

SOUTHERN RESEARCH STATION SCIENCE AREA CHARTER		1. Title Forest Values, Uses and Policies
2. Primary Research Work Units (RWU Number, Title, Locations) RWU-4703, Forest Operations (Auburn, AL) RWU-4704, Utilization of Southern Forest Resources (Pineville, LA; Athens, GA; Blacksburg, VA) RWU-4804, Forest Economics and Policy (Research Triangle Park, NC; New Orleans, LA; Tuskegee, AL) RWU-4952, Integrating Human and Natural Systems in Urban and Urbanizing Landscapes (Gainesville, FL; Athens, GA) RWU-4953, Greatest Good for the 21 st Century: A Program of Pioneering Forestry Research on Emerging Societal Changes (Athens, GA) <i>Note: RWU-4953 is a pioneering research unit, and as such reports to the Station Director. However, the work of this unit is embraced within the Forest Values, Uses and Policies Science Area. Because of its pioneering status, this unit has its own charter which is appended to this science area.</i>		
3. Science Area Leader John F. Kelly, Assistant Station Director for Research, Asheville, NC		
4. Area of Research Applicability Regional, national, and international	5. Estimated Duration 5 years	
6. Mission The mission of the Science Area is to develop and deliver knowledge and tools that enable people to effectively manage forest and related environments for goods and services and to develop policies and products to enhance and sustain ecological, economic, and social benefits.		
Signature	Title	Date
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7. Description

The **Forest Values, Uses and Policies Science Area** contains a broad diversity of disciplines that address the interface between people and forest ecosystems, and the resulting effects on both forests and the values obtained from the forests for people using them. It includes: **forest products** (maintaining, enhancing and developing new outputs from forest inputs, improved processes for manufacture and recycling), **forest operations** (developing more effective methods and tools for access, stand treatments, and recovery for improved management), **resource economics** (evaluating management tradeoffs and policy effects), and **social science** (broadly defining the connection between human and forest conditions). Some research in this Science Area is conducted by scientists working independently and with external collaborators, but much of the work requires interaction among scientists within the Science Area, with other Science Areas in the Station, and with other Stations. The “human-forest interface” defines the ultimate rationale for managing and protecting forest lands.

This Science Area provides the knowledge and technology for a variety of clientele including other scientists, landowners and land managers, industry, forest users, urban forest managers, community planners, and policy and land-use decision makers. By doing so, clients can apply sustainable management principles and decision-making practices to forests in a manner that is economically and ecologically feasible across the entire rural-urban gradient.

Southern forests cover 215 million acres, about 40 percent of the land area in 13 states. The South is unique from some other regions in that a large proportion of forest lands are held in private ownership rather than public, providing both opportunities and conflicts when compared with regions where public lands dominate. This area constitutes about 29 percent of the forest land in the total United States, with Southern forests providing 64 percent of the total timber harvested in the U.S. In terms of timber products, the South produces 52 percent of the nation’s saw logs and 77 percent of the nation’s pulpwood.

The 13 Southern states contained 33 percent of the U.S. population in 2006. For 1990-2000, Georgia was the fastest growing State in the South, with 26 percent growth in population. Texas and Florida had the largest numerical increases (3.9 million and 3.0 million, respectively). Overall, the growth of the South’s population in the 1990s (17.3 percent) was outpaced only by the West (at 19.7 percent). More recently, from 2000-2006, the South is estimated to be growing faster than the West. This population growth is not only increasing the number of people in urban areas, but also increasing the presence of people in the wildland-urban interface.

Thus, not only is timber important in the South and the U.S., but also the region is characterized by a large and growing population, which provide additional demands on the forest lands, such as increased impacts and opportunities for outdoor recreation, and additional impacts to water and air resources.

The South is still the primary producer of timber products in the U.S. and the world. However, the timber economy is changing. The timber industry has sold most of their timberland holdings, with much of it being bought by timber investment management organizations (TIMOs), and real

estate investment trusts (REITs). (Actually, TIMOs manage land for their investors and are not the owners. Typically an individual TIMO will have multiple clients, thus further increasing the ownership diversity beyond what it may appear.) For some areas in the South, timber remains a dominate forest use and part of local economies. Demands from the region's forest lands generally have long included timber and wood products, and increasingly environmental goods and services, home building sites, recreational opportunities, and scenic beauty. One phenomenon fuelling these demands is an expanding wildland-urban interface, a portion of the landscape consisting of a mix of homes and wildlands. As people seek more amenities and recreational opportunities associated with nature, it is important that we better understand how to provide these by managing southern forests, including the entire rural-urban gradient.

Thus, several forces of change have altered forests in the South throughout the twentieth century, which continue through the present. Among the most important are urbanization and changing demographics, changes in timber markets, shifts in ownership and forest management, and the spread of invasive species. Effectively addressing forest sustainability requires a better understanding of how: (1) people make decisions regarding management of forests, given the potential values they perceive; (2) human uses of land and resources alter forests and consequently the public goods they provide, including those in proximity to communities; (3) valuable services from the region's forests are defined; (4) innovations in the form of new forest products and the design of new institutions and policies could expand opportunities to achieve sustainable futures; and, (5) to simultaneously achieve sustainability and maintain desired levels of production of forest goods and services.

8. Goals

Research conducted in this science area addresses the entire continuum of landscapes from wilderness to rural to urban, including the wildland-urban interface. Research for this Science Area must identify linkage among economic, ecological and social components, but success in this can be enhanced by collaborating with other Science Areas.

The following are goals of the research for the Forest Values, Uses and Policies Science Area:

1. Provide the knowledge and technology for landowners, resource managers, community planners, and policy makers to inform and/or improve management of public and private landscapes for goods and services.
2. Provide knowledge to apply sustainable management principles to forests in a manner that is ecologically responsible, economically viable, and socially equitable.
3. Provide technology and knowledge for application to existing markets and potentially for the benefit of new markets for goods and services from forest resources.
4. Provide critical information on how the value of forests and their benefits change with changing land uses and ownerships.
5. Provide communities with the knowledge and tools to evaluate options for management, especially relating to the wildland-urban interface.

9. Focus Areas

The Forest Values, Uses and Policies Science Area will initially focus on four areas of research:

1. Improve understanding of how land use, forest management, climate, and policy affects forest disturbances and the flow of economic, social, and ecological values from forests, along rural-to-urban gradients.
2. Develop tools and options for addressing the sustainability issues of southern forests related to changes in land use, forest management, climate, policy, and other socioeconomic changes.
3. Evaluate the potential, and options for southern forest landowners to expand and diversify their returns through management focused on traditional forest products as well as emerging ecosystem services, while meeting other ownership objectives.
4. Develop technology to efficiently use woody biomass for biofuels, bioenergy, biochemicals, and traditional wood products and expand knowledge about these different uses and their respective roles in timber product markets.

Partnerships

Much of the research in the Forest Values, Uses and Policies Science Area is a continuation or evolution of previous work. Some of it is also relatively new. However, all of the research will benefit from close work with collaborative relationships that have been built up over a number of years. The importance of these collaborative relationships cannot be overstated. External research partners include other Governmental research institutions, university personnel, non-governmental organizations, industry groups, foreign and international institutions, and others. Forest Service collaborators include scientists within the Southern Research Station, many (most) other Stations throughout the Forest Service (including the Forest Products Laboratory and the International Institute of Tropical Forestry), and the Washington Office Research and Development staff.

A major objective of the SRS realignment was the integration of research. Virtually all scientists within the Forest Values, Uses and Policies Science Area have the potential to work closely on the same issues, but to address different components. Furthermore, the research conducted by this Science Area must be done with all other science areas to achieve an integrated product. In fact, new partnerships have been formed after the realignment was announced. The other science areas are:

- Forest Watershed Science
- Natural Resource Inventory and Monitoring
- Threats to Forest Health
- Forest Ecosystem Restoration and Management

One of the closest collaborators with this Science Area is the new Pioneering Science Unit, Greatest Good for the 21st Century: A Program of Pioneering Forestry Research on Emerging Societal Changes (RWU-4953). The work this unit does is part of the Forest

Values Science Area, but because the Project Leader reports directly to the Station Director, under its special designation, it has its own charter.

There are significant partners in the user community that assist with setting priorities, guiding and conducting research. These include Region 8 (both the National Forests and State and Private Forestry), the Southern Group of State Foresters, consulting foresters, private landowners and landowner associations, forest industries, recreational industries, conservation organizations, and many others. Much of the research involves National Forests across the country and the State and Private Forestry program at the national level and in other regions.

9.1 Improve understanding of how land use, forest management, climate, and policy affects forest disturbances and the flow of economic, social, and ecological values from forests, along rural-to-urban gradients.

The purpose of this focus area is to develop and deliver knowledge and tools that will enable people to effectively manage resources. Knowledge of the values, uses, and benefits that people obtain from forests is needed for understanding historical, current, and future changes in forests and for assessing the effects of policies on people and the landscape. While the methods for valuing timber are well developed, the quantification of non-market forest products and services is also crucial for a more holistic understanding of forest values. These valuations are important because they continually change with society, increasing in importance for many forest uses. For example, recreation and ecosystem services are increasingly important where population is growing at rapid paces. The values of forests and trees for urban residents are important to understand, but sometimes difficult to determine. The report “National Research Plan for Urban Forestry: 2005-2015” by the National Urban and Community Forestry Advisory Council documents some of the important specific questions at the national level.

a. Top Priority Research and Development Needs

1. Assess and forecast the timber, non-timber, and non-market goods, services, and values produced by forests, and evaluate how public policies, climate changes, altered natural disturbance regimes, and expanding and potential future invasive species may affect future goods, services, and values provided by forests.
2. Quantify the factors influencing natural forest disturbances, how these and climate changes affect the values produced by forests, and identify management practices and government policies that can mitigate the negative impacts of these processes on forest values.
3. Identify how management practices and government policies affect the values produced by forests in urban and wildland-urban-interface settings and how these practices and policies change along rural-to-urban gradients; recycling of woody materials is an important factor to consider.

4. Evaluate the social justice and equity implications of existing and proposed land use and forest management policies with respect to recreation and other non-timber values available to different societal groups, and evaluate how government policies and programs affect inequities.
5. Expand our understanding of how local, national, and international forest product markets and land uses affect the goods and services provided by forests.
6. Improve our understanding of how emerging forest products, including wood-based biofuel products, and changing forest operations technologies and input costs affect forest values of all kinds, and develop new approaches to mitigating the deleterious impacts of these new products and technologies.

b. Key Barriers to Conducting Research and Implementing Results

- The large number of private landowners in different and emerging groups complicates sorting out objectives and management strategies that are applied across the landscape; many of these landowner groups are forming and emerging due to tax laws, which are subject to change.
- Local and state governmental policies are varied and often difficult to determine and assess.
- The globalization of trade complicates the analysis of timber markets, especially as trade treaties and political situations change for various countries.

c. Role of each Research Work Unit

RWU-4703 provides forest operations component of economic value

RWU-4704 provides components related to forest products

RWU-4804 develops economic and policy studies for various segments

RWU-4952 identifies linkages among economic, ecological, and social components for urban and urbanizing landscapes, and for recreational values

9.2 Develop tools and options for addressing the sustainability issues of southern forests related to changes in land use, forest management, climate, policy, and other socioeconomic changes.

As populations grow in the South and the nation, pressures on natural resources will increase and cultural identities will change. Given the changes that are occurring, there is a continuous need for new knowledge, tools, and policies to deal with these resources. With people increasingly moving into areas adjacent to forest lands, at least partly to enjoy the benefits of forests but also due to a changing economy, old policies are strained and new policies are developed. These policies may affect not only the interrelationships among social and economic patterns and processes but also the ability of natural resource managers to manage forests for desired goods and services. The increasing influence of the wildland-urban interface on natural resources is significant and has been recognized as an area where better information is needed. New research

can enhance our understanding of how land uses, government policies, and the broader economy ultimately affect ecological and social processes and the subsequent risk to ecosystems and human communities.

a. Top Priority Research and Development Needs

1. Identify and assess spatially and temporally how changing markets for timber and land affect forest cover, the production of forest ecosystem goods and services, and ownership parcelization for different regions in the South and the nation.
2. Evaluate how governmental policies and programs and the broader economy affect forest management and operations, community development, and forest ecosystem goods and services; wood recycling and reuse is part of this evaluation.
3. Evaluate how communities and individuals are affected by changes in the availability of forest ecosystem goods and services, local and regional demographics, local and regional land-use patterns, and workforce opportunities.
4. Identify and evaluate how alternative forest operations and related policies affect the delivery of ecosystem goods and services along rural-to-urban gradients.
5. Create adaptive management scenarios/guidelines, tools and models to assist managers and policy makers in mitigating deleterious risks to ecosystems and communities from altered disturbance regimes.

b. Key Barriers to Conducting Research and Implementing Results

- Rapid land use changes are occurring in many areas, subject to a wide range of factors that are dynamic; these include local land-use controls, political changes affecting policies, and changing demographics.
- Landowner characteristics and objectives are changing rapidly, and are difficult to predict because of societal changes.
- The demand for forest based goods and services is rapidly evolving with changing demographics and global economies.
- The concern and emphasis on environmental threats and their effects on human health is increasing with changing demographics, but is hard to predict precisely.
- Communities in some locales are rapidly instituting land use control to influence growth and affect forest operations; these controls are subject to changing demands and political situations.

c. Role of each Research Work Unit

RWU-4703 develops options for forest operations for a diversity of ownerships and parcel sizes

RWU-4704 develops wood recycling options to reduce land filling while providing wood products

RWU-4804 assesses and forecasts land use and forest measures, quantifies how domestic and international forest product markets affect domestic forests, develops information on the economic and social consequences of altered natural disturbances regimes, and evaluates how tax programs and public policies and programs affect goods and services provided by forests along rural-to-urban gradients.

RWU-4952 Assess how management options and policy decisions places ecosystems and human communities at risk and how that risk affects the availability of goods and services (e.g. recreation) derived from forests in urbanizing and urban landscapes.

9.3 Evaluate the potential, and options for southern forest landowners to expand and diversify their returns through management focused on traditional forest products as well as emerging ecosystem services, while meeting other ownership objectives.

As society and forests change, management options available to forest landowners change with them. With these changes, traditional revenue sources available to landowners may decline in importance, but new sources may emerge that can replace lost income. While it is important to recognize that traditional sources of income (particularly timber) are still important for many areas, potential future changes could well be in store. Given that changes are currently occurring for many areas, societal and natural changes also affect the availability and quality of benefits that landowners and the broader society obtain from forests.

a. Top Priority Research and Development Needs

1. Develop alternatives for generating value from forest lands across the wide range of ownerships considering alternative management objectives, holding size, and economic capacity.
2. Examine means to expand the revenue portfolios for forest landowners through non-traditional forest outputs such as ecosystem services, recreational opportunities, non-timber forest products, and agroforestry options.
3. Develop and deliver tools that enable forest landowners to evaluate management alternatives with a range of potential values.
4. Improve understanding of how existing and potential markets for ecosystem services influence the delivery of public goods and examine the potential role of government in encouraging market development.

b. Key Barriers to Conducting Research and Implementing Results

- Determining an effective market-based means of compensating landowners for ecosystem services in non-traditional markets is difficult; many services are (viewed as) public goods.
- Government policies often affect payment for ecosystem services, and such policies are often the result of the political process, therefore difficult to anticipate.
- Some potential markets may depend on a variety of interrelated and external circumstances; for example, the sale of biomass for fuel will depend to a great extent on the price of traditionally-available fuels.

c. Role of each Research Work Unit

RWU-4703 develops alternatives for harvesting and other forest operations

RWU-4704 explores and develops alternative uses of wood fiber

RWU-4804 develops economic analyses for various market and institutional alternatives

RWU-4952 evaluates how the changes in goods and services from alternative management practices affect the linkages between social and ecological components in urban and urbanizing landscapes.

9.4 Develop technology to efficiently use woody biomass for biofuels, bioenergy, biochemicals, and traditional wood products and expand knowledge about these different uses and their respective roles in timber product markets.

The use of and interest in biomass for fuel and related products is growing. Interest in these uses is growing for several reasons. First, biomass is seen as a way to reduce net carbon emissions from energy use, a way to address climate change concerns. Furthermore, the chemicals available from woody biomass through a biorefinery process may also provide substantial benefits in addition to energy. These new uses of fiber provide opportunities for generation of additional income for landowners. While traditional timber products have provided a ready outlet for the production of forest landowners, these markets are changing and production and manufacturing efficiency is more important with the increasing globalization of the timber economy. Research can assist with increasing production efficiency and quality, thus increasing competitiveness in global markets. This need for efficiency extends to the reuse and recycling of timber products.

Although basic knowledge about how to turn biomass into energy and the biorefinery process is available, much progress can yet be made in technology development, particularly as it relates to cost efficiency of the various processes. The need to develop technologies exists along the entire chain of biomass operations, from growing the biomass, harvesting, conversion to energy, and utilization or disposal of residues. Research and development in this Science Area should be focused on the net benefits accruing to landowners from participating in biomass markets, characterizing existing and potential policies and programs that may affect biomass production and traditional timber markets, and evaluating alternative approaches, policies, and technologies for more completely utilizing downed woody debris in the aftermath of severe storms and other natural disasters. Other benefits of this line of research will also accrue to traditional wood

products, recycling processes, and development of nanotechnology. This focus on the entire spectrum of woody biomass utilization will ultimately expand forest land management options.

As new uses of woody biomass become more available, the sustainability of forests and traditional uses and products are of concern. Addressing sustainability issues in this focus area is important.

a. Top Priority Research and Development Needs

1. Develop new technologies to efficiently produce alternative forms of energy, biochemicals, and wood products using woody biomass
2. Characterize physical and chemical properties of various woody biomass streams and subsequent effects on energy production
3. Develop forest operation methods to efficiently extract woody biomass resources to be applied to energy production
4. Evaluate the efficacy and economic and social consequences of alternative governmental policies and programs that affect biomass utilization and biofuels production.
5. Evaluate the market interactions among demands for and supplies of wood for bioenergy and other timber products.
6. Evaluate how changing land usage may alter productivity of adjacent forests and the availability of primary and secondary forest products.
7. Evaluate the effects of a changing fuel supply, including new land use trends associated with emerging biofuels markets, on outdoor recreation and tourism patterns and experiences.

b. Key Barriers to Conducting Research and Implementing Results

- The price of traditional fossil fuels will impact the approach to this research; low prices for traditional fuels will require greater technological advances for biofuels to be feasible.
- Bioenergy is viewed as unsustainable, or in competition with other uses by some interests, likely causing concern about this research among these interests.
- The rate of increase in globalization of trade will influence this work, especially the potential for adoption of results.

c. Role of each Research Work Unit

RWU-4703 develops economically and ecologically feasible operational techniques for extracting biomass for energy

RWU-4704 develops the technology for economically converting woody biomass to energy and other wood products

RWU-4804 evaluates how wood for bioenergy interacts with traditional timber product demand and supply.

RWU-4952 develops the social acceptance information and assesses the ecological ramifications for production and use of bioenergy, with particular attention to rural-urban interface and urban issues.

10. Environmental Considerations

Proposed research activities in this science area are limited in context and intensity and are not expected to have a significant effect on the quality of the human environment. Most, but not all, activities conducted under this charter are covered by categorical exclusion. The environmental effects of specific actions will be considered during the development of study plans, at which time the existence of extraordinary circumstances related to the proposed action, and categorical exclusion will be documented as a part of the study plan as described in FSH 1909.15, Chapter 30. Where environmental concerns exist regarding particular studies, these may be evaluated within individual study plans, or by Environmental Assessments or Environmental Impact Statements prepared with and reviewed by the cooperating District or Forest staffs. For research having the potential to affect a plant or animal species that is federally listed as endangered or threatened or proposed for such listing, the unit will consult with the U.S. Fish and Wildlife Service as per Section 7 of the Endangered Species Act of 1973, as amended.

11. Science Capacity

Staffing

The Forest Values, Uses and Policies Science Area has (as of FY 2007) approximately 23 scientists whose primary disciplines include engineering, soil science, forest products technology, economics, forestry, and sociology. There are an additional 16 professional and technical support personnel, and 7 administrative support personnel. In addition, there are also various university collaborators (post-docs, etc.), shared administrative personnel, and others.

Budget

The total budget of the Forest Values, Uses and Policies Science Area for FY 2007 is \$5.03 million, Research and Development appropriated funding, which is 10.4 percent of the total SRS budget.

Infrastructure

The four Research Work Units in this Science Area are located at seven locations throughout the South. Of these seven locations, four are on, or adjacent to, university campuses. One additional location (Research Triangle Park, NC) is very near other

collaborating universities. Laboratory facilities are important to at least two units—RWU-4703 and RWU-4704. Both units have their own facilities; one location for 4704 shares laboratory space with a university. In addition, RWU-4952 works with collaborators for occasionally needed lab facilities.

Unique Capability/Instrumentation

There are several unique capabilities this Science Area offers. First, it includes the only research work unit in the nation working primarily on forest operations issues. The Forest Economics and Policy unit includes a component that has national responsibility for tax issues, and another component that has national leadership for the forest component of the RPA Assessment. The Utilization of Southern Forest Resources unit deals with unique issues relating to sustainability of Southern forests that are not done elsewhere, including the Forest Products Laboratory. The Integrating Human and Natural Systems unit is dealing with a most pressing issue—the urbanization of the South’s forest lands. This latter unit also works closely with the Pioneering Research Unit, which is leading the National Survey on Recreation and the Environment, and has national leadership for the recreation and wilderness component of the RPA Assessment.

Appendix A: Relationship of Science Area Focus Areas to Forest Service Strategic Plan and National Strategic Program Areas

Science Focus Areas:

1. Determine economic, social, and ecological values of forests along rural-to-urban gradients, the effects and causes of forest disturbances, and how these change with changing land uses, climate, ownerships, policies, and society.
2. Identify how forests and communities are affected by changes in climate, land use, resource management policies, and the broader economy.
3. Identify and evaluate the factors affecting the economic returns available to forest landowners while meeting other ownership objectives.
4. Develop technology to use woody biomass for biofuels, bioenergy, biochemicals and other wood products and expand knowledge about their roles in timber product markets.

Relationship to Forest Service Strategic Objectives (numbers refer to Science Area Focus Areas)

- 1.1 Reduce the risk to communities and natural resources from wildfire. **(1, 2)**
- 1.2 Suppress wildfires efficiently and effectively. **(1)**
- 1.3 Build community capacity to suppress and reduce losses from wildfires. **(1, 2)**
- 1.4 Reduce adverse impacts from invasive and native species, pests, and diseases. **(1, 2)**
- 1.5 Restore and maintain healthy watersheds and diverse habitats. **(1, 3)**
- 2.1 Provide a reliable supply of forest products over time that (1) is consistent with achieving desired conditions on NFS lands and (2) helps maintain or create processing capacity and infrastructure in local communities. **(1, 3, 4)**
- 2.3 Help meet energy resource needs. **(4)**
- 2.4 Promote market-based conservation and stewardship of ecosystem services. **(3)**
- 3.1 Protect forests and grasslands from conversion to other uses. **(1, 2, 3)**
- 3.2 Help private landowners and communities maintain and manage their land as sustainable forests and grasslands. **(1, 3)**
- 4.1 Improve the quality and availability of outdoor recreation experiences. **(1, 2, 3)**
- 4.3 Improve the management of off-highway vehicle use. **(1, 3)**
- 5.1 Improve accountability through effective strategic and land- management planning and efficient use of data and technology in resource management. **(1)**
- 5.2 Improve the administration of national forest lands and facilities in support of the agency's mission. **(1, 3, 4)**
- 6.1 Promote conservation education to increase environmental literacy through partnerships with groups that benefit and educate urban populations. **(1, 2)**
- 6.2 Improve management of urban and community forests to provide a wide range of public benefits. **(1, 2)**
- 7.1 Increase the use of applications and tools developed by Forest Service R&D stations and the T&D centers. **(1, 2, 3, 4)**

Appendix A: Relationship of Science Area Focus Areas to Forest Service Strategic Plan and National Strategic Program Areas

Relationship to Forest Service Research and Development Strategic Program Areas (numbers refer to Science Area Focus Areas)

- Wildland Fire (1, 2, 3)
- Invasive Species (1, 2, 3)
- Wildlife and Fish (1)
- Air and Water (1, 2, 3)
- Resource Management and Use (1, 2, 3, 4)
- Recreation (1, 2, 3)
- Inventory & Monitoring (1, 3)
- Emerging Opportunities (1, 3, 4)

Appendix B: Research Work Unit Charters

RESEARCH WORK UNIT CHARTER.

SRS-4703 – Forest Operations

Auburn, AL

Project Leader: Bob Rummer

The Mission of our Research Unit is to *provide the science and technology necessary for economically and ecologically viable forest operations for sustainable forest management.* Forest operations are the critical connection between the forest management plan and the realization of desired future conditions. Forest operations are the physical actions which change the forest, altering structure, composition, condition, or value in order to meet society's needs for clean air and water, forest products, wildlife, recreation, and other benefits. Forest operations also include the development and use of the infrastructure, primarily roads and trails, that support value recovery. On every type of forest ownership, the forest operation is the tool selected by the land manager to shape the future and provide value and benefits in the present. Forest operations are the source of both the benefits of management and the negative impacts. Forest operations generate value for society through improved forest conditions and product outputs. They also impact ecological processes and leave an imprint on the landscape. As part of the Forest Values, Use and Policy Science Area, this basic area of research will help define the economic values and technical feasibility of a wide range of tools for forest resource management.

Problem 1. Forest operations technology

Selecting appropriate forest operations to achieve management goals requires better information about the performance, cost, and operational ranges of new and existing forest operations systems.

Problem 1a. Production and cost studies. The objective is to evaluate performance of systems with respect to variables of management prescriptions and operational conditions. This information is critical to a wide range of other applications including modeling and resource assessments. Studies will focus on harvesting productivity and costs for thinning, mechanical fuel treatments, biomass recovery and utilization.

Problem 1b. Improve technology to meet management needs. This area of study takes evaluation of management requirements and translates it into engineering functional specifications for system improvements. Studies will focus on effect of payload capacity and product form to improve efficient recovery of biomass, specification of operations appropriate for WUI treatments, design of operations to enhance carbon sequestration, design of operations for treatment of invasives, and assessment of net energy consumption.

Problem 1c. Human factors in forest operations. People operate equipment and to a large part constrain the performance of the system. This area of work evaluates physical workload, safety issues, design of work tasks, training, and decision-making with the goal of better integration of people into forest operations.

Problem 2. Ecological effects of forest operations

Appendix B: Research Work Unit Charters

A critical management problem is the inability to effectively implement vegetation management on vast acreages of the Nation's forestland due to perceived ecological impacts. A lack of scientific knowledge about forest operations effects and/or a lack of technically and economically feasible operations that meet ecological requirements are a primary constraint on the ability to manage forest resources. Ecological effects must also be studied across the full range of temporal and spatial scales.

Problem 2a. Soil impacts. Operations can affect soil physical and chemical properties both adversely and favorably. Studies in this area will examine the interactions between operations and forest soils, including compaction, hydraulic properties, nutrient cycling and depletion, microbial communities, and carbon flow. Studies will define the magnitude of effects to help quantify total costs of management alternatives.

Problem 2b. Water quality. Forest operations disturb soil, alter drainage patterns, create concentrated flows. Erosion from forest operations can lead to impaired water quality. This area of study examines the effect of a wide range of forest operations at all scales on erosion processes and water quality impacts. Studies include effectiveness of BMP's, quantify impacts of management alternatives, development of mitigation measures to reduce erosion or transport. This information will inform the development of guidelines and policy to manage water quality.

Problem 2c. Additional effects. Operations also impact vegetative communities and structure, esthetics, wildlife, and forest health. This line of work evaluates the interactions among management tools and a wide range of responses. Studies include effect of management alternatives on invasives, visual quality, recreational value, insect and disease risk, and habitat condition. This specific research area relies on strong partnerships with other Science Areas.

Problem 3. Forest operations management systems

The organization and management of forest operations has a significant effect on performance and cost. Policy and regulation may constrain alternatives or impose additional operational costs.

Problem 3a. – Decision tools. The primary objective of this line of work is to develop models and tools to improve selection among alternatives and to estimate operational outcomes in the planning stages. Studies will develop cost estimating algorithms, optimization programs, spatially explicit project planning, including erosion and hydrologic models.

Problem 3b. – Business management. Engineering cost analyses typically ignore total cost of operation that are a function of business requirements. Overhead and profit are necessary to maintain financially healthy enterprises. Actual operational costs reflect risk and market factors. Studies include evaluation of project and bid estimates, business structures of forest contractors, workforce development, tax effects, financial assessments.

Problem 3c. – Policy and regulation. Management options can be constrained by policy or regulation. This can lead to a variety of cost impacts. This line of work seeks to identify the interaction among policy requirements and operational alternatives. Studies include effect of carbon policy, water quality regulations, WUI ordinances, energy policy.

Appendix B: Research Work Unit Charters

RESEARCH WORK UNIT CHARTER.

SRS-4704 – Utilization of Southern Forest Resources.

Pineville, LA; Blacksburg, VA; Athens, GA

Project Leader: Leslie H. Groom

Mission: To define and apply chemistry, materials science, forest management, and engineering principles to the characterization and utilization of southern forest resources for maximum societal benefits with minimal environmental consequences.

Problem 1. Wood Quality

The emphasis of this research is on relating basic wood properties to location within tree or stand, environment, forest management and genetic factors that affect southern pine wood formation. Understanding the effect of wood formation factors (e.g. juvenile/mature wood, sapwood/heartwood, earlywood/latewood content, specific gravity, tracheid length, microfibril angle) on wood quality will provide knowledge to develop forest management practices targeted to development of specific wood properties and modeling to predict basic wood properties. Research efforts in this area will be conducted in cooperation with the Wood Quality Consortium, located at the University of Georgia, and will rely on the availability of trees with a known history, thus utilizing material from university and industry studies and other well-documented stands across the South.

Problem 1a. Intensive silvicultural practices

The unit will study the effect of vegetation control, initial planting density, thinning, fertilization and length of rotation on wood physical and mechanical properties.

Problem 1b. Environmental factors

The unit will examine the relationship between wood quality and environmental factors such as precipitation, temperature, length of growing season and soils.

Problem 1c. Genetic improvements

The unit, in conjunction with other units, will study the effect of genetically improved seedlings have on basic wood properties such as stiffness, strength and dimensional stability to enable utilization of wood from fast growing southern pine plantations for current and emerging forest products.

Problem 2. Characterization of Wood and Woody Biomass

The demand for raw materials from southern forests has been high since the 1980's and will continue to increase. The perpetual state of strain on the southern forest resource has led to a change in the material that comprises the bulk of traditional forest product commodities. This problem area will focus on three elements pertinent to the effective utilization of our southern forest resource.

Problem 2a. Rapid assessment of material properties of wood and wood composites

The unit will develop predictive models that include property determination from increment cores, on-line monitoring of industrial processes, and characterization of woody biomass feedstocks for conversion to energy.

Problem 2b. Characterization of bark

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The unit will conduct basic studies to characterize bark anatomically as well as investigate the solvent-extractable compounds that are believed to impart to tree bark the resistance to attack by insects and pathogens. Applied research will also be conducted that targets the development of new products such as nutraceuticals, filtration media, and functional adhesive fillers.

Problem 2c. Timber assessment and allocation to evaluate standing and felled trees

Research will be conducted towards improving capabilities to monitor forest canopy, tree crowns, and tree stem soundness that will provide information on forest health and vigor. Analytical methods will also be developed that will permit non-invasive assessment of log quality thus allowing for more efficient processing decisions.

Problem 3. Improvement and Reuse of Solid Wood Products

In addition to improved processing, timber demands can be reduced by other major activities that extend the life of wood through reuse and recycling. Repairing and recycling wood pallets would reduce both hardwood and softwood timber needs. After intended use, pallets could be recovered, repaired, and reused, and at some point, recycled into other useful products to reduce timber harvesting needs. Other solid wood products, such as softwood house decking materials, can also be recovered and reused as decking or other solid wood products.

The unit will develop methods that allow pallet and house decking industries to extend the life of their products and reduce the volumes of materials presently ending up in landfills.

Problem 4. Utilization of Southern Resources in Biobased Products

The efficacious use of our southern forest raw materials begins with their importance in commodity products and then expands into novel products. The fast-grown nature of our wood species often produces a less-than-desirable starting material from which to construct structural products and often requires processing alterations to meet particular codes or standards.

Problem 4a. Influence of raw material properties on composite performance

The unit will characterize physical and mechanical properties of wood components such as wood strands, fibers, and crystallites and their effect on structural composite properties. This subelement will also encompass improved adhesive systems leading to better synergy between component and composite performance.

Problem 4b. Fiber modification and surface chemistry (nanotechnology)

The unit will refine and develop techniques that can alter cellulosic fibers, particularly their surfaces, in engineered composites. Modification processes include chemical and electrolytic treatments, plasma discharge, and ultrasound. Analytical methods to be employed will be inverse gas chromatography, atomic force microscopy, infrared spectroscopy, and time-domain nuclear magnetic resonance spectroscopy.

Problem 4c. Environmentally-friendly products from biobased feedstocks

The unit will develop fundamental information on lignocellulosic materials such that they can be more appropriately used as a chemical/biobased feedstock. The fundamental data collected will be used to define processing techniques such as wood liquefaction technology and the production of synthesis gas and liquid transportation fuels as well as to develop a non-acid hydrolysis process of lignocellulose under high temperature.

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RESEARCH WORK UNIT DESCRIPTION

SRS-4804 — Forest Economics and Policy

Research Triangle Park, NC; New Orleans, LA; Tuskegee, AL

Project Leader: David N. Wear

Mission: To advance understanding of how forest management and forest policy options affect forest conditions, the flow of goods and ecosystem services, and the hazards associated with wildfire and other disturbances; to forecast the effects of economic, social, biotic, and climate factors on future forests, goods, and services; and to develop methods and tools to assist landowners and government agencies in the management of the nation's forest resources.

Problem 1. Forest disturbance and management economics.

The nation's forests are affected and threatened by natural disturbances and a changing climate. Wildfires, invasive and endemic forest pests, hurricanes, and climate alter the values produced by forests and affect regional and national timber product markets. Management and policy actions can alter the consequences of these processes, but such actions involve costs and therefore economic trade-offs. Research can provide a better understanding of feasible options and economic tradeoffs for managing public and private forests affected by disturbance.

1a. Understand the spatial and temporal patterns, predictors of, and damages deriving from human-caused wildfires and develop tools for reducing the incidence and damages deriving from these wildfire sources.

1b. Evaluate the economic tradeoffs among interventions into wildfire processes, at multiple spatial and temporal scales; develop methods for understanding the demand for and supply of wildfire management inputs; and design tools for forecasting the supply and demand for wildfire management inputs.

1c. Quantify how the occurrence and economic effects of natural disturbances, including wildfire, and forests management approaches vary across the rural-urban gradient and how treatments can be targeted in this environment.

1d. Estimate costs and impacts of invasive and endemic forest pests by merging biological, climate, and economic analyses and evaluate the effects of alternative policies that can reduce the rates of introduction, establishment, spread, and damages resulting from these organisms.

1e. Evaluate the economic impacts of timber salvage following natural disturbances and evaluate how policies and programs alter the economic impacts from timber salvage.

Problem 2. Forest policy and program evaluation.

Taxes, subsidies, regulations, and federal and state government resource management guidelines affect the welfare of different societal groups, including public land users, private landowners, and industry; influence landowner decision making and alter the flow of ecosystem services. Research can lead to policy and program design that can better achieve the objectives of various participants.

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2a. Develop knowledge of how local, state, and federal tax codes and their interactions affect landowners' decisions, welfare, government revenue, and landscape conditions.

2b. Improve our understanding of the effectiveness of subsidies, zoning, and other regulations in achieving their objectives and how they influence forest management decisions and the values produced by forests.

2c. Improve understanding of how existing and potential markets for ecosystem services influence the delivery of public goods and examine the potential role of government in encouraging market development.

2d. Evaluate the distributive effects of policies and programs on minority and limited resource forestland owners, rural communities, and other societal groups.

Problem 3. Forest assessment and forecasting.

Natural disturbances and societal demands for forest based goods and services combine with biological and physical factors to create observed forest conditions. As nature and society change, forests and the values they produce will change. Research can evaluate historical relationships among disturbances, society, and biophysical variables to create tools for assessing current and forecasting future forest conditions and values.

3a. Refine our understanding of global and domestic timber product markets and response to changing technologies and products, the global economy, and domestic and international policies.

3b. Improve our understanding of how private and public good values are produced from forested landscapes, including commodities, income, and employment but also social and cultural values and the provision of ecosystem service values such as clean water and biodiversity.

3c. Evaluate the effect of changing demands for wood products, including demand for wood-based energy products, on the markets for established timber products and the provision of other forest values.

3d. Develop land use forecasting models that account for long-run shifts in timber product and agricultural markets, climate, natural disturbances, and the global economy.

3e. Develop a comprehensive modeling system for forecasting the future development of forest conditions in the United States in response to changes in economic, social, and climatic factors.

Research Partners

Research described in this document involves collaborations with individuals at universities in the US South and nationwide, private organizations, and state and federal governments. Within the US Forest Service, this research involves collaboration with other Research Work Units at

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the Southern Research Station and other Stations, the RPA Assessment Team, the National Fire Plan, State and Private Forestry, and the National Forests.

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RESEARCH WORK UNIT CHARTER

SRS-4952—Integrating Human and Natural Systems in Urban and Urbanizing Landscapes

Locations: Gainesville, Florida and Athens, Georgia

Project Leader: Vacant

Mission: To improve an understanding of how people living in urban and urbanizing landscapes both influence and are influenced by natural environments; and to develop and communicate technology transfer guidelines, models, and tools to natural resource managers, policymakers, planners, and citizens to address associated challenges and risks, while maximizing the goods and services provided by these natural resources in urban and urbanizing places.

Introduction: There are critical information gaps on the effects of urbanization on human and forest communities, particularly from a multi-disciplinary view that incorporates both social and ecological aspects. Some specific questions that remain largely unanswered are: How do humans influence forest ecosystems in urban and urbanizing landscapes? (Problem 1) How do human influences, in turn, affect human-derived benefits from forest ecosystems? (Problem 2) How does public policy influence changes to ecological processes, disturbances, and services? (Problem 3) How do we ensure that the best scientific information about interface issues reaches decision makers, natural resource professionals, and citizens? (Problem 4) These four problem areas provide a hierarchical framework for addressing the changes, challenges, trade-offs, and risks to forest and human communities from increased urbanization in the South.

Problem 1. Assess human influences on natural ecosystems in urban and urbanizing landscapes: The South is the fastest growing region in the Nation. Current estimates place population growth at 815,000 individuals annually. By 2020, over 12 million acres of forestlands are projected to be lost to growth-induced urban land-uses. The consequences of this land use change will have far reaching consequences for the sustainability of southern forests and community well-being.

Problem 1a. Assess how landscape change alters natural environments, disturbance regimes, and ecosystem services. The unit will address critical knowledge gaps related to how urbanization alters landscapes and ecosystem patterns and processes, and how to better predict effects.

Problem 1b. Examine the impact of population increase and diversification on urban green space. This problem addresses growing population pressure on natural resources in the South, particularly in urban environments with limited resources. Very little information exists on the relationships of migrant or immigrant populations to urban ecosystems, yet these groups comprise increasing population proportions in the region.

Problem 1c. Identify linkages among ecological and social components of urban and urbanizing landscapes. The unit will assess how ecological and social components are interrelated to enhance best management practices for sustaining the urban forest.

Problem 2. Assess how human influences on natural ecosystems affect human-derived benefits from those ecosystems: With the conversion of natural ecosystems through

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urbanization, the type and amount of ecosystem goods and services used by humans are altered. These changes directly affect community well-being. Research is needed to understand how benefits change with urbanization and to develop best management to optimizing services in urban and urbanizing landscapes.

Problem 2a. Examine how the urban forest (vegetation on both public and private lands) responds to the urban environment and the urbanization process, and how this response affects the availability of ecosystem goods and services. By understanding how the altered environments of urban landscapes directly and indirectly affect urban forest and its goods and services, policy makers and resource manager can better manage the resource for human benefit. This problem area also examines how the changing availability of ecosystem goods and services produces implications at the landscape, region and national scale, and what those implications mean from a resource management and policy perspective.

Problem 2b. Quantify the economic value of goods and services provided by urban ecosystems and how this value may change as landscapes are urbanized. By quantifying ecosystem service values through market and nonmarket methods, one can begin to assess the ecological costs of urbanization in conjunction with economic growth from development.

Problem 2c. Examine the social psychological impacts of landscape change on community identity by assessing sense of place response to landscape change. Central to this objective is the recognition of cultural services provided by ecosystems, one of which is sense of place. Rapid changes in rural landscapes can have both physical and emotive consequences for individual and collective identity. This problem considers the impact of such change on total community well-being and also the differential impacts to specific sub-cultural groups.

Problem 2d. Examine environmental justice implications of minority group access to and interaction with recreation and other natural resources in urban and urbanizing landscapes. The problem addresses environmental justice issues as they are created when landscapes are urbanized.

Problem 2e. Evaluate the importance of wild land recreation and examine the primary users of urban national forests and public lands in the South. With urbanization, available private lands for recreation declines, thus putting greater pressure on public lands for recreation. Understanding how public wild lands are being used and by whom will improve our ability to manage them for recreation while sustaining ecological integrity.

Problem 3. Define the relationship of land use policies to ecological and social patterns and processes and how they influence natural disturbances in urban and urbanizing environments: Public policies are often developed independently and often in the absence of full understanding of natural resource and ecological implications. Research is needed to assess how state and local land use policy and decision making alter ecosystem services and natural disturbance regimes often resulting in subsequent risks to human and forest communities.

Problem 3a. Determine factors leading to various land-use patterns. The unit will assess land-use policies and their institutional structures across different jurisdictions and scales to evaluate

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how these policies and institutions influence ecological and social fragmentation, ownership parcelization, and the sustainability of ecosystem benefits.

Problem 3b. Identify different human-network policy scenarios that reduce or increase deleterious risk to ecosystems and human communities. The unit will evaluate how current land-use policies alter natural disturbance regimes and the synergy of natural and anthropogenic disturbances (e.g., climate change) on risk to the environment and humans.

Problem 3c. Assess how public policies and socioeconomic contexts influence ecosystem function and subsequently the availability of goods and services. The unit will evaluate the links between environmental health and community well-being.

Problem 4. Develop technology transfer models, tools, and guidelines for natural resource professionals, policymakers and citizens to address and minimize risk due to changes from urbanization and other human influences on forest ecosystems: An integrated, multidisciplinary approach to understanding the social and ecological aspects of urban and urbanizing landscapes is critical, as well as is the dissemination of both new and existing information. This approach will provide information and tools for policy makers and natural resource professionals challenged with managing resources in these changing landscapes. It will also provide information for policymakers and homeowners who often have limited understanding of the benefits that ecosystems provide and how their land use decisions affect ecological processes and disturbance regimes.

Problem 4a. Explore the efficacy of different methods of information exchanges to meet the diversity of audiences in urban and urbanizing landscapes. To be effective in providing information, a variety of methods will be needed to be identified and linked with user groups.

Problem 4b. Create training modules, on-line resources, decision-making tools and models, guidelines, and distance learning opportunities for both the urban forest and the wildland-urban interface. Tools and guidelines needed by natural resource managers, policymakers, planners, and citizens to address the complexity of management needs and land-use decisions.

Problem 4c. Develop inventory and survey methodologies for communities to assess their natural resources and the importance of those resources. Most inventory protocols have been developed for northern regions. These protocols need to be adapted for southern species and environments.

Environmental Consideration: The work described under these problem areas will have no significant effect on the human environment; use hazardous materials, nor present potential environmental problems. To collect data, the research work will use standard and established field methodologies or through collection of primary data using standard survey and interviewing techniques. Thus, the research described in this Research Work Unit Description (RWUD) falls under one of the categories of actions that do not normally have significant effect on the natural environment and are therefore excluded from the need for documentation in an EIS or EA (ref: FSH 1909.15, Chapter 30). Should extraordinary circumstances arise regarding a particular

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study described in this RWUD; these concerns will be evaluated within individual study plans or by EIS or EA prepared with and approved by relevant Station, District or Forest Staffs.

Primary beneficiaries of the research described in this RWUD will be federal, state, county and city natural resource managers; university researchers; community and regional planners; rural development specialists; local community leaders; and various user groups including watershed associations, national and local non-governmental organizations, and citizens.