill Blackjacks HP/WMA in York County; Aiken Gopher Tortoise HP/WMA; Lynchburg Savanna HP/WMA in Lee County; Webb Wildlife Center/WMA in Hampton County and Tillman Sand Ridge HP/WMA in Jasper County. Information on these sites is available from the DNR Web site, www.dnr.sc.gov. You can also view grasslands at the Indian Creek area of the Sumter National Forest, the Francis Marion National Forest (www.fs.fed.us/r8/fms/) and Carolina Sandhills National Wildlife Refuge (www.fws.gov/refuges/). In North Carolina, check out Mecklenburg County Parks, www.charmeck.org/Departments/Park+and+Rec/Parks/Home.htm, for even more Carolina grasslands.

Grasslands and Humans: The Ancient and Inextricable Link

Some of the earliest and most profound human art has a subtle, yet overarching grassland theme. The mammoths, horses, aurochs (ancestor of cattle) and other Pleistocene megafauna painted more than 25,000 years ago in the caves of southwestern Europe are grazers dependent on extensive grasslands. The most prominent human civilizations have tended to arise in grasslands, and grasses remain the most important plants for humans and our domestic animals. In fact, grain, the seed of grasses, is a cornerstone of bread and brewing.

At first humans collected wild grass seeds, and we of course chose those that were most palatable and nutritious. Then we began domesticating these grasses. Our love of lawns and open, park-like groves of trees may be an atavistic trait from our primordial past, when grasslands meant grain for food, forage for grazing livestock and game animals, and open vistas, which provided clear views surrounding our dwellings, preventing surprise raids.

Grasses such as wheat were among the first plants cultivated; many of the first domestic animals were grassland-dependent grazers. Grasses and legumes tended to be cultivated together, their ecological compatibility being only one cultural benefit of this nexus. They also complement each other in the human diet, one providing the nutrients lacking in the other, and between them delivering much of what we require in terms of nutrition. Dietary staples of most, if not all, major civilizations were based on a cereal (grass seed) and a legume. Grass/legume dyads include corn and beans in the "New World," wheat and lentils in the Mediterranean, rice and soybeans in Asia and millet and peas in Africa.

Over the past fifty years, five of the six most widely planted food crops in the world have been grasses: barley, corn, rice, sorghum and wheat. Soybeans, a legume, is the other. Even today, we often alternately grow soybeans and wheat on the same field, this "double-cropping" allowing farmers to grow two crops a year on the same land.

In addition to their dietary roles, certain grassland plants historically played an important role in folk medicine. According to Richard Porcher, retired herbarium curator for The Citadel and author of Wildflowers of the Carolina Low Country and Lower Pee Dee, forbs such as rattlesnake master were used by Native Americans and settlers alike to treat a variety of ailments. Just as humans have evolved with grasslands, fire and grasslands are also inextricably linked. For more than one million years (about 40,000 human generations), going back to the savannas of East Africa from whence we sprang, humans have used fire to shape the landscape. Fire enabled us to easily manipulate our surroundings on a grand scale, and this mutually beneficial link between our species and fire, the ecological imperative, has created and maintained the world's grasslands, which in turn served both fire and humans. Together throughout the eons we have waltzed with fire, and the grasslands have been the music that drove our dance.

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The writers thank University of South Carolina ethnobotanist Gail Wagner for generously sharing her expertise and cache of grassland species for some of the photos accompanying this article.

Raising Cane

Johnny Stowe

South Carolina Department of Natural Resources

Abstract
Cane! Once widespread across the landscape, used extensively by Native Americans, home and food for wildlife, this uniquely Southern grass boasts a rich cultural and natural history. I review the ecological and cultural history of all three "types" of native cane – i.e., the tall "fishing pole" cane of streambanks, the switchcane of wet savannas, and the dwarf cane that grows on the ridges alongside table mountain pine.

Cane pole slung over his shoulder, a barefoot boy heads to the creek. Few images are as quintessentially Southern and timeless. Once the primary fishing tool in South Carolina, cane poles have been replaced by rods and reels. But many of us who learned to fish with cane poles still enjoy using one now and then, especially when teaching a small child to fish. Like many other things in life, sometimes simpler fishing is better.

Endemic to the South, and common but scattered in South Carolina today, cane was once the keystone of an important ecosystem—the famed Southern canebrakes. Almost every early account of the region's landscape prominently mentions canebrakes.

William Bartram noted them at least twenty-four times in his classic book Travels, which documented his ramblings through the South in the late 18th century. He described them in terms such as "vast cane swamps . . . and meadows . . . of immense extent, [where] canes grow . . . thirty or forty feet high, and . . . three or four inches in diameter."

Place-names like the ubiquitous "Cane Creek" in this and other parts of the South attest to the prominence of cane in the past. The Toxaway drainage of Lake Jocassee is known as The Canebrake, and S.C. Department of Natural Resources wildlife biologist Jamie Dozier says a quick search of the term "cane" using the federal Geographic Names Information System yields ninety-two locales in South Carolina alone!

Cane's lightweight strength and flexibility make it an excellent raw material for tools and construction. Besides their use in fishing, cane stalks make sturdy stakes for "beanpoles," trellises and other uses. Cane was one of the most important of all raw materials for southeastern Indians, according to DNR archaeologist Chris Judge. "Cane was used for many purposes," Judge says, "including houses and other structures, drills, knives, arrow and spear shafts, blowgun and medicine tubes, shields, baskets, mats, fish creels and traps, beds, cradles, torches, sieves, fanners, containers, rafts, litters and flutes, and to hold hair braids. Cane was ideal for granaries to store food, since it was difficult for rats to chew through. Indians also ate the seeds and tender shoots of cane."

Canebrakes and savannas are prime wildlife habitat. Six species of butterflies—five of them rare—are canebrake specialists. The larvae of the Creole pearly eye, Southern pearly eye, Southern swamp skipper, cobweb little skipper, cane little skipper and yellow little skipper all feed on cane foliage. Deer seek cover in cane and feed on its tender new growth, and in the 18th century, large herds of elk and buffalo were documented on canelands as far east as the Charlotte area. Most records of buffalo east of the Mississippi River were associated with canelands.

Cane lends its name to local critters such as the canecutter, or "buck" rabbit of the Upstate, and the canebrake rattlesnake. Black bears are fond of canebrakes for cover. Wild turkeys and canebrakes are mentioned in many historic accounts, and Audubon's famous wild turkey painting includes cane. Bachman's warbler, now feared extinct, may have been a cane-dependent species, and both Swainson's and hooded warblers nest in canebrakes. The demise of the passenger pigeon and Carolina parakeet may have been in part related to the loss of canebrakes.

Cane is a member of the grass family, and its taxonomy is "currently unsettled," says Patrick McMillan, Clemson University Herbarium curator. The cane most people know is "river" or "giant" cane, the fishing or beanpole cane that grows in bottomlands and along the margins of streams. This type grows largest and is evergreen. While a few individual stalks may flower each year, it generally flowers infrequently and en masse, with all the colonies in a widespread area blooming, setting seed in clusters like oats, and dying simultaneously. These events can leave wildlife and other animals fat from eating the cane seeds, which contain more nutrients than either rice or wheat.

The other cane associated with wet areas is the "switch" cane that grows in pocosins and savannas. It is short and evergreen or tardily deciduous. It flowers frequently, even annually in some populations, and profusely in response to fire.

The upland cane that grows on ridges in the Upstate is short and deciduous. McMillan says this type is now being described taxonomically. He has never seen it flower! It grows alongside table mountain pine and smooth coneflower on the fire-maintained ridges of Buzzard's Roost Heritage Preserve and Wildlife Management Area in Oconee County.

Cane ecosystems are classified as critically endangered—98 percent of the canebrakes are gone as a result of overgrazing by cattle, land clearing, lack of fire and inundation and flood control. Scattered stems of cane are still extremely common across the South, but the expansive thickets are all but gone. Many former cane sites now are either in pastures, row crops and pine plantations or have been invaded by invasive exotic plants like Oriental privet.

Managing for cane is not a popular or well-understood practice. Like longleaf pine or Atlantic white cedar, cane as a species is not imperiled, but the unique ecosystems centered on these species are in danger of disappearing. Indians managed cane by burning canebrakes to drive game, regenerate the plants, and clear riparian areas for various reasons. When burned, the airtight internodes on canes explode loudly—that's several explosions per stem, multiplied by many thousands of stems per acre.

The historical canebrakes were prime hunting grounds. Canebrakes and bottomland hardwood forests managed by Creek Indians were known as nokose-em-ekanas, or "beloved bear grounds." The settlers recognized the unique nature of canebrakes as hunting "honey holes." Frontier naturalist Gideon Lincecum described canebrakes as the "great sanctum sanctorum; the inner chamber of the hunting ground." The epic bear hunts of the Mississippi Valley so masterfully described by William Faulkner centered on canebrakes, as did the exploits of great bear hunters like famous South Carolinian Wade Hampton III.

Bobwhite quail are fond of the short cane that grows in frequently burned, poorly drained longleaf and pond pine flatwoods. Jimmy Bland of Mayesville, a dedicated and life-long quail hunter who remembers the glory days of "bird hunting" in Lee and Sumter counties, is interested in restoring cane to his land. "We used to find a heap of quail in those short canes," he says. "I reckon they used it for cover." Matt Nespeca of The Nature Conservancy and Pee Dee DNR staff are putting in experimental herbicide plots on land where Bland recently harvested timber, with the aim of getting cane back.

Another benefit of canebrakes is their ability to stabilize streambanks and streamflow by holding soil in place and mitigating against floods and droughts, and to enhance water quality. The U.S. Forest Service is restoring river cane on the Sumter National Forest, and switch cane is rebounding on state DNR lands where fire is the paramount land management tool.

Small-scale restoration can be as simple as transplanting clumps of stems and rhizomes, but make sure you are working with native cane, not one of the many Asian varieties, which can be highly invasive and disrupt ecosystem integrity. Ongoing research projects aimed at "raising cane" promise to yield new restoration techniques and improve old ones. One day, perhaps, we will see a resurgence of this uniquely Southern grass, along with the cultural and natural history that accompanies it.

Native Plants for Soil Stabilization, Ecological Integrity, Aesthetics and "Local Character" in Highway and other Rights-of-Way

Johnny Stowe[1] and Dhaval Vyas[2]

[1]SC Department of Natural Resources, Columbia, SC and [2]GA Department of Transportation, Atlanta, GA

Abstract

The damage from alien species is well-documented, and the movement toward native plant species is promising. But many groups continue to plant and foster aliens, including invasive species. We examine the reasons for continued use of these noxious species, and suggest paths by which to overcome this trend. One particularly salient issue is the need to immediately stabilize soil during construction projects. This practicality often presents ostensible conflicts between the utilization of invasive species versus the use of native species, with the former too often prevailing because of "time-tested" and customary practices. Efforts must be expanded to publicize the harm from invasive alien plant species in public projects, and to provide practical native plant alternatives that support ecosystem integrity, aesthetics and natural characteristics of the landscape.

The Coalition of Prescribed Fire Councils: Partnering to Promote Understanding of Prescribed Fire, and Address Management, Policy, and Regulatory Issues

Johnny Stowe[1], Mark Melvin[2] and Dale Wade[3]

[1]South Carolina Department of Natural Resources, [2]Jones Ecological Research Center and [3]US Forest Service (retired)

Abstract
As North America continues to experience rapid changes in land use and demographics, and to suffer from the resulting loss and degradation of ecosystems and landscapes, prescribed fire managers face increasingly complex challenges that limit or threaten the use of this ancient conservation tool. Across the continent, common prescribed fire issues related to public health and safety, ecological stewardship, liability, public education, air quality regulation and the wildland urban interface (WUI) concern the prescribed fire community. Networking existing state and provincial prescribed fire councils' efforts is proving synergistic in increasing communication, effectiveness of public education, participation in fire policy decisions, and representation in forums dealing with regional, national and international regulatory issues. In November 2006, a diverse group of private, federal and state agency, and non-governmental organization leaders agreed to form an overarching umbrella prescribed fire organization to facilitate formation of new fire councils, to serve as a repository for fire information and expertise, to provide a forum for discussion of current issues, and to speak as a unified voice for member councils. They chose to call this organization the National Coalition of Prescribed Fire Councils, and developed a strategic plan that includes a mission statement, purpose, goals, and plan of action. This Scoping Committee is pleased to announce formation of the inaugural Board of Directors, which comprises 9 members, each with an enviable track record and national reputation. Board members come from across the country and will meet 3-5 November 2008 to take over the reins from the Scoping Committee, peruse draft documents developed by the various interim committees, and tackle the tasks associated with making the Coalition relevant and effective, including incorporation, staffing issues, and funding sources. The Board realizes it has to work quickly if it is to effectively serve the needs of the state fire councils, as the number of states having such councils has grown from five in 2006, to 21 as of 1 October 2008, with some states having multiple councils. These 21 states represent 12 million acres of annual prescribed fire. The National Coalition of Prescribed Fire Councils already serves on regional, national and international platforms and looks forward to expanding its efforts to ensure that the ecological values and other public benefits of prescribed fire are secure for the future.

Influences of Fire Seasonality and Legumes upon Soil Processes in Young Longleaf Pine Plantations

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Abstract
Approximately 100,000 hectares of longleaf pine (*Pinus palustris* Mill.) plantations have been established on former agricultural sites in the southern USA in the past decade, many if not most with a primary objective for wildlife management using prescribed fire. Restoration goals for productive longleaf pine ecosystems with quality wildlife habitat include the need for reintroduction of prescribed fire and for development of a groundcover of native grasses and forbs. This study examines the long-term effects of dormant and growing season burning on soil nitrogen (N) in fourteen year-old stands of longleaf, factorialized with and without N_2-fixing native legumes. Total N, soil organic N, and soil and pine foliar $\delta^{15}N$ will be assessed over time to detect responses to N loss via burning and N additions via fixation. However, it may be problematic to follow fates of fixed N due to variability and isotopic ^{15}N fractionation of residual fertilizers, N in trees, or of residual N left after burning. Although most sites initially have some residual fertility, soils are generally highly depleted in both organic matter and total N relative to mature native longleaf woodland soils. The soil pretreatment $\delta^{15}N$ profile at 0-10, 10-20, and 20-30 cm increases with depth with means of 5.6, 6.8 and 7.5 respectively. Pine foliage (-3), and litter (-3.3) $\delta^{15}N$ values from the plantations only vary slightly from native woodlands. Legume foliar $\delta^{15}N$ values range from -.5 to -1.8. Measures of soil $\delta^{15}N$ may provide a useful technique for assessing changes in soil and vegetation pools of N from pines and legumes with restoration and burning treatments over time.

Current Status of Red-cockaded Woodpecker and Amphibian Population Monitoring on Eglin Air Force Base, Florida

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Abstract

This poster describes the current status of research and management on vertebrate species of concern inhabiting the longleaf pine (*Pinus palustris*) ecosystem on Eglin Air Force Base, Florida. Virginia Tech biologists are working in conjunction with Eglin's Jackson Guard natural resource management group to (1) meet Eglin's population recovery goals for the endangered red-cockaded woodpecker (*Picoides borealis*) and (2) refine our understanding of the distribution and habitat needs of the Florida bog frog (*Rana okaloosae*) and flatwoods salamander (*Ambystoma cingulatum*). The red-cockaded woodpecker management strategy includes ecosystem management (primarily prescribed burning), recruitment cluster construction, cavity management and translocation. The population grew by 21.5% between 2005 and 2008, resulting in 390 active clusters (7% annual growth rate). In 2008 there were 347 potential breeding groups, 3 groups shy of Eglin's recovery goal. With continued efforts to maintain the current management strategy, Eglin's population recovery goal may be reached in 2009. The flatwoods salamander, a threatened, longleaf obligate species, has been proposed for uplisting to endangered status. Eglin contains 3 historic populations consisting of 18 known wetlands, 7 of which have been occupied since 2003. We are currently evaluating factors that influence larval occupancy of known breeding wetlands. Our research on the Florida bog frog, a Florida panhandle endemic, focuses on identifying its distribution and habitat requirements at multiple scales. For both amphibian species, we have found that higher amounts of herbaceous vegetation and moderate levels of canopy cover predict occupancy, suggesting that fire plays an important factor in influencing their distribution.

Soil Respiration in Longleaf Pine Forests

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Abstract

Global climate change and the accumulation of the greenhouse gas carbon dioxide (CO2) in the atmosphere can be mitigated by the proper management of soils and forests through carbon sequestration. Particularly, longleaf pine (Pinus palustris Mill.) forests and soils are able to sequester large quantities of carbon through long rotations of timber and temperate climatic conditions. Soils compose the largest carbon sinks on earth and thus have potential to be the largest contributors of CO2 to total ecosystem respiration. However, more knowledge on the effects of stand structure on soil respiration rates is needed to understand how forest management influences carbon cycling. The objective of this study was to examine how forest structure influences the rate of soil respiration to better understand forest management effects on carbon pools. Soil respiration was examined in response to basal area, live, dead, coarse, and fine root biomass, woody debris in the soil, soil charcoal mass, litter depth, litter mass, downed woody debris, aboveground biomass in woody species, environmental conditions, and estimated percent ground cover. Various basal areas were tested so as to cover a range of management plans and silvicultural operations for natural longleaf stands.

Introduction

Longleaf pine historically dominated the upper and lower Coastal Plain in the southeastern states of east Texas to southeast Virginia and into the Piedmont of Alabama and Georgia. Extensive logging practices and improper regeneration techniques, reforestation with various species of southern yellow pines (P. taeda L., P. elliottii Engelm., P. echinata Mill.), the naval stores industry which utilized pine oleoresin, and suppression of natural wildfires all played an important role in the decline of the natural range of the longleaf pine. The original longleaf range has been reduced to less than 3 million acres. However, as interest in this species grows, lands are being reforested with longleaf pine through private landowner interests, governmental conservation reserve programs (CRP), and ecologists seeking to restore native habitat which supports many diverse forms of flora and fauna.

In a forested ecosystem there are many pathways through which carbon is sequestered. Forests are a large component of the carbon cycle in both sources and sinks for CO2. Because forests can be large carbon banks which are able to reduce the amount of greenhouse gases in the atmosphere, their value has increased. The cycle of carbon in a forested ecosystem also has many components, including above ground and below ground biomass production, decomposition, and respiration. Carbon is sequestered into the soil through photosynthesis and by organic matter decomposition. Sources of carbon dioxide from forests include forest fires, decomposition of leaf matter and woody debris, and respiration (Kimmins, 2004).

Total ecosystem respiration within forests is determined by autotrophic and heterotrophic belowground respiration. Soils are the largest storage bank of carbon, exceeding aboveground and belowground biomass or atmospheric CO2 amounts by two to three times (Johnson et al., 2003). Soil respiration was found to be between 58% and 76%, with a mean of 67%, of the total ecosystem respiration in a temperate mixed hardwood and conifer forest in Belgium (Yuste et al., 2005). Forest and soil carbon storage would act as a long term storage bank for carbon as the forests mature and grow through CO2 sequestration. Chen et al. (2007) describe soil organic carbon in relation to a carbon sink as equal in importance, if not even more significant, than the live biomass which grows in the soil. Because of the importance of soil carbon relative to a forest as a carbon sink, many soil factors should be considered, including the parent material, texture, depth, forest cover, and past and present management practices (Yu et al., 2007). Soil carbon is difficult to determine because of the non-uniform spatial distribution of carbon in the soil and limited methods for measurements of the soil carbon (Ebinger et al., 2003). In fact, there is only a partial understanding of the process of carbon allocation in forests, because there is a large range of unknown knowledge for certain factors in the carbon cycle such as belowground carbon fluxes and allocation of carbon through different forested ecosystems (Litton et al., 2007). Soil carbon has been noted by Birdsey (2006) to change in very small increments that are difficult to assess, confirming soil carbon's complexity.

Soil carbon can be released through disturbances such as fire, pest outbreaks, logging, or through land use changes. Valentini et al. (2000) found that as the use of land changes, there is a large change in the soil organic matter, which can be sequestered and accumulate within soil stores, or decompose and be recycled through the carbon cycle and increase soil respiration rates. Land carbon storage is composed of plant and soil carbon sinks. When the carbon sink is not maintained in the same manner in which carbon was sequestered, then the sink may transform into a carbon source (Scholes et al., 2001). For example, land use change from a forest to agricultural land results in different cycling patterns of carbon. The forest had previously taken CO2 from the atmosphere and through carbon allocation the distribution of the sequestered carbon became part of the tree and part of the soil. A land use change resulting in the transformation of a forest into cropland will loose long term storage ability as woody materials are excluded from the landscape. Land use may alter microclimate which changes the variable residence time of soil organic carbon. Factors which effect the mean residence time of soil carbon are the ability of a carbon source to resist decay and the amount of protection carbon sources have against decomposition (Paul et al., 2003). Both variables influence the storage and respiration of carbon in soil. Scholes and others (2001) state that carbon in plant biomass or soil organic carbon will be released back into the atmosphere with improper management. The transformation from a carbon sink to a carbon source can be a very rapid change as a result of disturbances altering the structure of the land. However, the transformation can also be gradual through the process of respiration. Falkowski et al. (2000) state three possible pathways by which carbon is reintroduced into the atmosphere. These are autotrophic respiration, heterotrophic respiration, and land disturbances such as fire, pests, land use change, deforestation, and aforestation.

The objective of this study was to examine soil respiration rates in relation to forest structure to determine what environmental factors and management practices maximize total ecosystem carbon sequestration in longleaf pine stands. If land managers are able to utilize a land management plan to produce timber and sequester carbon simultaneously, economic and intrinsic values increase for the land owner. Because soil respiration composes a large percentage of ecosystem respiration, factors affecting soil respiration influence whether a stand is a source or sink for CO2. We investigated relationships between soil respiration and live, dead, coarse, and fine root biomass, woody debris in the soil, soil charcoal mass, litter depth, litter mass, downed woody debris, aboveground biomass in woody species, environmental conditions, and estimated percent ground cover.

Methods

The study site is located at the Escambia Experimental Forest (EEF) located seven miles south of Brewton, Alabama. This is in the Middle Coastal Plain which is composed of well drained, nutrient poor, sandy loam soils. Lindsey Creek and some of its small tributaries flow through the forest into the Conecuh River. The USDA-Forest Service maintains this 1,200 ha (3,000 acre) forest as an experimental study site primarily for natural longleaf pine management. It was established as an experimental forest on April 1, 1947 when the T.R. Miller Mill Company leased it without charge for 99 years to the USDA-Forest Service. Site index is approximately 21 m (70 ft) at base age 50. The study site, Compartment 135, was naturally regenerated in 1957-1958 by the shelterwood method. The seedlings were released from the parent overstory in 1961. Since regeneration, the stand has been managed with prescribed fire every three years and the last prescribed burn for Compartment 135 was conducted on January 9,

2007. The average stand basal area is 18 m2/ha (80 ft2/acre) except in 15 plots which were separately managed for different densities throughout the 16 ha (40 acre) block. The 15 study plots cover a range in basal areas from 7-36 m2/ha (29-157 ft2/acre).

There were a total of 15 0.04 ha (approximately 0.10 ac) plots with every plot divided into 400 separate 1 m2 subplots. During the 10 month study, 5 1 m2 subplots from each plot were sampled. Different basal areas and the frequency of plots within basal areas were sampled to provide a varying range of densities and forest structure. In each subplot we measured soil respiration, litter depth, litter mass, live, dead, fine and coarse roots, woody debris within the soil, soil charcoal mass, soil carbon, and % ground cover.

Soil respiration rates were measured in one location in each subplot using an infrared gas analyzer (IRGA) (LICOR 6400, Li-Cor, Inc.; Lincoln, Nebraska USA) connected with a soil chamber head attachment (LICOR 6400-09 Soil CO2 Flux Chamber). Polyvinyl chloride (PVC) soil collars, 10 cm in diameter, were installed the day prior to measurements in order to avoid the resulting increased flux of CO2 after installation (Maier et al., 2000).

Subplot values were averaged by plot. Relationships between soil respiration and independent variables were examined using linear and nonlinear regression. The influence of basal area categorized as low (7-15 m2 ha-1), medium (16-25 m2 ha-1), and high (29-36 m2 ha-1) on soil respiration was examined using repeated measures analyses.

Results

Mean monthly soil respiration rates ranged from 1.4 μmol m-2 s-1 in February to 7.0 μmol m-2 s-1 in July (Figure 1). Soil respiration was 14.6% higher in the 29-36 m2 ha-1 and 16-25 m2 ha-1 basal areas plots than in the 7-15 m2 ha-1 basal area plots (Figure 1). Soil respiration increased exponentially with increasing air temperature and temperature explained 90% of the variation in soil respiration (Figure 2). Soil moisture, live and dead fine root biomass, residual charcoal and litter explained from 3-13% of soil respiration (Figures 3, 4, and 5). Ground cover explained 45% of the variation in soil respiration (Figure 3) possibly because % ground cover was significantly related to seasonal changes in temperature ($R^2=0.36$, $p<0.001$) and phenology. However, temperature did not vary significantly with basal area (data not shown).

Conclusions

Soil respiration was strongly related to air temperature followed by % cover, dead fine roots, and litter mass. These results indicate that annual soil carbon efflux in longleaf pine stands can be well predicted from air temperature. The 14.6% lower soil respiration in stands with the lowest basal area was not due to temperature but could be in response to differences between pine and herbaceous specific root respiration rates, overall biomass production, and more extensive pine root systems in the higher basal area plots.

These preliminary data will be used in combination with aboveground and belowground biomass and annual estimates of soil respiration to better understand how forest management effects ecosystem carbon sequestration.

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References

Birdsey, R.A. 2006. Carbon accounting rules and guidelines for the United States Forest Sector. Journal of Environmental Quality 35: 158-1524.

Chen, J.M., S.C. Thomas, Y. Yin, V. Maclaren, J. Liu, J. Pa, G. Liu, Q. Tian, Q. Zhu, J.-J. Pan, X. Shi, J. Xue, and E. Kang. 2007. Enhancing forest carbon sequestration in China: toward an integration of scientific and socio-economic perspectives. Journal of Environmental Management 85: 515-523.

Ebinger M.H., M.L. Norfleet, D.D. Breshears, D.A. Cremers, M.J. Ferris, P.J. Unkefer, M.S. Lamb, K.L. Goddard, and C.W. Meyer. 2003. Extending the applicability of laser-induced breakdown spectroscopy for total soil carbon measurement. Soil Science Society of America Journal 67: 1616-1619.

Falkowski, P., R.J. Scholes, E. Boyle, J. Canadell, D. Canfield, J. Elser, N. Gruber, K. Hibbard, P. Hogberg, S. Linder, F.T. Mackenzie, B. Moore III, T. Pederson, Y. Rosenthal, S. Seitzinger, V. Smetacek, and W. Steffen. 2000. The global carbon cycle: a test of our knowledge of earth as a system. Science 290: 291-296.

Johnson, D.W., D.E. Todd, Jr. and V.R. Tolbert. 2003. Changes in ecosystem carbon and nitrogen in a loblolly pine plantation over the first 18 years. Soil Science Society of America Journal 67: 1594-1601.

Kimmins, J.P. 2004. Forest Ecology. p 60. Pearson Prentice Hall: Upper Saddle River, NJ.

Litton, C.M., J.W. Raich and M.G. Ryan. 2007. Carbon allocation in forest ecosystems. Global Change Biology 13:2089-2109.

Paul, E.A., S.J. Morris, J. Stix, K. Paustian, and E.G. Gregorich. 2003. Interpretation of soil carbon and nitrogen dynamics in agricultural and afforested soils. Soil Science Society of America Journal 67: 1620-1628.

Scholes R.J. and I.R. Noble. 2001. Climate change: storing carbon on land. Science 294: 1012-1013.

Valentini, R., G. Matteucci, A.J. Dolman, E.D. Schulze, C. Rebmann, E.J. Moors, A. Granier, P. Gross, N.O. Jensen, K. Pilegaard, A. Lindroth, A. Grelle, C. Bernhofer, T. Grunwald, M. Aubinet, R. Ceulemns, A.S. Kowalske, T. Vesala, U. Rannik, P. Berbigier, D. Loustau, J. Guomundsson, H. Thorgeirsson, A. Ibrom, K. Morgenstern, R. Clement, J. Moncrieff, L. Martin, D., J. Beringer, L.B. Hutley, and I. McHugh. 2000. Respiration as the main determinant of carbon balance in European forests. Nature 20:861-865.

Yu, D., X. Shi, H. Wang, W. Sun, J.M. Chen, Q. Liu and Y. Zhao. 2007. Regional patterns of soil organic carbon storages in China. Journal of Environmental Management 85: 680–689.

Yuste, J.C., M. Nagy, I.A. Janssens, A. Carrara, and R. Ceulemans. 2005. Soil respiration in a mixed temperate forest and its contribution to total ecosystem respiration. Tree Physiology 25: 609-619.

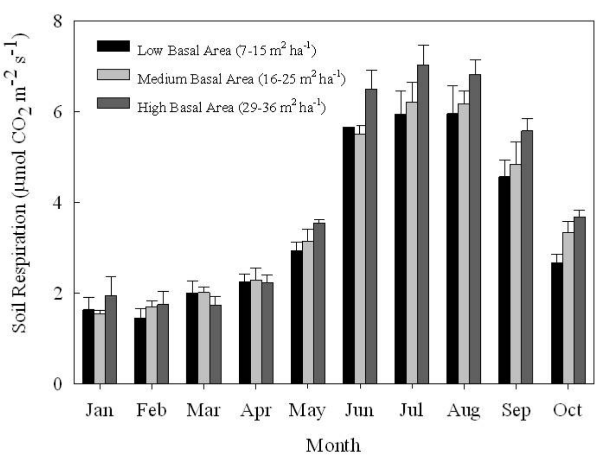

Figure 1. Average of soil respiration from January through October (2008) in plots with different basal areas.

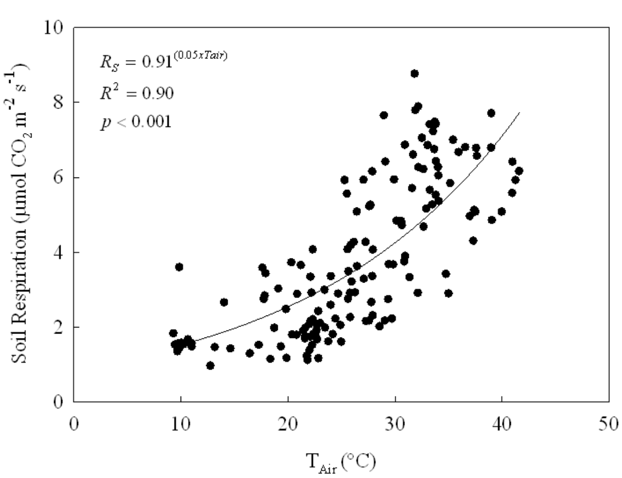

Figure 2. Soil respiration in response to air temperature (TAir) above the soil.

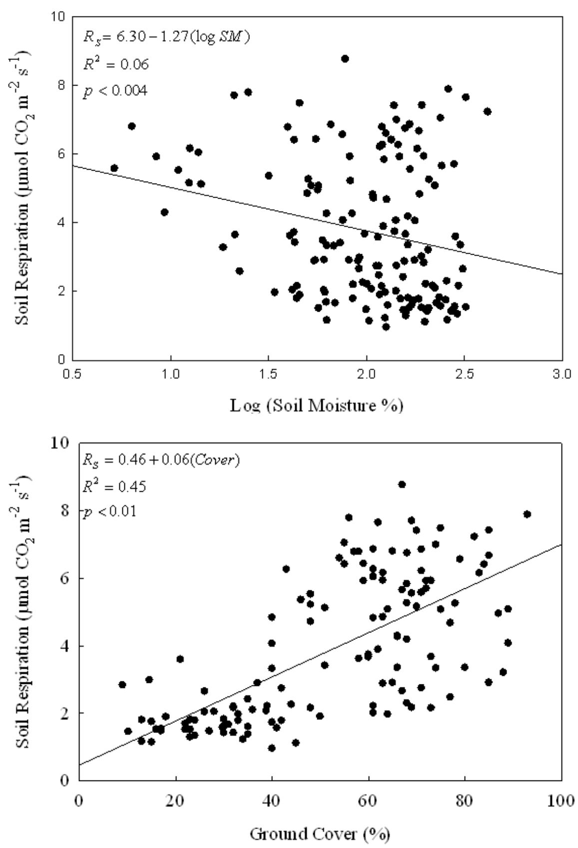

Figure 3. Relationship between soil respiration and soil moisture or ground cover.

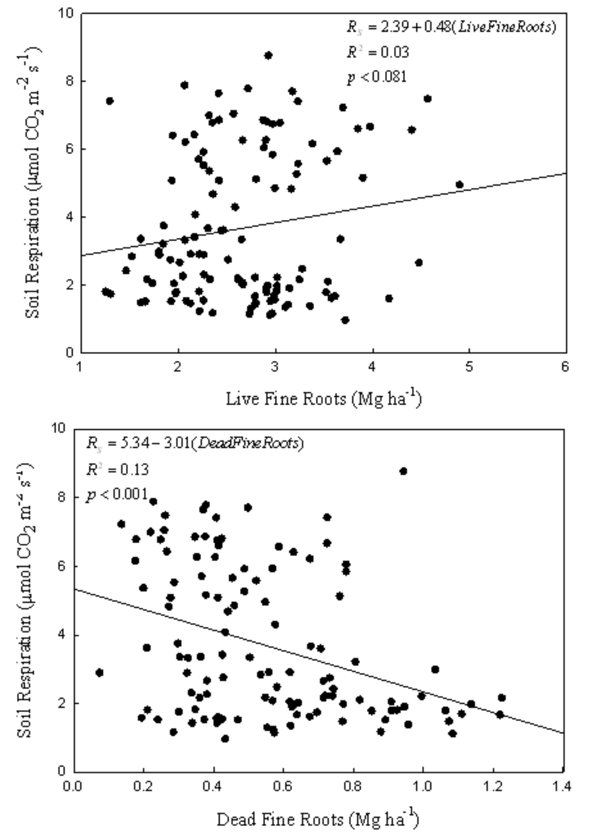

Figure 4. Relationship between soil respiration and live or dead fine roots.

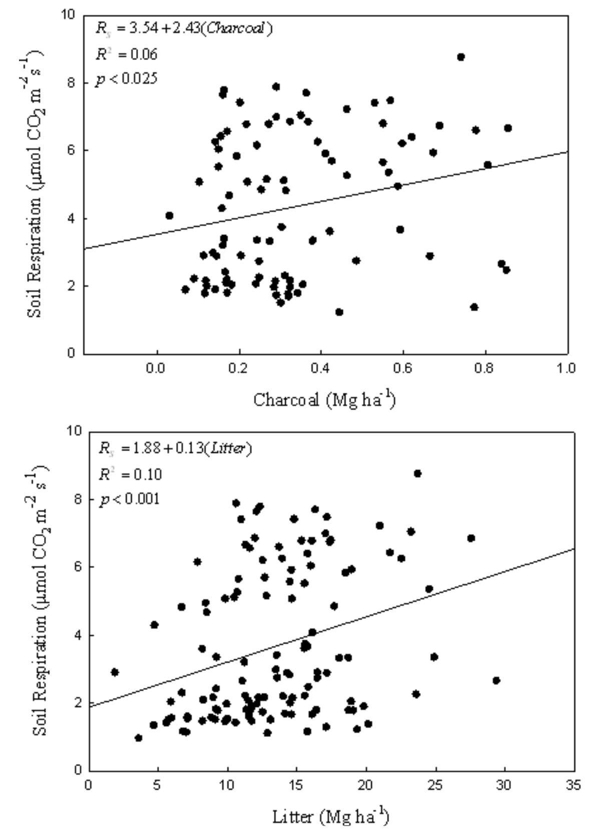

Figure 5. Relationship between soil respiration and residual soil charcoal mass or litter mass.

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Forestry & Environmental Outreach Program

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Longleaf Alliance and Forest Guild Joint Meeting, October 28-November 2, 2008

Last Name	First Name	Organization	Attendee Count: 367
Addington	Rob	The Nature Conservancy	Fort Benning, GA
Addington	Rob	The Nature Conservancy	Fort Benning, GA
Agpaoa	Liz	USDA Forest Service	Atlanta, GA
Albrecht	Barbara	The Nature Conservancy	Milton, FL
Allen	Brad	NC Division of Forest Resources	Rockingham, NC
Anderson	Carlene	Walton County School System	Defuniak Springs, FL
Aresco, PhD	Matt	Nokuse Plantation	Bruce, FL
Arney	Ken	USDA Forest Service	Atlanta, GA
Aycock	Ray	US Fish and Wildlife Service	Jackson, MS
Bachant-Brown	Eddie	The Longleaf Alliance	Milton, FL
Bachant-Brown	JJ	The Longleaf Alliance	Andalusia, AL
Bagley	Scott	National Network for Forest Practitioners	Athens, OH
Bailey	Mark	Conservation Southeast	Andalusia, AL
Balbach	Hal	US Army Corps of Engineers	Champaign, IL
Baldwin	Kenneth	Forest Guild	Douglas City, CA
Barbour	Jill	USDA Forest Service	Dry Branch, GA
Barlow	Becky	Alabama Cooperative Extension Service	Auburn, AL
Barmore	Ron	Range Fuels, Inc.	Acworth, GA
Bates	Jim	US Fish and Wildlife Service	Fort Benning, GA
Beam	Lynda	Guerry-Beam Farm	Savannah, GA
Beard	Bruce	US Department of Defense	Arlington, VA
Bell	Wayne	International Forest Company	Moultrie, GA
Benson	Maylon	Heart Pine Plank Flooring	Poulan, GA
Beter	Dale	US Army Corps of Engineers	Panama City, FL
Bhuta	Arvind	Meadowview Biological Research Station	Woodford, VA
Blackwell	Jessica	USDA Forest Service	Brent, AL
Blanc	Lori	Virginia Polytechnic Institute & State University	Blacksburg, VA

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Blanton	Jason	Blanton's Longleaf Container Nursery	Madison, FL
Blencowe	Craig	Blencowe Associates	Fort Bragg, CA
Blue	Lloyd	Nokuse Plantation	Destin, FL
Boensch	Bob	The Nature Conservancy	Silsbee, TX
Bohn	Cindy	US Fish and Wildlife Service	Atlanta, GA
Borg	C. K.	Tall Timbers Land Conservancy	Tallahassee, FL
Bowersock	Jonas	Auburn University	Auburn, AL
Bowersock	Elizabeth	Auburn University	Auburn, AL
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Bradley	William	Sutherland Asbill & Brennan LLP	New York, NY
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Brodbeck	Beau	Alabama Cooperative Extension System	Bay Minette, AL
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Cantin	Brian	Berger Peat Moss	Kingsville, ONT
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Cipollini	Martin	Berry College	Mount Berry, GA
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Corrie	Dan		Tifton, GA
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Cox	John	Lolly Creek, LLC	Sumner, GA
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Currie	Jim		Picayune, MS
Curry	James		Highlands, NC
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Dickinson	Joshua	Forest Management Trust	Gainesville, FL
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Frizzell	Karen	The Longleaf Alliance	Auburn, AL
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Garner	Mark	USDA Forest Service	Andalusia, AL
Garner	Mark	USDA Forest Service	Andalusia, AL
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George	Traci	State of Alabama	Montgomery, AL
Gibson	Susan	Department of Defense	Atlanta, GA
Gieger	Adonica		Maida Vale, LONDON
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Ginger	Shauna	US Fish and Wildlife Service	Jackson, MS
Gjerstad	Dean	Auburn University	Auburn, AL

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Gjerstad	Phil	Gjerstad Cattle Company	Maple Hill, KS
Gjerstad	Diane	Wichita City Schools	Wichita, KS
Glitzenstein	Jeff	Tall Timbers Land Conservancy	Tallahassee, FL
Goodman	Steve	Virginia Polytechnic Institute & State University	Blacksburg, VA
Grand	Barry	Auburn University	Auburn, AL
Graydon	Courtney	Alabama Dept. of Conservation and Natural Resources	Montgomery, AL
Grimes	Chuck	Grasslander	Hennessey, OK
Grimm	David	US Air Force	Niceville, FL
Gross	Howard	Forest Guild	Santa Fe, NM
Guerry	Janet	Guerry-Beam Farm	Savannah, GA
Gunter	Farroll		Lexington, SC
Guyer	Craig	Louisiana State University	Baton Rouge, LA
Hainds	Katie	The Longleaf Alliance	Andalusia, AL
Hainds	Mark	The Longleaf Alliance	Andalusia, AL
Halbert	Jason	The Oak Hill Fund	Charlottesville, VA
Hall	Heidi	Project Orianne	Pocatello, ID
Hanby	Kent		Dadeville, AL
Hanby	Janice		Dadeville, AL
Handley	Don	Handley Forestry Services	Florence, SC
Hardin	Dennis	Florida Division of Forestry	Tallahassee, FL
Harris	Amber	E.O. Wilson Biophilia Center	Freeport, FL
Harrison	Wade	The Nature Conservancy	Fort Benning, GA
Harrison	Wade	The Nature Conservancy	Fort Benning, GA
Hart	Roger	NC Division of Forest Resources	Hope Mills, NC
Hartrick	Lisa	NC Division of Forest Resources	Whiteville, NC
Hassell	Scott	US Air Force	Niceville, FL
Hatten	Karen	Georgia Forestry Commission	Macon, GA
Hatten	Rick	Georgia Forestry Commission	Macon, GA
Hayes	Lark	Southern Environmental Law Center	Chapel Hill, NC
Haynes	Ronnie	US Fish and Wildlife Service	Atlanta, GA
Haywood	Dave	USDA Forest Service	Pineville, LA
Henderson	Mike	Berger Peat Moss	Cleveland, TN
Herbert	Nancy	USDA Forest Service	Asheville, NC

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Hermann	Sharon	Auburn University	Auburn, AL
Hiers	Kevin	The JW Jones Ecological Research Center	Newton, GA
Hill	Brandon	NC Division of Forest Resources	Goldsboro, NC
Hodgson	Jol	Beaver Plastics Ltd.	Coquitlam, BC
Holmes	Gary	USDA Forest Service	Olustee, FL
Hubbard	Bill	The University of Georgia	Athens, GA
Hudgins	Kristina	Virginia Polytechnic Institute & State University	Maysville, NC
Hudson	Stephen	U.S. Army	Fort Benning, GA
Hughes	Glenn	Mississippi State University	Purvis, MS
Hurst	Bob	The Oak Hill Fund	Charlottesville, VA
Hurt	Holister	US Air Force	Niceville, FL
Jack	Steve	The JW Jones Ecological Research Center	Newton, GA
Jacob	Rick	The Nature Conservancy	Lake Charles, LA
Jacobs	Bob		Douglasville, GA
Jenkins	Chris	Project Orianne	Pocatello, ID
Johnson	Rhett	The Longleaf Alliance	Andalusa, AL
Johnson	Kathy	The Longleaf Alliance	Andalusa, AL
Jones	Justin	The Nature Conservancy	Milton, FL
Jones	Kelly	Virginia Polytechnic Institute & State University	Blacksburg, VA
Jones	Cecilia	Walton County Commissioner Elect	Santa Rosa Beach, FL
Karels	Jim	Florida Division of Forestry	Tallahasse, FL
Kelly	Patty	US Fish and Wildlife Service	Panama City, FL
Kelly	Patty	US Fish and Wildlife Service	Panama City, FL
Kensler	Mike	Auburn University	Auburn, AL
Kensler	Mike	Auburn University	Auburn, AL
Kensler	Mike	Auburn University	Auburn, AL
Kett	Susan	USDA Forest Service	Olustee, FL
King	Maddie	The University of the South	Sewanee, TN
Kleiner	Kevin	Auburn University	Auburn, AL
Kush	John	Auburn University	Auburn, AL
Ladd	Tammy	Plum Creek Timber Company	Hazelhurst, MS
Laird	E. Cody	Lolly Creek / Oakridge Farms	Atlanta, GA

Laird	Dobbs	Lolly Creek / Oakridge Farms	Sumner, GA
Langford	Paul	PJ Langford Timber	Pensacola, FL
Langford	Paul	PJ Langford Timber	Pensacola, FL
Langston	Wayne	NC Division of Forest Resources	Goldsboro, NC
Larson	Keville	Larson & McGowin, Inc.	Mobile, AL
Larson	Weezie	Larson & McGowin, Inc.	Mobile, AL
Lauer	Dwight	Silvics Analytic	Wingate, NC
Lawrence	Keith	USDA Forest Service	New Ellenton, SC
Ledbetter	Wendy Jo	The Nature Conservancy	Silsbee, TX
Lee	James	The Nature Conservancy	Camp Shelby, MS
Lee	Charles	USDA Forest Service	Andalusia, AL
Lee	Stephen	USDA Forest Service	Andalusia, AL
Lee	Charles	USDA Forest Service	Andalusia, AL
Lee	Stephen	USDA Forest Service	Andalusia, AL
Lentile	Leigh	The University of the South	Sewanee, TN
Leslie	Thomas		Atlanta, GA
Leslie	Mary		Atlanta, GA
Levine	Aaron	The Nature Conservancy	Altamonte Springs, FL
Lindeman	Steve	The Nature Conservancy	Abingdon, VA
Londo	Andy	Mississippi State University	Mississippi State, MS
Long	Barbara	Long's Services	Leesville, SC
Long	Gerald	Long's Services	Leesville, SC
Lopez	Roel	US Department of Defense	Arlington, VA
Loyd	Neil	Dupont	Raleigh, NC
Loyd	Neil	Dupont	Raleigh, NC
Luce	Greg	Luce Packing Company	Moss Point, MS
Luce	Susan	Luce Packing Company	Moss Point, MS
Lyman	Melinda	The Nature Conservancy	Camp Shelby, MS
Majesty	Raymond		Glenview, IL
Majesty	Raymond		Glenview, IL
Mark	Harper	Discovering Alabama	Tuscaloosa, AL
Marston	Tim	US Army	Fortson, GA
Martin	Jon		Albuquerque, NM
Martin	Joel	Auburn University	Andalusia, AL

Martin	Joel	Auburn University	Andalusia, AL
Masters	Ronald	Tall Timbers Research Station	Tallahassee, FL
McCarter	Kelley	NC State University	Raleigh, NC
McCartney	Robert		Aiken, SC
McClure	Nathan	Georgia Forestry Commission	Atlanta, GA
McCullough	Howard	US Fish and Wildlife Service	Folkston, GA
McDearman	Will	US Fish and Wildlife Service	Atlanta, GA
McDow	Will	Environmental Defense Fund	Raleigh, NC
McGuire	John	Westervelt Ecological Services	Auburn, AL
McHugh	Jim	Alabama Dept. of Conservation and Natural Resources	Montgomery, AL
McIntyre	Kevin	The JW Jones Ecological Research Center	Newton, GA
McQuage	Ken	Plum Creek Timber Company	Hazelhurst, MS
Meeks	Steve	Meeks Farms & Nursery, Inc.	Kite, GA
Melpin	Mark	The JW Jones Ecological Research Center	Newton, GA
Miller	Weldon	AG-Renewal, Inc.	Weatherford, OK
Miller	Susan	US Fish & Wildlife Service	Southern Pines, NC
Mitchell	Sharon	Panhandle Area Educational Consortium	Chipley, FL
Mock	Kevin	US Air Force	Niceville, FL
Moody	William		Lexington, SC
Moore	Susan	NC State University	Raleigh, NC
Moore	Julie	US Fish & Widlife Service	McLean, VA
Morrill	Richard		Orono, ME
Motherwell	Beth	University of Alabama Press	Tuscaloosa, AL
Myers	Erin	USDA Natural Resources Conservation Service	Gainesville, FL
Nelson	Dana	USDA Forest Service	Saucier, MS
New	Barry	NC Division of Forest Resources	Raleigh, NC
Nichols	Joanna	Longleaf Alliance	Selma, AL
Nichols	Ken	Longleaf Alliance	Selma, AL
Noss	Reed	University of Central Florida	Orlando, FL
Outcalt	Kenneth	USDA Forest Service	Athens, GA
Oxenrider	Sandy	Florida National Guard	Stark, FL
Page	Anita	South Walton Community Council	Santa Rosa Beach, FL

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Palola	Eric	National Wildlife Federation	Atlanta, GA
Pancake	Dale	Dixon Forestry Center	Andalusia, AL
Pardue	Jordan	The University of the South	Sewanee, TN
Paris	Kyle	Auburn University	Auburn, AL
Paris	Nathan	Auburn University	Auburn, AL
Parker	Mickey	Meeks Farms & Nursery, Inc.	Pensacola, FL
Parker	Jay	Virginia Polytechnic Institute & State University	Blacksburg, VA
Parker	Jay	Virginia Polytechnic Institute & State University	Blacksburg, VA
Patterson	Ann	Palmetto Interests, LLC	San Marino, CA
Pauley	Sara	D.J. Case & Associates	Mishawaka, IN
Pearsall	Sam	The Nature Conservancy of North Carolina	Durham, NC
Perschel	Bob	Forest Guild	Holden, MA
Pickens	Bill	NC Division of Forest Resources	Clayton, NC
Pittman	Jerry	J.E. Pittman Family Trust	Enterprise, AL
Pittman	Donald	J.E. Pittman Family Trust	Enterprise, AL
Pittman	Dana	J.E. Pittman Family Trust	Enterprise, AL
Platt	Bill	Louisiana State University	Baton Rouge, LA
Platt	Ad	The Nature Conservancy	Milton, FL
Pleas	Alexa	Nokuse Plantation	Destin, FL
Powell	Elizabeth	Booz Allen Hamilton	Arlington, VA
Pritchard	Donna	USDA Forest Service	Olustee, FL
Ragan	Tyrone		Fort Benning, GA
Ray	David	Tall Timbers Land Conservancy	Tallahassee, FL
Redding	Philip	The University of the South	Sewanee, TN
Reid	Roger	Discovering Alabama	Tuscaloosa, AL
Reinman	Joe	US Fish & Wildlife Service	St. Marks, FL
Rice	Cheryl		Freeport, FL
Riely	Christopher	Providence Water	Providence, RI
Riggins	John	Mississippi State University	Mississippi State, MS
Roach	Randy	US Fish and Wildlife Service	Daphne, AL
Robertson	Taylor	Jacksonville State University	Jacksonville, AL
Robertson	Kevin	Tall Timbers Land Conservancy	Tallahassee, FL

Robinette	Fred	Florida Fish and Wildlife Conservation Commission	Panama City, FL
Roe	Chuck	Land Trust Alliance	Raleigh, NC
Rose	Kevin	Virginia Polytechnic Institute & State University	Jacksonville, Nc
Ross	William	NC Department of Environment and Natural Resources	Raleigh, NC
Samuelson	Lisa	Auburn University	Auburn, AL
Saunders	Andrew		Mobile, AL
Savage	Thomas	Charles Dixon & Co., LLC	Andalusia, AL
Savereno	T.J.	Clemson University	Florence, SC
Scally	Christy	E.O. Wilson Biophilia Center	Freeport, FL
Scally	Niall	Fountain Investments	Santa Rosa Beach, FL
Seymour	John	Roundstone Native Seed, LLC	Upton, KY
Sharp	Doug	Plum Creek Timber Company	Hazelhurst, MS
Shaver	Brent	The Nature Conservance of Alabama	Mobile, AL
Shelburne	Doug	Smurfit-Stone Container Corporation	Brewton, AL
Shelferl	Richard	USDA Forest Service	Tallahassee, FL
Sheridan	Philip	Meadowview Biological Research Station	Woodford, VA
Sherman	Adam	Biomass Energy Resource Center, BERC	Montpelier, VT
Shouse	Scott	Mountain Association for Community Economic Development	Berea, KY
Smith	Ken	Forest and Watershed Institute	Las Vegas, NM
Smith	Stephen	S.G. Smith and Associates	Ukiah, CA
Smith	Jo Ann	USDA Forest Service	Hot Springs, AR
Smith	Jo Ann	USDA Forest Service	Hot Springs, AR
Sorrell	Geoff	Auburn University	Auburn, AL
Spadgenske	Eric	US Fish and Wildlife Service	Birmingham, AL
Spaine	P.	USDA Forest Service	Athens, GA
Spencer	Tommy	USDA Forest Service	Olustee, FL
Stallings	Vickie	The Longleaf Alliance	Andalusia, AL
Steele	Phil	Mississippi State University	Starkville, MS
Steele	Phil	Mississippi State University	Starkville, MS
Steponkus	Pete	NC Division of Forest Resources	New Bern, NC
Stewart	Beth	Cahaba River Society	Birmingham, AL
Stiff	Charles	FORSight Resouces	Milton, WI

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Stokes	Tom	Auburn University	Auburn, AL
Stowe	Johnny	South Carolina Department of Natural Resources	Columbia, SC
Strickland	Eric	Innovar Environmental, Inc.	Tulsa, OK
Strippelhoff	Cade	Berry College	Mount Berry, GA
Stuewe	Eric	Stuewe and Sons, Inc.	Tangent, OR
Summers	Marcia	Forest Guild	Santa Fe, NM
Sung	Susana	USDA Forest Service	Pineville, LA
Sutsko	Al	US Air Force	Niceville, FL
Tallman	Shawnea	Okaloosa County School System	Ft. Walton Beach, FL
Tarver	Charley	Longleaf Alliance	Bluffton, SC
Tate	Randy	The Nature Conservancy	Atlants, GA
Taylor	Steven	Auburn University	Auburn, AL
Taylor	Scott	The JW Jones Ecological Research Center	Newton, GA
Thompson	Cindy	USDA Forest Service	Olustee, FL
Tobe	John	ERC, Inc.	Tallahassee, FL
Tobe	John	ERC, Inc.	Tallahassee, FL
Trianosky	Paul	The Nature Conservancy	Mountain City, TN
Trott	Katherine	US Army Corps of Engineers	Washington, DC
Tucker	Ron	USDA Forest Service	,
Turner	Andrew	Southern Poverty Law Center	Montgomery, AL
Vankus	Victor	USDA Forest Service	Dry Branch, GA
Varn	Merrill	Varn Turpentine & Cattle Company	Folkston, GA
Viker	David	US Fish and Wildlife Service	Atlanta, GA
Walker	Bob	Nokuse Plantation	Bruce, FL
Walker	Viola	US Air Force	Niceville, FL
Waller	Bill	Green Circle Bioenergy	Cottondale, FL
Ward	Mike	US Fish and Wildlife Service	Folkston, GA
Watkins	Sarah	Luce Packing Company	Moss Point, MS
West	James	NC Division of Forest Resources	Goldsboro, NC
Whitaker	Ben	Auburn University	Auburn, AL
Whitaker	Andy	Wildlife Trends	Pike Road, AL
White	Tom	NC Division of Forest Resources	Norman, NC
Wiley	Amelia	Florida National Guard	Stark, FL

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Wilkes	Diane	Fountain Investments	Destin, FL
Wilkins	Neal	Texas A&M University	College Station, TX
Wilkinson	Bill	BBW Associates	Arcata, CA
Williams	Brett	US Air Force	Niceville, FL
Wilson	Jessica		Monteagle, TN
Wilson	Nathan	Forest Guild	Monteagle, TN
Wilson	E.O.	Harvard University	Cambridge, MA
Wood	Beth	Clemson University	Orangeburg, SC
Wooten	Monty	Greenleaf Forest Management	Asheville, NC
Yates	Camille	Three Creeks Timber Company	Fort Pierce, FL
Young	Beth	Beth Maynor Young Conservation Photography	Birmingham, AL