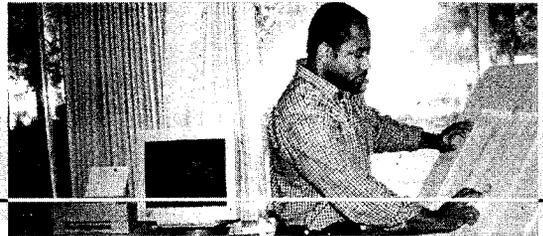


Strategies for the 21st Century



The Framework

Southern Pines

Wetlands, Bottomland Hardwoods, and Streams

The Southern Appalachians

The Interior Highlands

Large Scale Assessment and Modeling

Inventory and Monitoring

Strategies for the 21 st Century

The Framework

We published "The Strategic" Framework for the Southern Research Station" in 1997 and continue to refine and implement it. The Strategic Framework enhances our ability to work with other members of the forestry, community on a, broader scale, across State and local boundaries, to respond to the complex issues challenging natural resource management. It provides a mechanism to leverage our science and resources in an integrated fashion and to assure accountability in our research programs. The Strategic Framework supports our commitment to collaborative stewardship by delivering usable information and technology to public and private customers to implement sustainable land and resource management. Sustainability is the concept that brings focus to the Southern Research Station research and development program.



The Forest Service is committed to the goal of sustainability, which is defined as the ability of the biophysical resources or ecosystems to meet human needs and wants without degradation. By maintaining forest health, diversity, and productivity, sustainable forest management ensures that the commodity and environmental needs of present and future generations can be met.

The Strategic Framework establishes three emphasis areas for, a 'dynamic system for setting goals, priorities, and making significant accomplishments:

1. measuring and monitoring forest resources;
2. understanding ecosystem structure, function, and processes; and
3. ensuring environmental quality and sustainable productivity.

Achieving sustainability and incorporating human values into our research program requires a multi-disciplinary approach and a customer-driven framework for applying that approach. To integrate the efforts of our 25 Research Work Units, six cross-cutting themes (CCTs) were developed that will help bring people together to address the three emphasis areas across the South:

1. Southern Appalachian Ecosystem Research and Sustainability;
2. Sustainability and Productivity of the Interior Highlands Ecosystem;
3. Ecology and Management of Forested Wetlands, Bottomland Hardwoods, and Riparian Zones;
4. Sustainability and Productivity of Southern Pine Ecosystems;
5. Landscape and Regional Integrated Assessment and Modeling;
6. Inventory and Monitoring.

During 1998, the Research Work Units involved in the CCTs made efforts to identify internal collaborative opportunities, current and emerging issues, and potential external partners. The CCTs are a useful tool to incorporate and address national concerns, and position us to be responsive with research direction to study those concerns.



Strategies for the 21st Century

Southern Pines

A Steering Committee has been established to facilitate the continued development of the Sustainability and Productivity of the Southern Pine Ecosystems CCT. This committee consists of one member from each of the 17 Southern Research Station Research Work Units that have been identified with the CCT.



The group reviewed the draft charter of the Southern Pine CCT and began development of an informal, but dynamic, team-based approach to address the critical resource needs related to the Southern Pine Ecosystems. This document will help our widely dispersed Southern Research Station scientists develop a regional, landscape, and corporate vision of the important issues and information gaps that surround the Southern Pine Ecosystems.

The document sets forth our current thinking on the Sustainability and Productivity of the Southern Pine Ecosystems theme. It begins to identify research needed to provide for ecologically sound, economically viable, and socially acceptable management of the southern pine and pine-hardwood ecosystems. It also provides a framework to bring together other scientists, managers, and stakeholders to develop consensus on research needs for sustaining our southern pine and pine-hardwood resources

The Montreal Process Criteria, developed for use by the international forestry community for assessing forest sustainability on a national level, is now being used to categorize research issues and questions for this very broad theme. The seven Montreal Process Criteria used in the document to array research goals and directions include the following:

1. Conservation of biological diversity
2. Maintenance of productive capacity of forest ecosystems
3. Maintenance of forest ecosystem health and vitality
4. Conservation and maintenance of soil and water resources
5. Maintenance of forest contribution to global carbon cycles
6. Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies
7. Legal, institutional and economic framework of forest conservation and sustainable management.



Strategies for the 21 st Century

Southern Pines



The document prepared by the Southern Pine CCT Steering Committee was reviewed by interested Southern Research Station scientists; it is being revised and is in the process of being published by the Station. The publication will be used to facilitate the development of more specific research goals and to engage interested cooperators from universities and public and private forestry organizations in development of cooperative research programs.

Supplying knowledge to meet the increasing demands for forest benefits (wood: fiber; recreation, and wildlife) in a sustainable and environmentally conscientious manner is perhaps the primary issue facing forestry researchers. As we move forward under this CCT, we will define the ecological capacity of the Southern Pine ecosystem, using multi-disciplined team-based ap-

proaches that will build on internal capacity and expand interaction with scientists and managers from other Forest Service research stations, other federal, state, private industry, and nonindustrial private landowners. New aspects including urban/wildland, social/recreation, and wilderness issues will be incorporated into studies of sustainable pine ecosystem management. Southern Pine CCT research will address and provide significant accomplishments to meet the Government Performance and Results Act Outcome Objectives: Clean Air and Water; Productive Soils; Robust Fish and Wildlife Populations; Healthy Forests and Grasslands; Improved Knowledge of Decision Making to Support Sustainable Ecosystem Management; Improved Urban Environment; and Quality of Outdoor Recreation and Natural Settings.

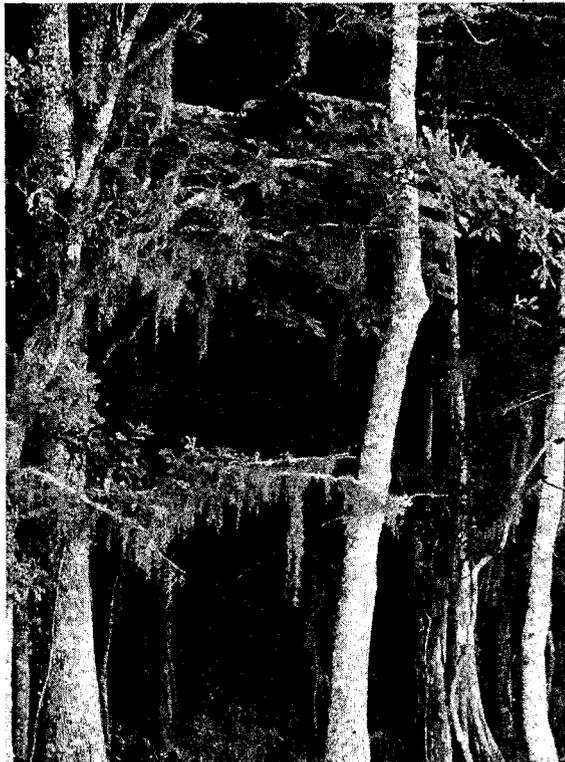
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Wetlands, Bottomland Hardwoods, and Streams

Wetland forests and riparian areas are a major component of southern forests, but their extent has been drastically reduced over the past century. These ecosystems are the ultimate resting place of all water-borne pollutants and nutrients that can be trapped by surface vegetation. Enormous amounts of recreational activity occur there. They are capable of yielding a wide range of wood products. Their function can be impacted by a substantial extent by hydrologic manipulation. These ecosystems occur from the Appalachian Valleys to the coastal lowlands, crossing the breadth of the Southern Research Station.

Progress in understanding the function and management of wetland forests and riparian areas depends upon five research program components:

1. Determination and description of basic ecosystem function, as hydrology, biogeochemistry, vegetation community dynamics and productivity, ecophysiology, pathology, and wildlife of forested wetlands, bottomland hardwoods, and riparian zones.
2. Methods of management:
 - a. of hydrology and nutrients to forested wetlands
 - b. of silvicultural practice, and of harvesting, site preparation, and roading systems for improved production of desired outputs with reduced impact to the state and productivity of the systems themselves.
3. Methods of determining policy for, and evaluating the economic and social effectiveness of, the management of forested wetlands, bottomland hardwoods, and riparian zones.
4. Determination of modelling approaches to management of these systems at multiple scales.
5. Experimental manipulations of the systems, in field-scale as well as microcosm settings, to test hypotheses, raised in the other components.



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Strategies for the 21st Century

Wetlands, Bottomland Hardwoods, and Streams



During FY '98, 20 Research Work Units conducted work dealing with some aspect of forested wetlands, bottomland hardwood forests, or riparian forests. Scientists or cooperators in 16 Research Work Units published 138 papers dealing with bottomland or riparian forest species or issues relevant to management of such resources. Research work unit descriptions of the additional four units identify problems that have direct applicability to issues relevant to wetlands, bottomland hardwoods, and riparian forests.

Condensed into several questions, the tasks of this CCT are to answer the following:

1. What are the most important biotic and abiotic determinants of biological productivity of each of the major wetland types in the South and how can they be quantified?
2. How do we accurately predict biological and economic growth and yield of mixed species bottomland hardwood stands?
3. How do we predict response of ecosystems to natural disturbance and silvicultural activities?
4. What are the key biological and environmental indicators of ecosystem health for each of the major wetland types?

Streamside management zones (SMZ) are recognized to be critical for sustaining water quality, biodiversity, and habitat, yet there is little information about effectively designing and implementing these essential landscape features. We propose an initiative to do a multi-scale study to characterize the hydrologic setting and dynamics for stream systems across the region; to determine the historical rates of sedimentation in major and minor river systems; and to measure sedimentation rates associated with varying landscape and management settings. We will initiate controlled experiments to determine the effects of SMZ width and topographic position on water quality and habitat, and develop regional models for planning and designing SMZ systems.



Strategies' for the 21st Century

Southern Appalachians



The working document for the Southern Appalachian CCT was reviewed and the organization of the CCT was reaffirmed. The major topical categories for research are:

1. ecosystem dynamics structure and function;
2. social and economic influences; and
3. synthesis and integration.

A steering team consisting of Project Leaders of involved Research Work Units or their designees was formed and had their initial meeting. A synthesis and integration team was formed. This team completed an analysis of work needed in their research category, recommended a

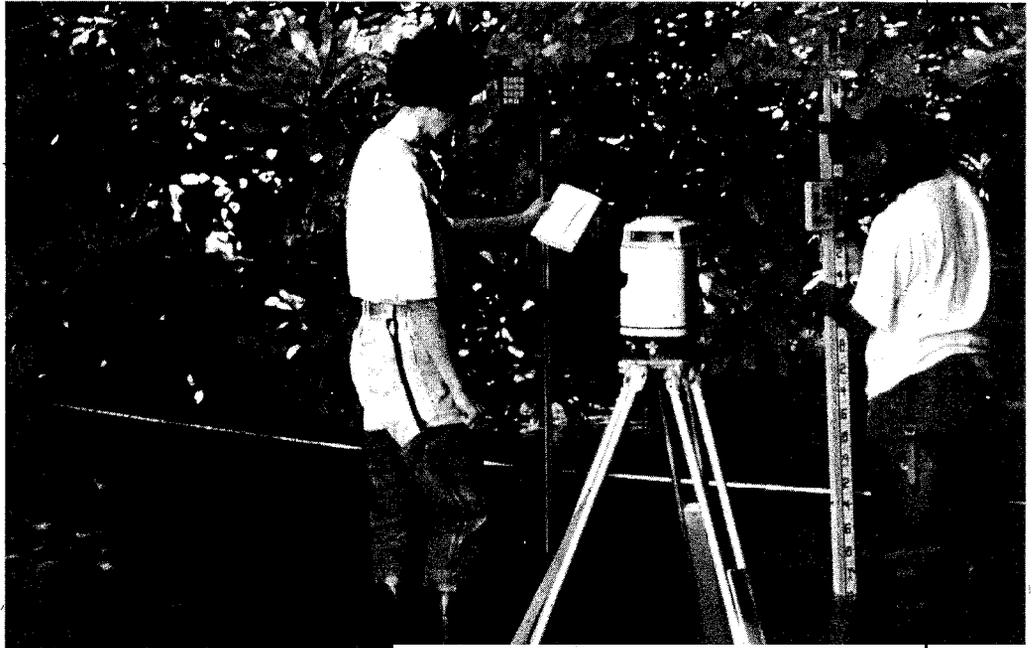
set of alternative approaches, and developed a proposal and submitted it for outside funding.

Research identified with this CCT remained very active. A myriad of activities on the Wine Spring Creek ecosystem management research area continued. Significant progress was made on developing a Southern Appalachian variant of the Forest Vegetation Simulator, including a regeneration prediction submodel. Research in timber supply economics, valuation of nonmarket outputs, and social values continued, as did work on wildlife habitat. A new research component dealing with assessing tree quality for forest products was added in 1998.

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Strategies for the 21st Century

Southern Appalachians



Two of the natural resource issues in the South that will be used to focus our efforts for the next five years are:

1. Wilderness research in 'the Southern Appalachians; and
2. Social and resource dynamics in the Southern Appalachians.

Key research activities to address the wilderness issue would include: assess demand; understand perceptions, values,, attitudes, and socioeconomic interrelationships toward wilderness and management alternatives; examine special forest products collection; examine the impact and design, of recreational access on water quality, aquatic biota, and other indicators of ecosystem health; understand fundamental ecological processes

and dynamics in non-manipulated ecosystems as a basis for model development or as a basis for development of conservation strategies.

Key research activities to address social and resource dynamics would include: quantify demand for outdoor recreation; quantify and forecast resource use and land use, change; examine design, costs and ecological impacts of access; model the compositional and structural dynamics of vegetation in manipulated and nonmanipulated ecosystems; develop strategies for watershed-scale restoration of riparian/aquatic ecosystems; quantify the impacts of increasing angler use and changing land use patterns " on wild trout.



Strategies for the 21st Century

Interior Highlands

Research plays an important national role in establishing the scientific basis for sustainability in the context of ecosystem management. This CCT, Sustainability and Productivity of the Interior Highlands Ecosystem, embraces one of the most important regions in the mid-South, although one that has not been extensively studied in an ecosystem context. Four major ecological provinces comprise the Interior Highlands — the Ozark Highlands of southern Missouri and northern Arkansas, the Boston Mountains of north Arkansas, the Arkansas River Valley, and the Ouachita Mountains of western Arkansas and eastern Oklahoma.

The Interior Highlands CCT is designed to provide the scientific basis and integrating framework to support management of the Interior Highlands forests for public, forest industry, and nonindustrial private forest landowners. As an element of this theme, Southern Research Station scientists are developing cooperative relationships and studies with scientists from the North Central Forest Experiment Station as well as with university, state, and industry cooperators in Arkansas, Oklahoma and Missouri. The CCT builds on both the long-standing ongoing research in forest ecology and silviculture of oaks, and on newer interdisciplinary research programs that encompass vegetation, wildlife, aquatic ecology, hydrology, and human dimensions.



A major effort contributing to this CCT has been the Ozark-Ouachita Highlands Assessment, an interdisciplinary assessment of conditions in the region coordinated by the National Forest System and the Southern Research Station. Findings from the assessment are not yet published, but the bulk of the collection of existing data on the social, terrestrial, aquatic, and atmospheric conditions of the region occurred during 1997-98.

Progress under the Interior Highlands CCT was made in the ongoing measurement and monitoring associated with the Ouachita Mountains Ecosystem Management Research Project, a comprehensive ecosystem management research projects in Arkansas and Oklahoma. In FY '98, the fourth year of post-treatment data was collected in the 52-stand database; these data quantify the effects of reproduction cutting alternatives on vegetation, wildlife, arthropods and microbial diversity, logging and economics, visual quality, and soils and water quality.

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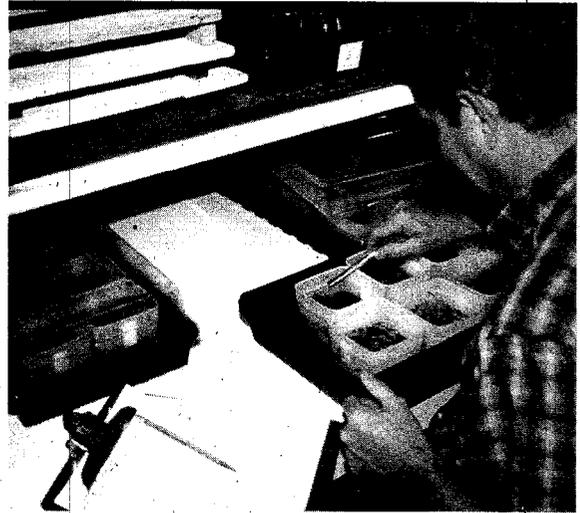
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Interior Highlands

Similarly, the fourth and final year of baseline data collection was completed in the four-watershed landscape study, in which time substitutes for space in large-scale experimental replication of pretreatment conditions. The landscape treatments, operationally conducted by cooperators in the National Forest System and industry, were also planned in FY '98, for implementation in FY '99. The experimental design, execution, treatment, and monitoring of such broad-scale plot-intensive studies would not be possible, without the superb cooperation of colleagues in the National Forest System, industry, state agencies, and universities within and near the Interior Highlands.

Additional studies will be planned to close existing research gaps in order to better characterize the human uses and values; to evaluate the effects of large-scale ecological process restoration using prescribed fire on public and private forests; to quantify the effects of forest management at the broad scale, and of stand-level management alternatives on wildlife, hydrology and aquatic ecosystems; and, to link extensive monitoring of vegetation, wildlife habitat, hydrology, aquatic ecology, and human dimensions to; GIS-based models usable by practitioners. The approach to achieving the objectives of these studies will be:

1. Develop a GIS-based data and analysis system for assessing social resource-management interaction dynamics from local to regional



scales, concentrating on recreation, wilderness, and special forest products; conduct major regional study on interrelationships of public and private forest management on rural development; develop cooperative urban forestry prototype in selected Interior Highlands urban areas.

2. Develop cooperative studies and models to predict the ecological and silvicultural effects of restoring fire in Interior Highlands forest types; study how fire affects forest health, diversity, and sustainability.
3. Initiate hydrology source behavior study on water quality and aquatic systems of warmwater wild and scenic rivers, including effects of forest operations and roads, and linking to existing wildlife, hydrology and aquatic ecology research.
4. Expand use of GIS in existing research and link new studies to existing GIS platforms.

Strategies for the 21st Century

Large Scale Assessment and Modeling

The research goal of this CCT is the development of an integrated, cross-disciplinary modeling framework to provide systematic analysis and assessment of the condition, productivity, and human interrelationships of large-scale forested ecosystems. Resulting models, relevant scientific outputs, and assessment processes are being used to evaluate the status of southern forested ecosystems at the landscape and regional scales.



The impact of current and predicted future environmental conditions, including anthropogenic stress, are being assessed to determine effects on forest health, productivity, and distribution. The human dimensions of forest ecosystems are being considered by looking at land-use change effects, shifting demands for resources and service, and effects of changing populations and their relationships to natural systems.

The Southern Global Change Program has developed and initiated a five-year, integrated east-wide assessment framework, in conjunction with the Northern Global Change Program. The framework encompasses a large portion of the Southern Research

Station program, 'as well as that of forest industry and southern universities. 'During the past year, research activities have focused on the development of regional Forest Inventory and Analysis, climate, demographic, and soil databases, and the initiation of assessing regional forest structure and productivity, hydrology, and timber supply and demand. The scope of research during the upcoming year will increase to include climate prediction scenarios, wildlife, land use, and other nonmarket factors.

'The Southern and Northern Global Change Programs have developed and begun implementation of a five-year integrated modeling effort that will link the research from both regional programs. The objective of this research is to better understand how environmental stress influences forest productivity and hydrology across eastern U.S. forests. The goal of the five-year assessment is to predict the impacts of environmental stress (i.e., climate change, elevated atmospheric carbon dioxide, regional ozone, and nitrogen deposition) on a baseline model to predict and validate predictions of forest productivity and hydrology east of the Mississippi River. The proposed modeling framework will allow us to assess in a more timely manner the current and future impacts of environmental stress on forest structure and function. After the baseline model has been completed, additional model components will be added in a modular format.

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strategies for the 21st Century

Large Scale Assessment and Modeling

Additions to the base model include:

1. a carbon budget of forest ecosystems;
2. development of a forest maturation and density component;
3. land cover and use change;
4. subregional and interregional scale economic modeling; and
5. wildlife diversity and threatened and endangered species.

We are also proposing to conduct a large-scale integrated assessment of social and environmental change in the South and its implications for resource use, ecosystem condition, and environmental quality.

The three stages of this effort would be

1. a social and economic assessment of Southern forests;
2. an ecological assessment which, incorporates regional forest productivity, hydrology, and habitat fragmentation; and
3. development of regional scale biological sampling and ecological assessment of nonnative invasive species and environmental stress-related diseases.



Additional research into biological implications of economic and environmental change would provide additional insights into the long-term consequences of current and anticipated growth and development of the south. Bringing the social and biological components into an integrated framework would provide a linkage between cause and effect and provide an innovative approach to evaluating various policy approaches.



Strategies for the 21st Century

Inventory and Monitoring

The goal of this CCT is to provide current resource information and analysis on forest ecosystem sustainability issues and to improve techniques to inventory, monitor and evaluate resources. Immediate needs relating to this theme can be summarized with four key questions:



1. How can strategic inventory and -monitoring be implemented to meet timeliness and quality needs across all ownerships of the South?
2. How can social and economic influences be integrated into the strategic inventory and monitoring programs?
3. What are the relevant analytical procedures to address forest ecosystem sustainability questions and what criteria and indicators need to be developed?
4. How can the technology to achieve the necessary inventory and monitoring needs be developed?

This past year, the Forest Inventory and Analysis work unit hosted several meetings across the South that focused on annual inventories. Several hundred individuals from across the country representing states, universities, industry associations, forest industries and the Forest Service attended the meetings. Out of these meetings came the establishment of a Southern Annual Forest Inventory System (SAFIS) Committee. This Committee met in mid-November 1998 to review SAFIS plans and approaches, and identify future research needs. Other planned meetings will provide a means to monitor the new inventory system's effectiveness.

Several states are now using their own resources to hire staff for field data collection for the base set of SAFIS plots. In FY '98, the Southern FIA unit collaborated and distributed approximately \$1.2 million dollars to six States. These funds were matched on a 50/50 basis with State funds.

The Forest Inventory and Analysis unit began collaborating with the Southern Region and other Federal natural resources agencies to develop methods for assessing forest sustainability of southern forests. Key elements of the analysis will include productivity of forests, ecological diversity and sustainability. It is anticipated that the study will require approximately 2 years to complete, and will be based on available information.

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Strategies for the 21st Century

Inventory and Monitoring

Nine Southern Research Station Research Work Units and the Southern Forest Health Monitoring Program are now identified with this CCT. Initial discussion with representatives from each unit has identified several areas for potential research; These include:

1. recreation supply and demand;
2. tree volume taper function development;
3. using economic and ecological models in broad scale assessments;
4. using FIA plots to develop a site-wide database;
5. social/economic impacts on forest sustainability;
6. effects of forestry and environmental laws;
7. ultrasonic and digital camera technology.

The next step is to develop a plan and approach for incorporating the science issues into the Inventory and Monitoring CCT.

The SRS Inventory and Monitoring CCT has identified three natural resource issues in the South that will be used to focus our efforts into the next century:

1. A method is needed for assessing the sustainability of southern forests at different scales;
2. New approaches are needed in developing spatial forest information and assessing nontraditional forest resources;

3. There is an urgent need to provide the constituent groups of both FIA and FHM with a seamless database that covers all forestland and non-forest lands in the South.

Future research will:

1. Provide information on how and what to inventory and monitor for forest sustainability.
2. Evaluate and assess social and economic impacts on timber availability in the 13 southern states.
3. Evaluate and assess the rules, regulations, and BMPs at the State and local levels.
4. Develop integrated systems of generic models, algorithms, and procedures that provide effective ways of using FIA data at large spatial scales.
5. Investigate new techniques for inventorying and monitoring exotic invasive plants.
6. Expand the usefulness of forest inventory data beyond the traditional estimation of average conditions for sample strata, into estimation of stand-by-stand descriptions of forest structure.
7. Improve our understanding of "nonforest" tree-covered ecosystems.
8. Provide information to improve land use planning efforts that achieve increased sustainability for riparian areas.