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| RESEARCH WORK UNIT DESCRIPTION Ref: FSM 4070 | 1. Number FS-SRS-4851 | 2. Station Southern Research Station |
| | 3. Unit Location Research Triangle Park, NC | |

4. Research Work Unit Title

Economics of Forest Protection and Management

5. Project Leader (Name and address)

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6. Area of Research Applicability
Nationwide

7. Estimated Duration
Five Years

8. Mission

The Research Work Unit's Mission is to improve the economic foundation for natural resource policy and management by: (1) evaluating alternative strategies for managing forests in the presence of forest disturbances including wildfire and invasive species; (2) expanding knowledge of how forest products trade, regional timber markets, and forest conditions are linked; (3) providing knowledge of how forests provide goods and services of value to people; and (4) integrating economic concepts into interdisciplinary research on resource uses and values.

9. Justification and Problem Selection

(see attached pages)

10. Approach to Problem Solution

(see attached pages; starts at conclusion of item 9.)

| Signature | Title | Date |
|------------------------------------|---------------------------------|---------|
| Recommended: /s/John F. Kelly | Assistant Director for Research | 2/20/04 |
| /s/ Linda L. Langner | Assistant to Staff Director | 2/25/04 |
| /s/ David A. Cleaves | Staff Director | 2/25/04 |
| Approved: /s/ Peter J. Rousopoulos | Station Director | 3/11/04 |
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9. Justification and Problem Selection (continued)

Economics of forest disturbances--Natural disturbances such as fire, pests, and weather have long been recognized as important factors influencing the structure and health of forests. During the last two decades, both natural and human disturbances to forests have changed in response to the expanding wildland-urban interface, shifting climate patterns, and increasing mobility of people, insects, plants, and pathogens across the world. Government expenditures for fire suppression and management have risen rapidly over the last few years, with limited understanding of the underlying causes of these increases. Nonnative forest insects, diseases, and plant species threaten the health and economic value of U.S. forests for timber production, recreation, wildlife habitat, and water. Hurricanes, ice storms, and drought have damaged forests, often making them more vulnerable to fire, pests, and diseases, with resulting negative impacts on the broader economy. Research is needed to evaluate the economic impacts of these disturbances at local, regional, and national levels; to identify economically optimal solutions to prevent or reduce the damages; and to develop public policies and management strategies in response to these disturbances.

Problem Statement: Evaluate the impacts of forest management and policies on the prevention, control, and restoration needs associated with fire and other forest disturbances.

Forest management, markets, and trade--The U.S. is the world's largest producer and consumer of forest products, and the South produces more timber than any other single nation. The nation's timber and forest product markets are affected by trade policies, supply shocks, market structure, forestland ownership, and technology. Understanding the relationships between these factors and wood products markets is essential to projecting timber supplies and demands and their effects on forest conditions. Accuracy of these models is constrained by: incomplete knowledge of how land and forest product markets are related spatially and temporally, insufficient representation of timber investment behavior, inadequate characterization of the processes underlying technological change, and incomplete understanding of forestland owner and consumer preferences.

Problem Statement: Refine understanding of how forest and trade policies, supply shocks, market structure, forestland ownership, and technology affect regional timber markets, forest products trade, forest sector benefits, and forest conditions.

Values of forest amenities and services--Forests produce value for members of society, and at the same time are shaped by the values held by forest owners, interest groups, and the public at large. The heterogeneity of forestland uses reflects the mix of values and incentive structures that guide forest management and protection decisions. Many of the environmental and amenity services supplied by forests, such as clean water and attractive landscapes, are public goods that provide benefits to all members of society, regardless of whether they are produced on public or private forests. Rising demand for forest amenities in combination with a shrinking supply has led to increasing scarcity. Forest amenities are undersupplied because they are non-priced and take decades or longer to produce. At the landscape scale, the mix of forest and other land uses that result from individual decisions leads to under-provision of some forest goods and services for society as a whole. In addition to direct human influence, forest conditions are also affected by biotic (insect and disease) and abiotic (fire and atmospheric) disturbances that may be indirectly related to human behavior. A better understanding of how changes in forest conditions alter forest values, and how such changes impact various segments of society, will help forest managers and land use planners identify forest values at risk and design policies that enhance the quality of life for all members of society.

Problem statement: Improve methods for measuring non-market values provided by forests; characterize the distribution of forest values across members of society and geographical regions;

develop strategies to utilize non-market values in decision-making.

Economics of broad scale human-forest interactions--Changes in society have led to increased demands for forest goods and services. In addition, changes in the structure and characteristics of existing forests affect the ability of forests to meet societal needs such as solitude, biodiversity, adventure, and wood products. Supplying these benefits will affect both the quality of life and the standard of living in nearby communities and regional economies. Research is needed to evaluate and forecast the effects of resource production on forest extent and condition; the effects of changing forest ecosystem conditions and resource use patterns on human communities; and the effects of various policies and institutions on resource conditions, conservation goals, and communities. Research in this problem area will address the sustainability of forests and associated human communities by estimating models of relationships between social factors, land use, and forest fragmentation; simulating resource, land use and community impacts under varying macroeconomic and societal scenarios; and cataloguing and projecting forest conditions, uses, and values.

Problem statement: Integrate economic concepts into interdisciplinary research on resource uses and values and improve methods for integrated assessments of regional and national resource issues.

10. Approach to Problem Solution

Problem 1 – Economics of Forest Disturbances

Research in this problem area will address several important knowledge gaps in the management of forested ecosystems in the presence of disturbances such as wildfire, invasive species, and hurricanes. General knowledge is needed regarding how management is affected by and addresses these disturbances and their associated risks. Research studies will emphasize fire as a forest disturbance, focusing especially on the evaluation of fuel treatments, development of models to address spatial aspects of fires, analysis of fire as a 'production' process, and the economic costs of fires including suppression costs. Additional studies regarding the economic impacts of invasive species and native pests are also planned. Specific studies will:

1. Evaluate the impact of vegetation management, including timber harvesting and fuel treatments, on fire occurrence, extent, and severity in forests of the Western U.S. This study will model fire acreage and ignitions as a function of weather, climate, harvest and other treatments, population, and the wildland-urban interface.
2. Develop models and analytical methods for examining trade-offs between cost and effectiveness of treatment, pre-suppression, suppression, and rehabilitation for wildfire management. Fire production function analysis, risk analysis, and welfare analysis will be applied in examining the tradeoffs between alternative approaches to managing forest disturbances and for evaluating the most efficient and efficacious combination of actions to minimize the net costs of wildfire and its control to society.
3. Develop methods for evaluating the economic impact of invasive species on various stakeholders. This research will include the application of remote sensing and hedonic property value methods to estimate the impact of the hemlock woolly adelgid (HWA) on property values, and the impact of the HWA on recreational value and use.
4. Develop models to assess the market impacts of broad-scale fuel treatment programs. This study will develop timber market models to determine market effects of fuel treatments to reduce fire damages, and will endogenize the effects of timber prices, selection of treatments, and the amount of land treated for a given subsidy program.

Problem 2 – Forest management, markets, and trade

Research in this area will focus on the linkages between forest management activities, regional timber markets, and trade in forest products while continuing the unit's efforts to understand the temporal dynamics of forest product markets. This information is crucial for evaluating the possible future of forest conditions in the South and other regions of the country. Key conservation policies use subsidies or taxes to change management incentives, so evaluating policy effectiveness requires knowledge of management behavior and response to prices. Trade is increasingly important in shaping domestic markets and therefore domestic forest conditions. Work in this area will support ongoing national efforts including the RPA Timber Assessment and agency efforts to evaluate the effects of international environmental and trade policies. Research studies will:

1. Evaluate the structure of timber supply and forest investment at fine spatial scales using forest inventory plots. Test for appropriate aggregations of supply. Develop models for projecting timber supply relationships at these scales.
2. Identify the determinants of interregional market integration in timber and other forest products, both nationally and internationally. Quantify the impacts of trade policies on the U.S. forest sector. Determine how spatial and temporal linkages in U.S. timber markets affect market equilibria.
3. Describe how policy and catastrophic shocks affect timber markets. Identify and evaluate potential policy and management responses to natural risks and events in forest product markets.
4. Evaluate how and where new forest management technologies are adopted and how these affect timber production. Describe the resulting spatial distribution of forest types and species diversity.

Problem 3 -- Values of forest amenities and services

Public values continue to play a central role in debates over existing and potential rules and regulations that guide the protection and management of forest land. Efforts to formulate and implement policies consistent with public desires will be aided by a better understanding of how forest values are related to forest management, protection, and restoration activities; how forest values are distributed across segments of society; which forest landscapes hold particularly high value; and how the provision of forest amenities on non-industrial private forest land affects timber supply. The following studies will be conducted to improve understanding in this area:

1. Develop conceptual and empirical models to estimate the value of public goods provided by private forests in the South. These models will emphasize the linkages between forest amenities and management practices; the distribution of values across segments of the population; and the distribution of values across geographic regions in the South.
2. Evaluate the attitudes, values, and motivations of non-industrial private forest owners in the South regarding the production of forest amenities on their land. Investigate how demographic and land use change will affect the provision of amenities and timber on these lands.
3. Develop and implement methods to enhance understanding of the investment behavior of property owners faced with the risk of natural forest disturbances such as wildfires and invasive forest species. This research will investigate the factors that motivate mitigation efforts by private property owners, as well as identifying constraints to risk mitigating investments.
4. Evaluate public values associated with ecosystem restoration on public forests. This research will investigate the benefits and costs associated with restoration decisions following catastrophic wildfires as well as the trade-offs arising from other natural and human disturbances to forests and related ecosystems.

Problem 4 – Economics of broad scale human-forest interactions

Concerns regarding the sustainability of forests center on how human uses affect the flow of services from forested ecosystems. These effects are determined at broader scales than those at which much forest science has been conducted. Since sustainability is also defined by the interactions of social and biophysical systems, effective research requires interdisciplinary efforts. Research in this area will focus on linking models of resource utilization, in the form of land use and timber management, to resulting configurations of forest conditions, and will be conducted at multiple scales. Much of the work conducted here will apply and extend findings from the preceding three problem areas to broad scale assessment of human-forest interactions. Studies will:

1. Develop methods for forecasting the implications of land use and forest management changes for forest conditions within a region. This study will focus on forecasting changes in species composition, age, availability for timber management, and vertical structure.
2. Evaluate the impacts of forest conditions and production of goods and services on local and regional economies. This study addresses the direct and total contribution of wood product sectors to employment and income at the state level and over time.
3. Develop models to test the influence of social and economic factors on patterns of land use in the South and other regions of the country. The resulting modeling framework will then be used to examine the role of public land and conservation easements in protecting ecological conditions and to forecast land use change and fragmentation.
4. Evaluate the needs for interdisciplinary research and forecasting in natural resource/ecological systems. Identify key challenges to developing effective integrated assessments and potentially beneficial approaches to overcoming these challenges.

Environmental Considerations: This work does not involve field work or use of hazardous materials, nor does it present other environmental problems. This work will be accomplished by collecting secondary data from available data sources, or occasionally primary data from survey instruments, and analyzing the data with quantitative and qualitative statistical methods. Thus, the work described in the Research Work Unit Description (RWUD) falls under one of the categories of actions that do not normally have a significant effect on the quality of the human environment and are therefore excluded from documentation in an Environmental Impact Statement (EIS) or Environmental Assessment (EA; see FSH 1909.15, Chapter 30). If environmental concerns arise regarding a particular study that arises from the research described in the RWUD, these will be evaluated within individual study plans, or by EA's or EIS's prepared with and approved by cooperating District or Forest staffs.

Cooperation: In conducting this research, the RWU will collaborate with researchers at universities and with other work units at the Southern Research Station or at other Forest Service Stations. In particular, we will cooperate with the two other social science research work units in the Southern Research Station:

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| SRS-4802 | Evaluation of Legal, Tax, and Economic Influences on Forest Resource Management. |
| SRS-4901 | Recreation, Wilderness, Urban Forest, and Demographic Trends Research |
| SRS-4951 | Southern Wildland Urban Interface |

We will coordinate our research efforts under problem areas 1 and 2 with SRS-4802. Research that addresses forest valuation (problem area 3) will be coordinated with SRS-4901. Other likely cooperators in the Southern Research Station include:

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| SRS-4801 | Forest Inventory and Analysis |
| SRS-4351 | Evaluation of Watershed Ecosystem Responses to Natural, Management, and other Human Disturbances of Southeastern Forests |

SRS-4101 Ecology and Management of Southern Appalachian Hardwood Forests

Likely cooperators at other stations include:

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| NE-4805 | The relationships between Forest Product Markets and the Composition, Structure, and Sustainability of the Eastern Hardwood Resource. |
| PNW-4851 | Human and Natural Resource Interactions |
| RM-4851 | Identification and Valuation of Wildland Resource Benefits |
| FPL-4851 | Timber Demand and Technology Assessment Research |
| RM-4802 | Economic Aspects of Forest Management on Public Lands |

The RWU will cooperate with the Research Valuation and Use Research Staff in the Washington Office. The RWU also will cooperate with staff groups at both national and regional levels, representing Cooperative Forestry, Ecosystem Management Coordination, Strategic Planning and Resource Assessment, and International Programs. The RWU will cooperate with public and private universities, various nongovernmental organizations, and other Federal or State agencies.

11. Staffing and Budget

As of January 2004, the RWU will be staffed with the project leader, four research foresters or economists, one ecologist, and a financial assistant. In addition, one to three temporary positions may be employed as needed. The scientist years of internal staff devoted to research are classed by problem area below. Additionally, scientist-years will be contributed by academic cooperators and by temporary employees who may assist in completion of some research.

| Problem Number | Scientist-Years Per Annum |
|----------------|---------------------------|
| 1 | 2.2 |
| 2 | 1.0 |
| 3 | 0.8 |
| 4 | 1.0 |

Full implementation of this RWUD would require a budget of approximately \$1.5 million. Current levels of station funding (\$970,000, before national and station overhead assessments) are insufficient to cover costs of personnel and operations at the current level of staffing. Research operations have been maintained with funds received through the National Fire Plan and other external sources. Selection of studies to be completed is therefore heavily influenced by the availability of funds from these external sources. Funding at current levels will result in diminished efforts in all problem areas but especially in problem areas 2 and 4.