

<p><b>RESEARCH WORK UNIT DESCRIPTION</b> Ref: FSM 4070</p>	<p>1. Number 4801</p>	<p>2. Station SRS</p>
<p>3. Unit Location Knoxville, TN</p>		
<p>4. Research Work Unit Title Forest Inventory and Analysis</p>		
<p>5. Project Leader (Name and address) William G. Burkman 4700 Old Kingston Pike, Knoxville, TN 37919</p>		
<p>6. Area of Research Applicability Regional, Multiregional, National, International</p>	<p>7. Estimated Duration 5 years</p>	
<p>8. Mission</p> <p><b>To conduct a program of research to improve the understanding of forest ecosystems through inventory and analysis of the status and trends in resource conditions, use, productivity, and sustainability; and to conduct research to provide improved technology for timely and accurate resource inventories.</b></p>		

9. Justification and Problem Selection

The Natural Resources Inventory and Monitoring (NRIM) Science Area collects, analyzes, and reports data, and performs research on the status and trends of U.S. forests. FIA data are collected to estimate forest extent, forest location, forest ownership, and changes in these characteristics. In addition, FIA data are used to estimate growth, mortality, and removals of forest vegetation. Data can be used, for example: to assess the sustainability of ecosystem management practices, to evaluate wildlife habitat conditions, and to provide information for planning and decisionmaking activities by public and private enterprises. In addition, FIA uses plot-level data with related data on insects, diseases, and other types of forest damages and stressors to assess the health, condition, and potential future risks to forests.

The passage of the 1998 Farm Bill led to the development of a nationally consistent approach to forest inventory across the four regional FIA work units. This included a new national sample design, a national plot design, annual systematic measurement of a proportion of permanent plots in each State, data summaries 6 to 12 months after the completion of the annual data collection, and State inventory reports every 5 years. In addition to these changes, measures relating to forest ecosystem function, condition, and health were added to FIA. With this new Research Work Unit Description, we build on the program mandated by the 1998 Farm Bill with items contained within the recently-passed 2014 Farm Bill. Emphasis areas in the new Farm Bill include (1) increased Timber Product Output (TPO) monitoring; (2) improved carbon and biomass estimates; (3) enhanced ownership study; (4) land use/land cover change research, and (5) urban inventory. Additional items in the 2014 Farm Bill, which will be adopted as budgets allow, include a 5-year cycle nationwide, increased collaborative efforts, non-Federal IT engagement, and potentially doubling the sample as a partner expense. Our cost estimates (section 13) are based upon full implementation of the FY2014 Farm Bill.

Forests and woodlands occupy about 50 percent (about 268 million acres) of the South's 534 million acres of total land area. These lands provide goods and services ranging from traditional forest products to recreational opportunities. The 13-State region of the South covers about 32 percent of the total forest land in the U.S., with roundwood removals from Southern forests making up 58 percent of the total removals in the United States. Southern forests exist in diverse conditions. From the tropical Caribbean climate to the cool and humid slopes in the Southern Appalachian Mountains the diversity of the region is explained by 60 associate forest cover types in 8 physiographic regions. The areas of responsibility for the Southern Research Station (SRS) span from Puerto Rico and the U.S. Virgin Islands to woodlands of Oklahoma and the temperate rainforests of the Appalachians. The SRS Forest Inventory and Analysis (FIA) Program delivers knowledge about the forest resources of the region by providing data, information, and research across this diverse and complex landscape.

The 13 Southern States contain 33 percent of the U.S. population, and 88 percent of the forest land is in private ownership. Furthermore, the region is growing faster than any other region. Forest ownership patterns in the South are dynamic due to the large proportion of privately owned forest lands, population trends, and the changing forest products industry. For example, timber investment management organizations (TIMOs) and real estate investment trusts (REITs) have become far more common as timber industry entities have sold land over the past decade. In addition, more homes are being built in the wildland-urban interface because an increasing ex-urban population wishes to retain traditional ties to the land that were common to farmers and forest land owners. SRS FIA provides timely and relevant information across these dynamic ownerships and conditions.

One important step toward transitioning from the past timberland-centric forest inventory to the monitoring of all treed land regardless of its land use is the expansion of the FIA program into urban forest inventory. Trees in urban landscapes deliver valuable ecosystem services to their local communities that include air quality improvement, temperature mitigation, building heating and cooling energy savings, carbon storage and sequestration, storm water retention and filtering, soil stabilization, biodiversity enhancement and wildlife habitat, and the production of timber products and useful biomass. FIA's mandate under the latest Farm Bill has been expanded to include the inventory and monitoring of trees within urban areas. FIA will assess the more traditional forest characteristics within urban areas as well as quantifying many of the ecosystem services that urban trees provide.

Demands placed on Southern forests are increasing and these demands are both industry based and nonindustry based. Forests in the South provide the raw material for timber products and they are a source of renewable feedstocks for energy and biofuels. Underutilized material from harvest operations can provide the material for other bio-based products. Southern forests also provide food, medicine, decorations, and fine arts and crafts to the region's economy. Non-industry demands are expanding as people seek out nonforest products. Rural and urban forests must satisfy the recreational demands of the increasing population. SRS FIA provides timely, consistent, reliable information on forest product output and is implementing urban monitoring where appropriate.

Within the Southern U.S., the status, condition, health, and trends of forest resources are important to State foresters, forest industries, nonindustrial private landowners, Federal agencies, nongovernmental organizations, and university researchers. All of these groups are important clients of FIA. Also, the annual inventory provides the framework to conduct the inventory in a collaborative manner with the southern State foresters and their respective forestry organizations. Due to the dynamics of forest resources in the Southern U.S., the mission of FIA is critical to assessing sustainability, strategic decisionmaking, and forest resource management. To accomplish the FIA mission and enhance the utility of FIA data, we outline four broad program areas.

#### 10. Approach to Problem Solution (Start at conclusion of item 9.)

All work conducted under this RWUD will conform to the requirements of the Food Security Act (7 U.S.C. 2276, as amended) and will adhere to the terms of the directive of FIA Data Privacy and Release. Likewise, all work will conform to direction received under the 1998 and subsequent Farm Bills, which clearly identify what is to be done with regard to the annual inventory process. Plot design and sampling methodology are presented in Bechtold and Patterson (2005) (*The enhanced forest inventory and analysis program—national sampling design and estimation procedures*. Gen. Tech. Rep. SRS-80, Asheville, NC: U.S. Dept. Agriculture, Forest Service, Southern Research Station. 85 p.) and will not be repeated herein.

#### **Problem 1 – Forest Inventory and Health.**

Problem 1 involves forest inventory and health information including area of forest land, volume, components of change (growth-removals-mortality), and regeneration. Within the area of forest ecosystems function, condition, and health, FIA collects information on tree crown condition, down-woody material, soils productivity and erosion, vegetation structure and diversity, and invasive plant distribution. All of this information is critical for describing forest conditions, status, distribution, and health. We are incorporating urban forest inventory into this problem area to address the new emphasis in the 2014 Farm Bill and meet the needs of a growing urban constituency. Problem 1 is broken out into sub-components as listed below. Over the next 5 years, we will:

**1.a.** Assess and document forest status, condition, and health at the State level every 5 years with annual

updates, in addition to sub-State, regional, and national assessments. Work with collaborating States and urban communities to implement the urban forest inventory.

**1.b.** Improve our understanding of ecological patterns, ecosystem processes, and socioeconomic forces that govern stand dynamics and forest development in Southern forests, identifying trends as they relate to these and other factors.

**1.c.** Conduct research to identify, monitor, and explain changes in the health and sustainability of forest ecosystems across the Southern region, including urban forest health issues, using a multidisciplinary approach.

**1.d.** Assess and document the responses of Southern forests to disturbances and stressors such as climate change, extreme weather events, pest and disease outbreaks, air pollution, nonnative species invasions, wildland fires and other disturbances at the stand and landscape level.

**1.e.** Improve techniques for quantifying and documenting complex land-use change dynamics caused by market conditions, woodland ownership, urbanization, forest fragmentation, and other socioeconomic forces.

**1.f.** Investigate and develop procedures to inventory and monitor nonforest areas within the FIA sampling framework and integrate these areas into the National FIA program, with particular focus on urban forest ecosystems and rangelands.

**1.g.** Support the implementation and expansion of the FIA program through research directed toward improving program efficiency and effectiveness, data accuracy and precision, data processing and analysis, and data interpretation and information delivery to stakeholders.

**1.h.** Expand reporting on nonnative invasive plants to include them within online FIA Database tools, and engage State Cooperators annually to get input on status of invasive plants in their respective states.

**1.i.** Conduct research to identify repeatable, objective measures related to tree quality / grade.

**1.j.** Assist with development and assess functionality of the urban forest inventory database, and develop and implement new means of disseminating information to urban forest stakeholders and communities.

The beneficiaries of work on forest inventory and health are numerous and diverse, and include:

- The general public
- Forest Industries
- Land managers (all uses – e.g., recreation, natural resources, preservation, etc.)
- Urban planners and urban communities
- Scientists and partners (Universities, other Federal agencies)
- Policymakers at the local, State, and national levels

The potential benefits of this research are current, comprehensive, and reliable resource statistics, summary reports, and analyses that are necessary for the development and implementation of programs and policies to improve the quantity, quality, and services from the forest resources of the South.

The nature of this research is such that a reasonably high level of success can be expected. Meeting the production requirements of FIA will provide needed information to land managers, resource analysts, and partners while improvements and expansions will be incorporated as they are developed and tested.

## **Problem 2 – Forest Products Output.**

Problem 2 describes forest products output studies to describe and monitor the dynamics of commercial and noncommercial uses. Timber product output (TPO) studies are designed to monitor the composition, size, and locations of the primary wood-using industry facilities; their use of roundwood (logs) by species, product, and geographic location; and their generation and disposition of mill residues. To complete the picture of removals, harvest and utilization studies are conducted to characterize the sites logged, the trees cut, the products taken, and the residues left behind. Forest products studies include nontimber forest products (e.g., food, medicine, arts and crafts, nursery and landscape products) and biomass available for

energy. National emphasis on nontimber forest products, carbon, and biomass availability for energy will be provided by the newly established Center for Forest Products Survey and Analytics. Over the next 5 years, we will:

- 2.a. Deliver information for use in sustainably managing the resource by estimating timber product removals, production by timber processors, and amounts of logging and mill residues with Timber Product Output (TPO) surveys every 1-2 years and Harvest and Utilization studies conducted annually across the South.
- 2.b. Conduct research to develop statistical designs for (a) an annual forest product survey, (b) quantifying trends in utilization, and (c) a nontimber forest products survey.
- 2.c. Conduct research to (a) quantify forest carbon and biomass from origin, to product, to disposal based on life cycle analysis and other techniques, (b) quantify land use changes and local to international market changes and their influence on forest product (timber and nontimber) availability and sustainability.
- 2.d. Lead and collaborate in broad scale studies related to carbon stored in harvested wood products in support of quantifying overall forest sector carbon flux.
- 2.e. Conduct research to develop a suite of online analytical and visualization tools for analyzing timber and nontimber forest products availability, sustainability and trends.
- 2.f. Work with regional TPO data collection and reporting groups and other stake holders from academia, industry, and nongovernment organizations (NGOs) on problems identified in the previous items, and implementation of new statistical designs. Work with national forests, landowners, and professional groups on a nontimber forest products survey.
- 2.g. Continue work to determine how to track 'nontraditional' ways wood is leaving States as well as research focusing on new and emerging markets, such as wood pellets and bioenergy; develop new partnerships (i.e., DOE) to supplement TPO data on emerging markets.

The beneficiaries of work on forest product output are similar to the beneficiaries of Problem 1. In particular, industry stakeholders, land managers, consumers, economists, and other Federal agencies have a keen interest in TPO, while land managers and consumers are important stakeholders with regard to nontimber forest products.

The potential benefits of this work include a clearer picture of how forest resources are being harvested, transported, and utilized, and accurate, timely information on nontimber forest products, which have received little attention in inventory and monitoring efforts. This information will be vital to understanding the economics and sustainability of timber and nontimber forest products.

The nature of this research is such that a reasonably high level of success can be expected. Fulfilling Forest Product Output reporting goals will provide needed information to land managers, resource analysts, and partners. Survey of nontimber forest products presents a unique set of challenges, including resistance to sharing information by individuals who profit from gathering and selling products and who may have an interest in protecting their sources for such products. However, progress has already been made in deriving information on some nontimber products from existing inventory data, and work is underway to develop methods for recurring inventory of other nontimber forest products. While full incorporation of a nontimber forest products survey with ongoing TPO or FIA survey is not expected during the next 5 years, significant progress will be made to form and enhance relationships with partners who can provide needed data. We expect to greatly increase knowledge of the distribution and abundance of major nontimber forest products in the South in relation to relevant landscape characteristics, and anticipate completion of an initial survey of major nontimber forest products within the next 5 years.

### **Problem 3 – National Woodland Owners Survey (NWOS).**

Problem 3 involves characterization of the owners of the South's forests, to determine their ownership objectives, management practices, and future intentions for their forest property. Over the next 5 years, we will:

- 3.a. Report on forest landowner characteristics, attitudes, and behaviors.

**3.b.** Engage with State partners to initiate, investigate, develop, and disseminate research information about owner corporations, partnerships, clubs and other entities, including timber investment and management organizations and their associated influences and impacts on forest resources and ecosystems in the South.

**3.c.** Conduct research to understand the reasons for and consequences of trends in forest ownership, improved analytical techniques are needed to fully understand the linkages between the ownership survey and forest inventory data and other nontraditional data.

The beneficiaries of this research include economists, sociologists, policy makers, forest industry partners, and others with an interest in understanding trends in forest ownership and use.

The potential benefits of this research are current, comprehensive, and reliable information on landowner characteristics, attitudes, and behaviors, and novel application of that information to questions regarding trends in ownership.

The nature of this research is such that a reasonably high level of success can be expected. Stakeholders are eager to contribute to this work and to assist in developing and conducting the research.

#### **Problem 4 – Methods and Techniques Research.**

Problem 4 focuses on research into methods to improve the efficiency and effectiveness of FIA and examines novel methods for FIA data collection, processing, and reporting. Over the next 5 years, we will:

**4.a.** Conduct research on developing a robust Quality Assurance (QA) statistical design and develop an annual QA reporting framework.

**4.b.** Conduct research to develop land use and land cover status and trends estimators that integrate longitudinal data collected via field-based observation and photo-based aerial photo interpretation or other remote sensing platforms.

**4.c.** Conduct research to develop assessment techniques to quantify disturbances and their impacts in both rural and urban forests, including standard ways of rapidly assessing major disturbances and their impact across multiple States.

**4.d.** Conduct research to develop statistical and econometric techniques to quantify emerging trends in forest inventory and forest products data.

**4.e.** Develop and implement research to produce new systems, techniques, and tools that will improve the capability to rapidly map and analyze forest ecosystems.

**4.f.** Test new technologies, data sources, and data collection approaches to increase efficiency of pre-field activities and field activities for forest land and urban areas.

**4.g.** Conduct research on questions that bridge the rural to urban forest gradient.

**4.h.** Working with State partners, assess the feasibility of using more economical means of inventorying special forest areas (e.g., mangrove and mesquite), addressing the issues of stem form and accessibility.

**4.i.** Conduct research to assess feasibility of using FIA data and supplementary data to develop statistically robust, small-area estimates (geographic areas less than an FIA Unit – e.g., county).

The beneficiaries of this research include internal and external stakeholders and partners, including (but not limited to):

- Natural resource managers
- Resource analysts
- Researchers and partners
- Forest industry
- Statisticians and modelers
- Program managers seeking to increase production and/or decrease costs

The potential benefits of this research are current, comprehensive, and reliable resource statistics, summary reports, and analyses that are necessary for the development and implementation of programs and policies to improve the quantity, quality, and services from the forest resources of the South.

The nature of this research is such that a reasonably high level of success can be expected. The Program's outputs will provide land managers and resource analysts with improved estimates (increased precision and lower costs), more spatially explicit information, and techniques for managing and evaluating the forest resources of the region.

#### 11. Environmental Considerations

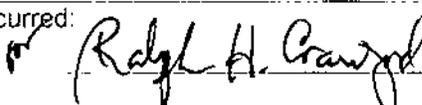
The work planned involves inventory and research activities which are clearly limited in context and intensity, and as such are categorically excluded from environmental analysis requirements (FSH 1909.15, Chapter 30, Section 31.1a(3)).

#### 12. Staffing Plan

Problem Area	Scientist Years				
	2016	2017	2018	2019	2020
Forest Inventory and Health	51	51	51	51	51
Forest Product Output	6	7	7	7	7
National Woodland Owner Survey	2	2	3	3	3
Methods and Techniques Research	8	8	9	9	10

#### 13. Costs<sup>1</sup>

	Fiscal Year				
	2016	2017	2018	2019	2020
Cost for Full Implementation (millions of dollars)	24.40	24.77	25.14	25.51	25.90

Signature	Title	Date
Recommended: WILLIAM BURKMAN	William Burkman Assistant Director for Research	2/19/2016
GREGORY REAMS	Greg Reams Assistant to Staff Director	
LINDA HEATH	Linda Heath Staff Director	2/29/2016
Approved: ROBERT DOUDRICK	Robert Doudrick Station Director	
Concurred: 	Deputy Chief for Research	3/2/2016

<sup>1</sup> Based upon completion of OPTIONS A through E; Full Farm Bill funding option nationally (\$108 million), adjusted upward 1.5% per year