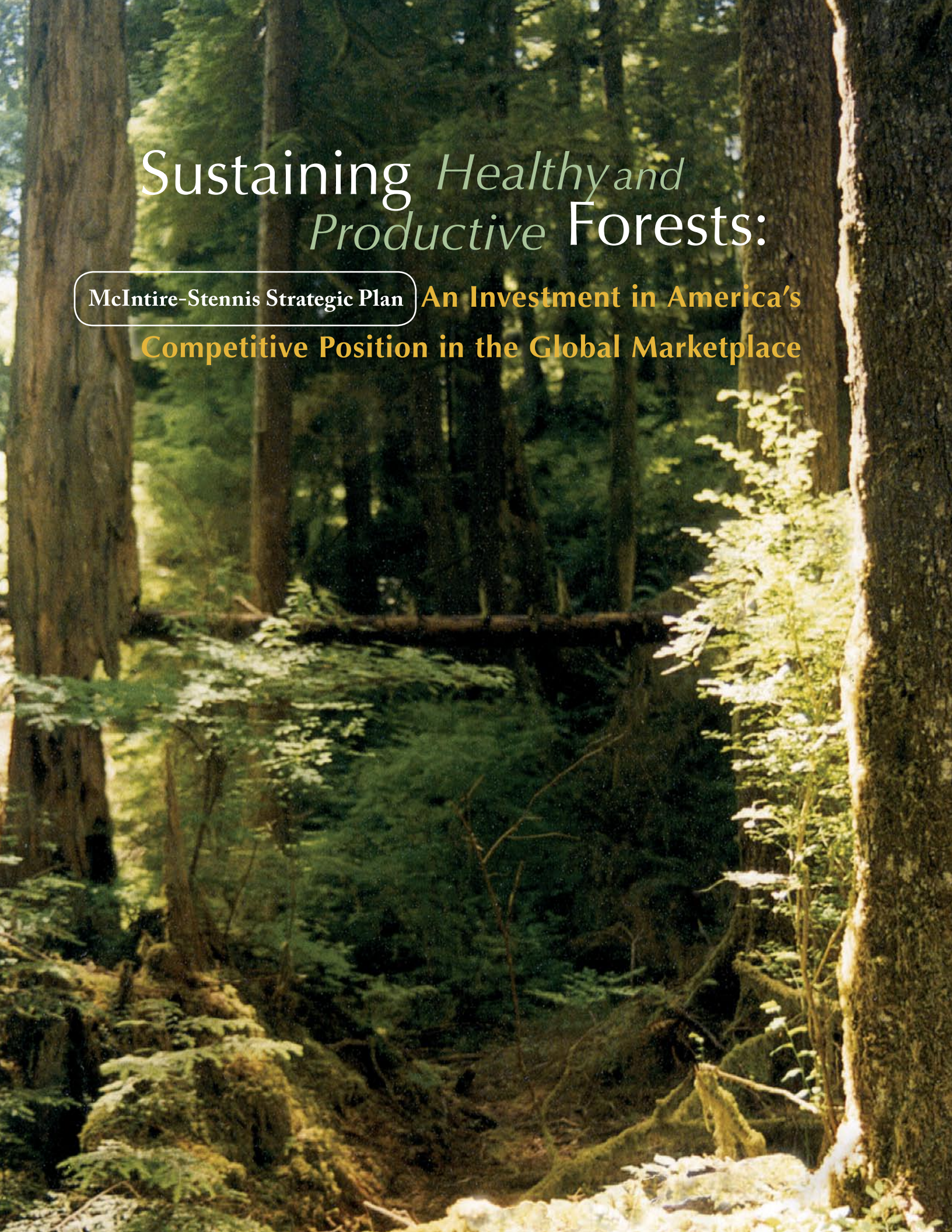


Sustaining *Healthy and Productive* Forests:

McIntire-Stennis Strategic Plan

An Investment in America's Competitive Position in the Global Marketplace

NAUFRP

National Association of University Forest Resources Programs

Creating Knowledge–Developing Leaders

McIntire-Stennis Strategic Plan: An Update

A strategic plan for the **McIntire-Stennis Cooperative Forestry Research Program** was completed in 2007. This 2010 update of the basic recommendations of the plan recognizes changes that have occurred in research, graduate education and funding since the plan was completed. The Program has continued to enjoy modest increases in funding provided by the US Congress each year since the plan was completed. In addition, several socio-economic and natural resource issues have sharpened the research and graduate education emphases of the plan.

McIntire-Stennis Program

The McIntire-Stennis Cooperative Forestry Research Program (PL87-788) is funded through the USDA National Institute for Food and Agriculture (NIFA) as a formula-based program for forestry research at Land Grant and related universities. The individual states determine which eligible universities are included in the Program including 1862 and 1890 Land Grant and related state universities. The program provides funding for critical state and regionally focused research and for graduate education in forestry.

Recommendations for *Sustaining Healthy and Productive Forests: Investment in America's Competitive Position in the Global Marketplace* (the Strategic Plan)

Vision

A bold forest research agenda built around new ideas, emerging societal needs, new approaches, and the potential for higher impact—an agenda built around knowledge, science, and technologies that will enhance the health and sustainability of forests and engage and enrich humanity.

Mission

To deliver scientific results and management technologies to forest landowners, managers, and policy makers and to prepare the future workforce in forestry and related natural resource science for the 21st Century.

We seek to accomplish this by delivering foundational knowledge and extending our research to emerging and integrative areas of knowledge that are central to addressing the major issues of today and tomorrow.

Recommendation (1): Foundational Areas of Knowledge

For major societal and environmental issues such as climate change, alternative energy development, human health, water resource management, economic development and competitiveness, and population growth and distribution, attention to several foundational areas of knowledge remains important. Foundational research to improve the understanding of individual species, soils, hydrology, invasive species, pathogens, and wildfire is fundamental, as is research on the social, physical, engineering, and material sciences.

Recommendation (2): Emerging and Integrative Areas of Knowledge

A New Science of Integration—a new science of integration focusing on ecosystem approaches to land management is needed. In the face of climate change, energy, human health and other issues this will involve an all lands approach to research and management, interactive systems models dealing with both human and natural systems, and a much greater understanding of the institutional landscape for forestry and other natural resource management.

Ecosystem Services—a much better understanding of ecosystem services and their values is needed. A green infrastructure and a green forest-based economy require an understanding of a broader variety of services, their production,

and value than we have considered previously. Adding green and other jobs and responsibly developing our forests requires more knowledge than we have previously developed about the variety of ecosystem services provided, often over large areas and long time horizons, by our forests.

Human Attitudes and Behaviors—without a much better understanding of peoples' relations to forests, dealing with major issues such as adaptation to climate change, job creation, human health and safety, and alternative energy likely will falter. Understanding landscape as a concept of place, institutional structure and collaboration, and communication about risks are major challenges.

Conflict, Uncertainty, and Decision-Making—living with both considerable uncertainty and risk and with real and potential conflicts over resources such as energy-wildlife conflicts, presents major challenges to society. Risk assessment and priority setting, adaptive management, landscape restoration, and organizational effectiveness all will benefit from research in this arena.

Technological Advancements, Productivity, and Forest Applications—to effectively confront major issues such as alternative energy development, climate change, human health, water management, and increased jobs, work on technology in the forestry arena is essential. Use of new harvesting and utilization technologies, environmental sensors, implementation of monitoring technologies, and development of rapid compilation and analysis techniques are needed now.

New Applications for Forest Products—green building, sustainable communities, renewable energy systems, bioremediation and many other areas of social and economic endeavor require development of new technologies and products, many based on wood and other biofuels. Renewable forests are likely to be at the forefront for solving many of the major problems of today.

Urban Ecosystems—given that more than 50% of the world's population and 80% of the US's population lives in urban places, attention to the urban environment is crucial. Livable and sustainable cities, providing healthy and green environments, and with alternative energy sources, depend on plants, conservation, careful water management, imaginative design and many other factors arising from forestry research and outreach activities.

Graduate Education—a hallmark of the McIntire-Stennis Program for nearly 50 years has been developing the future forestry research and outreach workforce for the Nation. With the myriad issues facing society today, we must prepare a workforce to meet the challenges outlined in the above recommendations.

Funding

At FY 2010 funding of $29 million, McIntire-Stennis funding is well below its authorized level of one-half the forestry research funding of the USDA. Funds are needed now to move forward on an aggressive agenda of research and outreach to deal with the major issues outlined above, especially building capacity for leading edge research and graduate education in our universities on topics such as climate change and bioenergy production and development. For FY 2011, $35 million would allow expansion of the base program and addition of initiatives focused on these important topics. The following chart depicts how the McIntire-Stennis Program might grow with a major increase in funding in FY 2013 that reflects a major increase at the 50th anniversary of the McIntire-Stennis legislation. **$50 million at 50 years is a desirable short-term goal.**

Fiscal Year	Base	Strategic Initiatives	Total
2011	$30,000,000	$ 5,000,000	$35,000,000
2012	$35,000,000	$ 5,000,000	$40,000,000
2013*	$40,000,000	$10,000,000	$50,000,000
2014	$45,000,000	$10,000,000	$55,000,000
2015	$50,000,000	$10,000,000	$60,000,000

*50th Anniversary of the McIntire-Stennis Cooperative Forestry Research Program…signed into law by President John F. Kennedy on October 10, 1962.

2007 McIntire-Stennis Strategic Plan

Sustaining Healthy & Productive Forests: Investment in America's Competitive Position in the Global Marketplace

Developed by the National Association of University Forest Resources Programs (NAUFRP), P.O. Box 2004, Falls Church, VA 22042

Acknowledgements

Generous financial support was provided for development of the strategic plan by the Cooperative State Research, Education, and Extension Service (CSREES). CSREES and the USDA Forest Service provided support for the Summit on Natural Resources Research and Graduate Education. Prime contributors to the strategic plan were Donald DeHayes, Dean of the Rubenstein School of Environment and Natural Resources at the University of Vermont; Margaret Gale, Dean of the School of Forest Resources and Environmental Science at Michigan Tech University; J. Michael Kelly, Dean of the College of Natural Resources at Virginia Tech University; and Perry Brown, Dean of the College of Forestry and Conservation at the University of Montana. Editing, layout, and printing were performed by the Forestry Communications Group at the College of Forestry, Oregon State University, where Dean Hal Salwasser provided oversight and editorial contributions.

Table of Contents

Introduction 1

The Critical Roles of Forests.....3

A Cooperative Forestry Research Program...3

Continuing Contributions 4

A McIntire-Stennis Program for the 21st Century 5

Guiding Principles for Reenvisioning A McIntire-Stennis Cooperative Program of Forestry Research and Graduate Education.....5

A Bold New Agenda to Meet National Knowledge Needs 6

Foundation Areas of Knowledge.....6

Emerging and Integrative Areas of Knowledge.....8

A New Science of Integration..... 8

Forest Ecosystem Services 9

Human Attitudes and Behaviors 10

Conflict, Uncertainty, and Decision-Making 11

Technological Advancements, Productivity, and Forest Applications..... 12

New Applications for Forest Products 12

Urban Ecosystems..... 13

Graduate Program Needs 14

Research Equipment and Infrastructure 15

Multi-institutional Projects 16

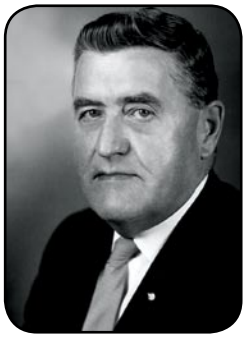
Funding Strategy 16

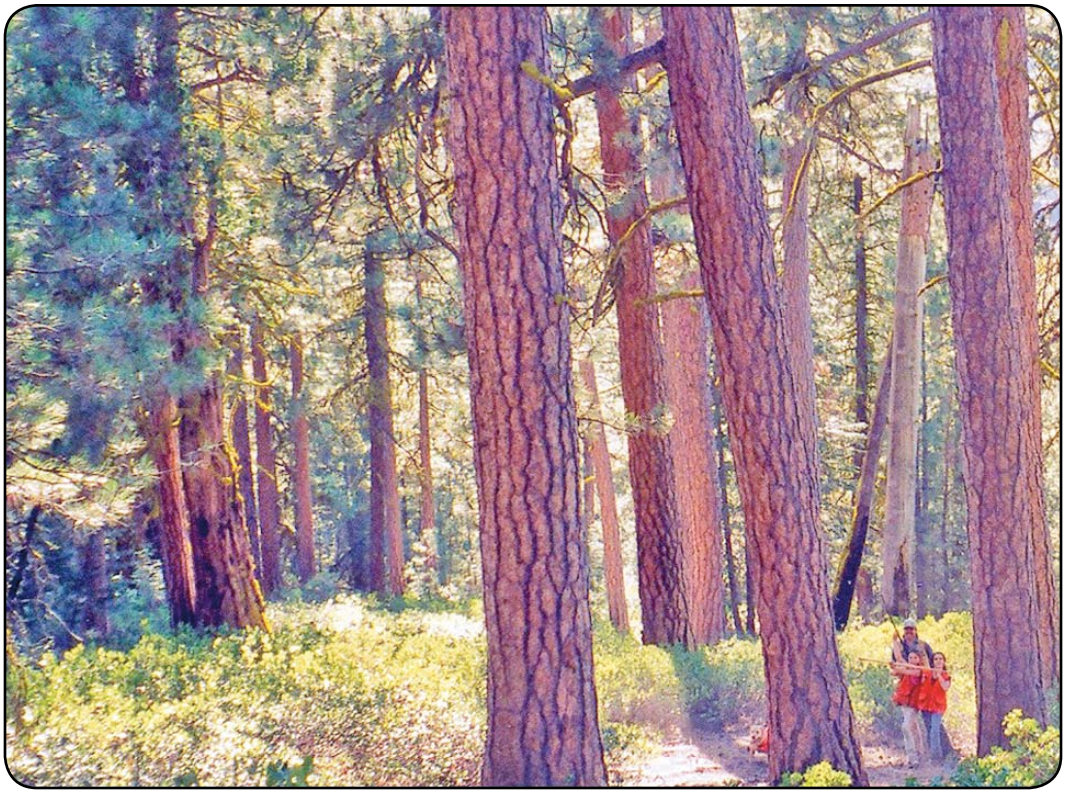
Funding Options 16

Proposed Funding Model 18

Appendix 19

Sustaining Healthy and Productive Forests: Investment in America's Competitive Position in the Global Marketplace





Introduction

Given a pressing need to enhance university-based research in forestry and related natural resources, the Congress of the United States passed the Cooperative Forestry Research bill (PL 87-788) in 1962. This bill provided funding through the Cooperative State Research Service (presently the Cooperative State Research, Education, and Extension Service) on a formula basis for forestry research at state Land Grant and related universities. The goal was to promote research in forestry, because "research in forestry is recognized as the driving force behind progress in developing and utilizing the resources of the Nation's forests and related rangelands" (PL 87-788).

For the past 45 years, this program (known as the McIntire-Stennis program) has provided extremely valuable base support to university programs of research and graduate education. Discoveries and training through the program have influenced the nation's forest stewardship and helped the nation's forest products companies maintain competitive advantage in global

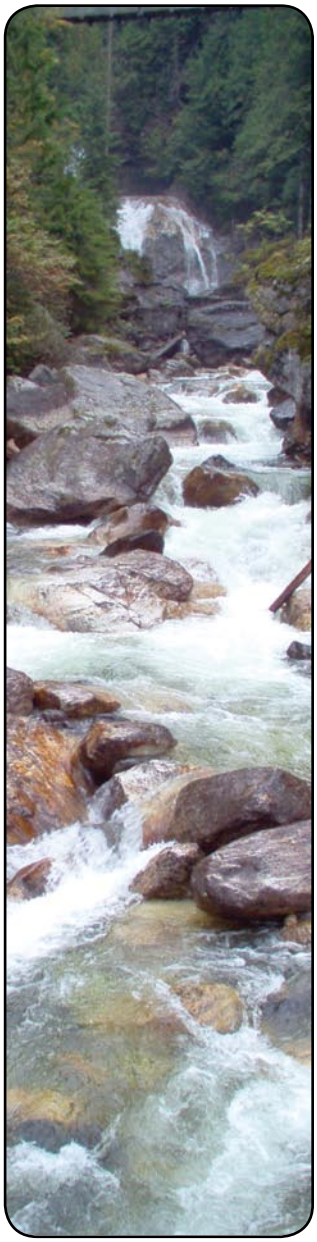
markets. Thousands of research projects have been completed by faculty members and graduate students supported through the program, providing many deliverables specifically focusing on state and regional forest-related societal needs.

In advancing the legislation, Senator John Stennis (MS) remarked that "such legislation would go a long way toward developing a research program for the furtherance of forestry in America (*U. S. Congressional Record,* 87th Cong. 2nd sess. 108, pt.16:21185). In a speech at about the same time, President John F. Kennedy remarked, "One of our most important natural resources and one of our most neglected is our forestland." He went on to cite the need to "expand forestry research, too long neglected." The McIntire-Stennis Program has expanded forestry research; yet funding has not kept up with the authorized level deemed appropriate by its founders for meeting the need: one-half the direct Federal funding of forestry research in agencies of the USDA.

In the 45 years since the McIntire-Stennis Program came into effect, the population of our nation has grown from 187 million people to 300 million. Our national use of softwood lumber has grown from slightly more than 30 billion board feet per year to over 60 billion board feet. Demands for quality water, recreation, and biodiversity conservation have also grown, and the area of forest to meet all these needs has remained relatively stable. Thus, the need for knowledge and technology on how to meet growing, and sometimes conflicting, human needs from the same area of forest has increased. This need shows no signs of abating in the future; indeed, it appears to be growing. Yet research funding is shrinking in real purchasing power.

The National Association of University Forest Resources Programs (NAUFRP) has envisioned a "*national commitment to understanding, enhancing, and protecting the health, productivity, and sustainability of forests—a commitment needed to ensure our forests will thrive and remain vibrant and dynamic ecosystems capable of providing the full array of benefits, services, and intrinsic values necessary to sustain and enrich quality of life*." It envisions forests as "*a constant source of learning about the relationship between humans and natural resources that simultaneously benefits both people and nature*" (Forests for a Richer Future, NAUFRP 2006).

Universities are prepared to make commitments to build an ever-improving body of science and science-based technologies that, together with local knowledge, contribute to sustaining forest resources and ensuring that they are productive, diverse, and resilient in the face of constant change. Similarly, they are prepared to educate both future managers and scientists, particularly at the graduate level, who are committed to advancing the sustainability of forests in order to enhance human well-being, provide needed and desired goods and services, and protect the intrinsic values of forests. Development and implementation of this strategic plan for the McIntire-Stennis Program is one part of fulfilling this vision. It is a proposal to invest



in a richer forest future for the nation than will occur absent that investment.

The Critical Roles of Forests

Forests cover approximately one-third of the land of the United States, some 750 million acres. They are a critical component of our nation's vitality, wealth, and resiliency. By strongly influencing ecological, economic, and social conditions, the nation's forests contribute directly to the distinctiveness of the country's landscape, the quality of life of our citizens, and our competitive position in an increasingly complex global marketplace.

"Forests mitigate climate change by sequestering carbon and minimizing temperature extremes."

Forests provide many ecosystem services and represent viable solutions to vexing environmental and societal challenges. Healthy forests stabilize soils, provide clean air, mitigate stormwater pollution and flooding, and protect the headwaters and quality of all of our river systems and aquifers. They mitigate climate change by sequestering carbon and minimizing temperature extremes. Their diverse habitats harbor a vast reservoir of complex organisms and processes—the biological diversity necessary to sustain life.

As a source of timber, paper, fiber, energy, food, and health products, forests positively impact the lives of all citizens. As a source of biofuels, forests contribute directly to our nation's quest for energy independence. The vital forest products industry that our forests support employs millions. Forests provide beauty and recreation in our rural, suburban, and urban communities. Healthy and productive forests of all types thus function as a core component to a vibrant and productive economy and way of life for Americans.

A Cooperative Forestry Research Program

Ensuring the sustainability of forests and their many services and products requires attention to their management and stewardship. These activities in turn require an understanding of forest ecosystems, the society in which they exist, and the effect of use and management at all scales and across all ownerships. That understanding and new technologies for management and product and service development come from research and analysis, exactly the work accomplished through the McIntire-Stennis Program.

The focus of the McIntire-Stennis Program is partnership for our nation's universities in the total forestry research enterprise, in collaboration with the USDA and other federal agencies, state agencies,

nongovernmental organizations, and private enterprise. McIntire-Stennis is used in many ways; importantly, it provides the base funding for university scientists, enabling them to compete for funding from a wide variety of sources. Collectively, universities are the largest supplier of forest research, and McIntire-Stennis is an important piece of the base that provides both breadth and depth for the nation's university forestry research and education programs.

Continuing Contributions of the McIntire-Stennis Program

Forests are changing rapidly as the result of climate change, urbanization, invasive species, fragmentation, advances in bio- and nanotechnology, and increased global competition. At the same time, public interest in forests and their values to society is increasing. Attention to forests and forestry and natural resources research is therefore even more critical today than it was when Senator Stennis and President Kennedy made their comments.

Over the past several years, interest in forests, fish, and wildlife has broadened to embrace all of life's complex organisms and processes. Sustainable forestry seeks to perpetuate those aspects of biological diversity that are essential to and compatible with the primary purposes of different forest types and ownerships. But sustainable forestry still requires work beyond simply embracing a broader notion of biological diversity. It is crucial that a better understanding of the cultural and economic aspects of forests also be incorporated in the

concept and practice of sustainability. Cultural and economic diversity and vitality are no less valued and vital to future forests than is biological diversity. The McIntire-Stennis program was designed to address these values and to provide, through the nation's universities, new knowledge and technologies to meet the needs of society.

While the McIntire-Stennis Program has a research emphasis, graduate training is integral to the program. From the beginning, the training of future generations of forest researchers has been central to the McIntire-Stennis mission, and such is still true and necessary. This robust research and graduate education program delivers scientific results, management technologies, and well-prepared research workers for the nation.

Bev Law

A McIntire-Stennis Program for the 21st Century

This history and the current recognition that we need greater knowledge and technologies for healthy sustainable forests suggest a compelling need to enhance the McIntire-Stennis Program. The McIntire-Stennis Cooperative Forestry Research Program is not broken, but it can be more responsive and effective. A bold change in direction will enhance effectiveness and ensure its relevance for the next several years.

Envisioning and implementing a new program will better serve the nation by driving progress in developing, utilizing, and stewarding forest resources in the 21st Century. This calls for a new vision and mission for the 21st Century McIntire-Stennis Program that boldly and holistically addresses important societal and ecological issues. It is time for action, and this strategic plan provides a view of the way to deliver on this new vision.

Vision:

A bold forest research agenda built around new ideas, emerging societal needs, new approaches, and the potential for higher impact—an agenda built around knowledge, science, and technologies that will enhance the health and sustainability of forests and engage and enrich humanity.

Mission:

To deliver scientific results and management technologies to forest land owners, managers, and policy makers and to prepare the future work force in forestry and related natural resource science for the 21st Century.

The plan is divided into three major sections:

- guiding principles for a robust program of research and graduate education
- a bold research and graduate education agenda highlighting emerging areas of knowledge
- a funding strategy and recommendation that moves toward meeting the need

> *"A bold change in direction will enhance effectiveness and ensure its relevance for the next several years."*

Guiding Principles for Reenvisioning a McIntire-Stennis Cooperative Program of Forestry Research and Graduate Education

The test of whether or not a sound and relevant McIntire-Stennis program is developed is embodied in the principles for a reenvisioned program:

- enhanced capacity for research—personnel and infrastructure
- accountability
- ethnic and cultural inclusiveness
- long-term capability
- competitive benefits
- integration in a larger system
- both fundamental and applied research
- seamless integration with transfer of knowledge and technology
- options for integration across geography, administration, and disciplines

Each principle is explained further in the Appendix.

A Bold New Agenda to Meet National Knowledge Needs

The connections between forests and the dynamic human landscape have evolved dramatically over recent years. These relationships are both essential and complex and directly influence economic opportunities and quality of life for all our citizens, whether living in urban, suburban, or rural settings. They drive the future health, productivity, and sustainability of forests at local, national, and global levels. At the same time, technology has advanced, allowing us to explore, discover, and monitor changes at scales ranging from outer-space views of macroenvironments to molecular analyses and nanosensor monitoring of interstitial spaces. Indeed, our capacity for discovery is greatly enhanced, as is our need to reexamine the questions we ask, our approaches to analysis, the areas requiring our exploration and investment, and the ways we communicate.

Maintaining the competitive status of the U. S. requires investment in research about the role, value, and potential for forests to serve the nation and its citizens. Challenges associated with climate change, invasive species, exotic pests, wildfire, forest fragmentation, urban sprawl, and globalization, along with dwindling forest research capacity in our agencies and universities, threaten the vitality and resiliency of our forests and our nation's competitive position in the global community. An investment in the future of our forests is an investment in the future of our nation.

Under the leadership of the NAUFRP, 100 leading scientists from academic, agency, nonprofit, and industrial sectors gathered in January 2006 to define the new knowledge and science needed to advance our understanding of forests—to articulate the elements of a new forest-based research agenda for the 21st century. One result of this summit, entitled *Forest Research for the 21st Century: Defining Strategic Directions and Rebuilding Capacity*, was the development of a new McIntire-Stennis research agenda, divided into two major components: Foundation Areas of Knowledge and Emerging and Integrative Areas of Knowledge. Implementation of this agenda will require changes in graduate education and in funding for research infrastructure and equipment. Multi-institutional collaboration will also be imperative.

"Challenges associated with climate change, invasive species, exotic pests, wildfire, forest fragmentation, sprawl, and globalization, along with dwindling forest research capacity in our agencies and universities, threaten the vitality and resiliency of our forests and our nation's competitive position in the global community."

Foundation Areas of Knowledge

The knowledge base for ecology and management of forests and other natural resources requires continued attention to several foundation areas of knowledge. Fundamental research on individual species, soils, hydrology, invasive species, pathogens, and wildfire are all still critical to our understanding of forests, watersheds, and global functions. Fundamental research in the social, physical, engineering, and material sciences is also instrumental in decision making, developing new products, and utilizing natural resources more effectively in environmentally and socially sound ways. Yet many resource management problems are complex and large scale, demanding a fundamental and integrative understanding of ecology, ecosystems, watersheds, social

"Natural resource management and stewardship are fundamentally social processes and thus are important to policy makers, planners, and managers. Increased knowledge of how ecological and social processes are integrated is needed."

processes, and connectedness of global forests and watersheds. Research must continue in these fundamental areas and in the development of models to enable us to synthesize complex systems and to make environmentally and socially sound management decisions.

All fundamental research must expand with technological advances. Fields such as biotechnology, nanotechnology, and remote sensing, melded with our present knowledge of any of the topics mentioned above, will significantly increase our ability to find the interconnectedness of plants and animals that reside in our forests, watersheds, and global communities.

Natural resource management and stewardship are fundamentally social processes and thus are important to policy makers, planners, and managers. Increased knowledge of how ecological and social processes are integrated is needed. Management and policy decisions are often problematic due to the complexity of issues and individuals influencing the outcomes. Issues such as climate change and biofuels initiatives will continue to require our fundamental research to answer questions and advance our theories on the functions of these forests in our society and in the global landscape. It is important that those developing policies and making decisions have science-based information about the consequences of their decisions.

Emerging and Integrative Areas of Knowledge

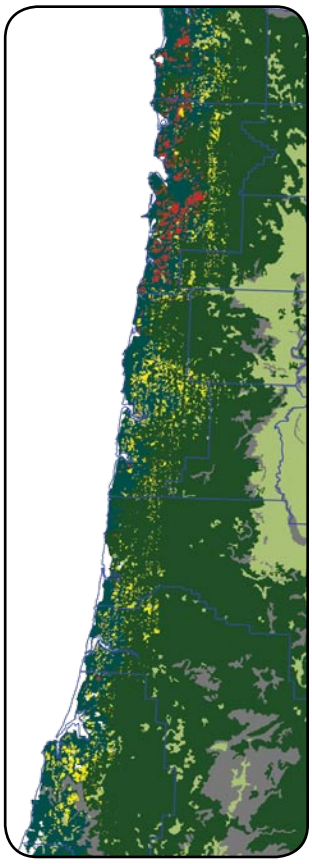
While acknowledging the need to continue research on fundamental topics, the 100 participants at the NAUFRP-sponsored summit strongly concurred about the emerging needs in science and research to advance the health, productivity, and sustainability of our forests and the competitive position of the nation. This has led to a bold new agenda to meet the knowledge and resource management needs of the future. Participants of the summit identified seven new areas of knowledge to be addressed: A New Science of Integration; Forest Ecosystem Services; Human Attitudes and Behaviors; Conflict, Uncertainty, and Decision-Making; Technology Advancements and Forest Applications; New Applications for Forest Products; and Urban Ecosystems.

A New Science of Integration

Goal—to develop and implement a new science of integration, focusing on ecosystem approaches to land management. The focus is on whole system analysis, exploration across biophysical boundaries, ownerships, and agency jurisdictions, and the development of models, tools, and theories for the integration of geophysical, ecological, socioeconomic, and cultural dimensions of natural resources management.

Rationale—Forest systems are inherently "integrated settings" that simultaneously involve community planning and well-being, economics, and ecological considerations. Natural resource management increasingly

demands understanding across disciplinary, geographic, and/or administrative boundaries to be useful and effective. In particular, landscape-level and larger geographic considerations cut across ownership and administrative boundaries. Given that both social and biological issues are central to natural resource management, integrating knowledge from these realms and others through research focused on forests and grasslands is critical to meeting the needs of our citizens. Traditional research largely has explored components of forests; there have been few efforts to integrate at the system level to encourage thoughtful and effective management strategies and regimes. A science that clearly addresses spanning this disciplinary and geographic boundary is essential to sustaining healthy and productive forests.



"Managing forests for resilience in the face of climate change and natural disturbances such as fire, drought, storms, and disease epidemics will require knowledge and technology."

Actions

1. Explicitly emphasize the importance of advancing the new science of integration as a priority for all McIntire-Stennis funding recipients.
2. Require interinstitutional projects to include a significant integration component.
3. Modify the proposal and final report formats to insure that all project proposals and reports address the integrative cross-disciplinary and cross-boundary aspects of forest research and translate findings into terms meaningful at the community level.
4. Encourage and support synthesis projects that combine findings across multiple projects following similar themes.
5. Encourage forums that bring together scientists, practitioners, and policy makers to present and discuss the applications of this research and of their educational results.

Performance Measures

- Number of projects certifying an integration component
- Synthesis papers that present a science of integration
- Number of graduate students trained in the new science of integration
- Number of forums held to share the scientific knowledge gained and the use of that knowledge by practitioners and policymakers

After 1980 Mt. St. Helens eruption and current conditions; courtesy Weyerhaeuser Company

Forest Ecosystem Services

Goal—to promote a comprehensive understanding of forest ecosystem services, including their value and restoration, the viability of ecosystem service markets, and the full contributions of forests to the global economy and quality of life

Rationale—Society increasingly is demanding abundant services from forest ecosystems, in addition to traditional forest products. The increased recognition of the value of ecological services will also prompt a greater emphasis on ecological restoration of disturbed or disrupted ecosystems. Managing forests for resilience in the face of climate change and natural disturbances such as fire, drought, storms, and disease and insect epidemics will require knowledge and technology; resilience will increase the likelihood that ecosystem service disruptions from disturbances will be socially tolerable. A growing human population living mainly in urban areas likely will demand more of these services, while also requiring more wood products, all from a stable to slightly declining forestland area. The management and stewardship challenges are prominent and depend on a comprehensive understanding of valuation of forest ecosystem services and full cost accounting. Therefore, research and training are needed on the measurement, valuation, and sustainability of ecosystem services and the contribution of these services to a global economy.

Actions

1. Place a premium on research that enhances our understanding of forest ecosystem services and how they can be developed, valued, and produced.

2. Increase visibility to society of the numerous services derived from forest ecosystems, as well as their broad-based value to quality of life and economic development.

Performance Measures

- Increased number and variety of research projects and products focused on ecosystem services and valuation
- Growth in formalized ecosystem services markets and increased valuation of forest land benefiting humanity
- Observable integration of management for ecosystem services with management for ecosystem products, e.g., carbon sequestration and developed recreation
- Increased science-based policy decisions at the state and federal level dealing with complex forest ecosystem services

Human Attitudes and Behaviors

Goal—to increase understanding of human attitudes and behaviors to enable enhancement of management and stewardship of natural resources and to enable development of effective tools to engage the diversity of perspectives in natural resource decision making

Rationale—Because natural resource management and stewardship are fundamentally rooted in social values and processes, better understanding and gauging of societal attitudes and behaviors are necessary. In addition, given the democratic desires of the U.S. population, further development of participatory processes that engage and give voice to all stakeholders in decisions about natural resource management and stewardship is important, especially so for public resources.

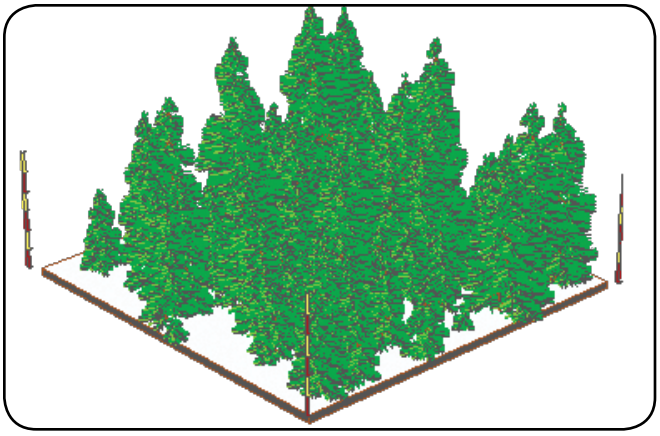
Actions

1. Develop projects specifically focused on public values, attitudes, and behaviors related to natural resource management and stewardship, including multicultural dimensions of resource and environmental management.
2. Develop and assess collaborative learning techniques for effective engagement of the public in decision processes to assess the consequences of natural resource management and stewardship choices for states, regions, and nations.
3. Increase research and outreach efforts focused on effective communications among scientists, stakeholders, and policymakers about natural resources issues and opportunities.

Performance Measures

- Increased number and variety of research projects and products focused on human attitudes and behaviors
- Observable effective interaction of a wider variety of people in planning and managing natural resources than at present
- Increased understanding by the public of the importance of our nation's forests to society and the competitive position of the nation
- Development of new collaborative techniques to address attitudes of scientists, stakeholders, and policy-makers

"Research and training are needed specifically in conflict resolution and in the uncertainty and risk attached to decisions made by different groups about natural resource management."



Conflict, Uncertainty, and Decision-Making

Goal—to develop natural resource decision-making frameworks useful in situations with high uncertainty and conflicting values, with careful consideration and analysis of risk, roles of government structures, disturbance, and adaptive management

Rationale—Natural resource decisions, especially decisions concerning public resources, often are mired in conflicts and unclear decision processes. Better understanding of these phenomena and how better to execute them is needed so that natural resource management and stewardship can move forward and ecosystem services and products can be produced sustainably. Research and training are needed specifically in conflict resolution and in the uncertainty and risk attached to decisions made by different groups about natural resource management.

Actions

1. Develop projects focused specifically on the study of conflict, risk assessment, and decision-making.
2. Assess the effectiveness of natural resource conflict resolution techniques and their application to enhance natural resource management and stewardship.
3. Develop new and effective decision tools and technologies aimed at reducing divisiveness associated with land-use plans and diverging stakeholder interests.

Performance Measures

- Increased number and variety of research projects and products focused on conflict, risk assessment, and decision making

- Increased effectiveness in addressing natural resource conflicts outside the courts, including the development and implementation of land management and stewardship plans
- Increased use of decision models and techniques that deal effectively with concepts of risk and uncertainty
- Mention of scientifically based risk and uncertainty measures in newly developed forest policies

Technological Advancements, Productivity, and Forest Applications

Goal—to advance and apply new technologies for monitoring, assessing, and expanding the productivity and utility of forests

Rationale—New technologies, including spatial analysis, nanosensors for monitoring, "green" design innovations, and biotechnologies, have enormous potential to enhance our understanding of forest systems and the applications and enhancement of products and services derived from forests. The advancement and application of new state-of-the-art technologies will advance our capacity to protect forests and increase their productivity while spurring innovative markets for forest-based products that are inherently environmentally friendly and needed by society.

Actions

1. Develop projects aimed specifically at adapting new and existing technologies to applications for study of forest ecosystems or the development of new forest productivity and product applications.
2. Strongly encourage the incorporation of spatial technology capabilities and nanosensors into forest planning and forest health monitoring programs.
3. Provide additional funding to explore biotechnology applications as an approach to enhance forest productivity and the competitiveness of the U.S. forest products industries.
4. Provide additional funding for projects that integrate forest practices from the genetic to the product level that aim to increase productivity and value relative to investment.

Performance Measures

- Increased number and variety of research projects and products focused on advancement and application of technology in relation to forests
- Increased sophistication in incorporating new technologies in forest planning and monitoring
- Use of biotechnological applications to enhance forest product development and applications of forest-based commodities

New Applications for Forest Products

Goal—to develop sustainable forest industry practices and business models and innovative forest products and applications, such as biobased polymers, alternative wood fibers, renewable energy systems, and bioremediation

Rationale—Society increasingly is seeking alternative and renewable products that are safe, sound, and sustainable. This has created novel market opportunities for forest-based products and the opportunity to develop a new "green"

market image for forest products industries. The national and global economic implications of sustainable and innovative products and alternative energy systems are substantial. Development of new and better forest products is necessary to enhance competitiveness of U.S. industries and probabilities for environmental sustainability, including wood products and pharmaceuticals.

Actions

1. Develop and test new wood-based composite products that serve as alternatives to synthetic chemical products.

"Forests are important in sustaining and improving quality of life in these settings by providing ecosystem services and stimulating economic and spiritual opportunity."

2. Develop and test new pulp and paper processes.
3. Identify, develop, and test the viability of creating sustainable nonwood forest products and markets, including pharmaceuticals.
4. Examine and test methods of product marketing and of assessing and developing trade in forest products.

Performance Measures

- Number and type of new wood-based and composite products coming to market
- Number and type of nonwood-based forest products and viable pharmaceuticals coming to market
- Enhanced effectiveness of marketing to get forest products into the hands of consumers
- Increases in the trade revenue derived from forest products

Urban Ecosystems

Goal—to develop our understanding and appreciation of urban centers as functioning ecosystems that include substantial human elements and interacting natural/built environments and to enhance the livability of urban places through developing and sustaining urban forest resources

Rationale—Currently, greater than 50% of the world's population and 80% of the U.S. population live in urban settings. Urban settings are increasingly viewed as the places that influence the quality of life for the majority of our nation's population. Forests are important in sustaining and improving quality of life in these settings by providing ecosystem services and stimulating economic and spiritual opportunity. In particular, understanding the role of urban

forest landscapes in enhancing human health, harboring plant and animal diversity, mitigating temperature extremes and stormwater pollution, and improving air and water quality are of increasingly high priority, as is the equitable distribution of forest resource benefits across ethnic and socioeconomic communities. Thus, it is important to understand how urban forest ecosystems and their desired benefits can be sustained.

Actions

1. Develop projects explicitly focused on urban forest ecosystems, the services and benefits they provide, and how these can be sustained.
2. Assess how urban forests can be restored, maintained, and enhanced in view of pressures for land development and consequences of disturbances, such as air pollution and modified water runoff conditions.
3. Develop projects that examine the equitability in distribution of urban forest benefits across ethnic and socioeconomic communities.

Performance Measures

- Greater use of scientific information about urban forests in city planning, stormwater and climate-change mitigation strategies, and economic development
- Clear evidence of stronger understanding of the connections between urban forests and issues related to quality of life, human health, and community development

- Examples of active restoration, enhancement, and sustainability of urban forests and their associated benefits

Graduate Program Needs

As our understanding of the new knowledge and science needed to promote the health, productivity, and sustainability of our forests grows, so too must our approach to educating the next generation of scientists, the "discoverers" and "interpreters" of that science and its applications. Given the importance of the McIntire-Stennis Program nationally to the education of natural resource scientists, it is necessary and appropriate for the McIntire-Stennis program to respond to and support the new graduate education directions and initiatives needed.

"The McIntire-Stennis Program has been critical to the training and mentoring of the nation's scientific capacity related to forests and natural resources and has supported the education of greater than a third of all doctoral-level scientists in natural resources."

It is becoming increasingly clear that graduate training of the future in natural resources will continue to provide specialized and focused education. At the same time, it will include interdisciplinary systems thinking, emphasizing the need to achieve disciplinary integration and application of knowledge to complex social and biological problems—most importantly, how to deal with uncertainty and rapid change. That is, natural resources programs of the future will need to achieve a balance between greater depth and greater breadth. This change is stimulated by the nature of the new science needed, but also by changes in how our forests are viewed and utilized by society, including dramatic shifts in the economic drivers related to forests and the full range of services they provide.

The 100 participants in the January 2006 summit determined that natural resource scientists of the future will need to

- view issues, problems, and opportunities holistically
- know how to deal with uncertainty and rapid change
- understand specializations other than their own and apply analytical thinking and problem solving in a larger context
- communicate through a broad range of media and to a variety of audiences
- exhibit significant leadership through mentoring, ethical practice, social responsibility, and scientific vision
- possess strong skills in quantitative and qualitative analysis for dealing with complex data and trend sets
- possess a global perspective founded on real world experience
- have a greater awareness of the impact of their research and scholarly efforts on society.

Our university graduate programs generate scientists who serve society through numerous sectors, including education, federal and state agencies, industry, and nonprofit organizations. The McIntire-Stennis Program has been critical to the training and mentoring of the nation's scientific capacity related to forests and natural resources and has contributed to the education of greater than a third of all doctoral-level scientists in natural resources.

"Natural resources programs of the future will need to achieve a balance between greater depth and greater breadth."

The need for graduate program support will only grow in the future, as programs seek to educate scientists with cross- and interdisciplinary abilities, restructure reward systems to encourage integrated and collaborative research, explore programs with alternative doctoral level tracks, engage the "best and brightest" in undergraduate research experiences, and more. Indeed, an evolutionary transformation is underway in our fields and in the way we educate the next generation of natural resource scientists. The McIntire-Stennis Program must provide support that insures the development of new and progressive natural resource graduate programs and produces the next generation of scientists to meet the needs of a changing society. Thus, McIntire-Stennis research projects need to include graduate education as a central component, and all research projects should include graduate education in their design.

Research Equipment and Infrastructure

Key components in developing and sustaining a viable and relevant research program are state-of-the-art equipment and an

infrastructure that allows research to be accomplished most efficiently. The recent National Research Council report on Forest Research Capacity specifically noted that the infrastructure needed to support long-term research in forest systems has lagged significantly. This is partly because the structure of the McIntire-Stennis Program historically did not lend itself to the purchase of major pieces of research equipment or the allocation of funds to create or upgrade research infrastructure.

The addition of a competitive pool of funds will provide a means by which to entertain proposals in support of research infrastructure. It is recommended that up to 10% of the available competitive pool of funds in each funding cycle be allocated to proposals for one-time funding of the purchase of key pieces of research equipment or for the creation or upgrading of essential research infrastructure. At least a 25% funding match from nonfederal sources should be required for any such proposal.

Multi-institutional Projects

The agenda for a reenvisioned McIntire-Stennis makes it imperative for institutions to collaborate in delivering societal relevant science to landowners, managers, and policy makers. Two ways to achieve this collaboration are through the establishment of topical projects and virtual centers. Both types of multi-institutional activities will lead to a more holistic and collaborative approach to research-based problem solving, effecting more collaborative land and resource management and policy development.

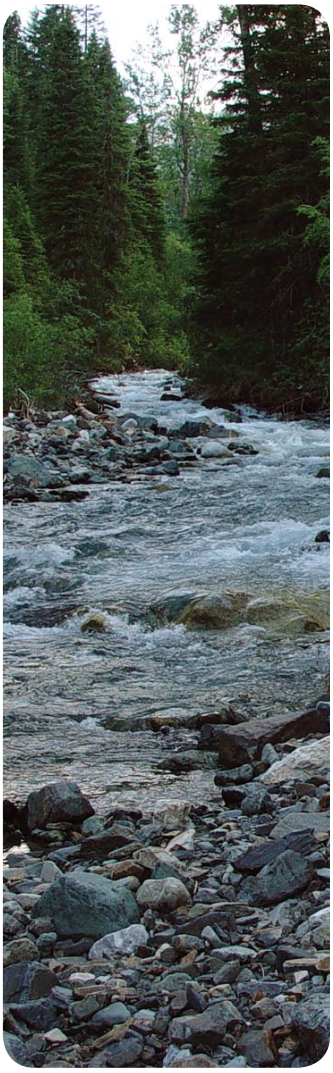
Drawing together the best scientists across disciplines, no matter their locations, to focus on topical projects will foster development of a science of integration and allow holistic investigation. For example, a project might be established to coordinate and compare watershed research across Montana, Vermont, and Mississippi.

Likewise, research on some topics might be managed and communicated most effectively by establishing virtual centers of expertise where natural and social scientists join in a common enterprise. These virtual centers will focus attention more fully on integrative approaches to major societal issues and engender continuing engagement of scientists, landowners and managers, and policy makers. They also might engage other partners in the enterprise. For example, one might establish a virtual center on the topic of wildfire with multiple university, state, and federal agency partners, including both management and research partners. Such a center would develop proposals and project plans, organize the coordination and exchange of information, develop ways to communicate findings to relevant audiences, and stimulate integration across natural and social science disciplines, geography, and administration.

Funding Strategy

Funding Options

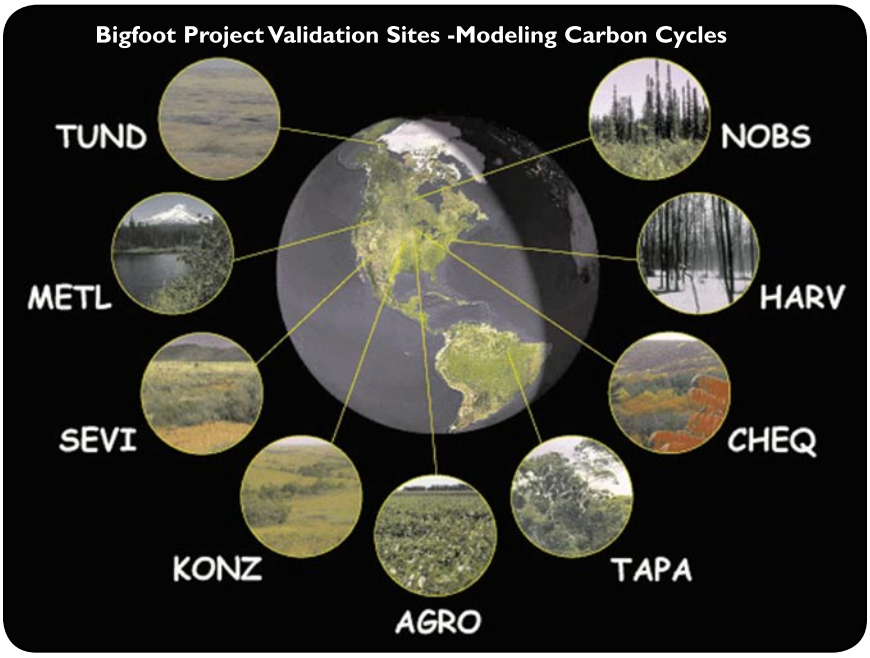
The McIntire-Stennis Program is presently funded at approximately $30 million. Yet, in the original enabling legislation, McIntire-Stennis was authorized to achieve a level of funding equal to 50% of the total funds



"Because these funds have provided a foundation for university-based forest resources research, many universities have come to depend on their allocation as part of the funds supporting the research and graduate education enterprises of their institutions."

allocated to forest research across all USDA programs. Based on current allocations to Forest Service research alone, this would equate to an authorized level of at least $150 million dollars for McIntire-Stennis. Therefore, this strategic plan identifies a graduated program to increase the federal dollars allocated to approximately $46 million over 5 years, with the longer term goal of eventual realization of the full authorized federal funding level.

McIntire-Stennis funds currently are allocated on a formula basis to the individual states and federal territories. Recipient institutions are designated by the respective governors. Because these funds have provided a foundation for university-based forest resources research, many universities have come to depend on their allocation as part of the funds supporting the research and graduate education enterprises of their institutions. The federal funds allocated to states must be matched 100% with nonfederal funds. In effect, the $30 million federal program is, at a minimum, a $60 million federal-state cooperative effort. The authors of the McIntire-Stennis legislation recognized the need for this federal-state partnership to offer sufficient research flexibility to simultaneously address issues of both local and national interest. In many cases, this has led to a vibrant mix of projects designed to meet specific local needs, as well as research partnerships across both institutional and state boundaries that address broader or more complex issues.



Given the huge need for research and research capacity building in natural resources, especially in view of major changes resulting from climate change, population growth, changes in forestland ownership patterns, and restoration needs, at least triple the current federal investment is needed. This will require increases averaging 7% per year in base program funding; these increases would be targeted at the suggested Emerging and Integrative Areas of Knowledge. In order to support these research areas, additional funding beyond the base program must be developed. Likewise, given the gravity of these issues, a mechanism is needed to stimulate the best thinking possible and, where appropriate, to develop broad-based partnerships to serve the greater needs of the nation in terms of science, policy, and competitive position. The development of a competitively funded component based on an additional allocation of funds will be used to stimulate research in selected areas while allowing research focus to change as new issues arise.

Proposed Funding Model

The development of a new funding model containing both a formula-funded base program of research and graduate education and a flexible, grant-based competitive research program will further research in ways that have not been possible. Evaluation of several potential scenarios has shown that a base program with an average annual cost of expense adjustment of 7% per year and a competitive component composed of entirely new funds provides the best approach to facilitate the orderly progression of a competitive program.

Because efficiency in management of a competitive program requires a size threshold, a base of approximately $16 million in new money at the end of 5 years will be needed to establish a meaningful competitive component to the program. It is essential that the first increment of competitive funding be at least $5 million in order to get the program off to a meaningful start. In addition, since this part of the program is competitive, not cooperative, the matching requirement will be dropped and thus will not double with each federal dollar added. (See 5-year allocation scenario.)

The 5-year total federal figures for this option are as follows: base program, $30,000,000; competitive program $16,000,000; total program, $46,000,000.

Under this option, the federal funding for the McIntire-Stennis base increases by 36% over the current base level. The total program after 5 years, with matching funds for the base program, is at least $76,000,000. It will be necessary to continue this pattern of growth in subsequent 5-year periods in order to continue to progress toward a fully funded program. Continuing the previously identified rates, total federal investment would be $92,000,000 at the end of 10 years and $138,000,000 at the end of 15 years.

"An investment in the future of our forests is an investment in the future of our nation."

5-Year Allocation

Year	Base	Competitive	Total
1	$25,000,000	$5,000,000	$30,000,000
2	$26,000,000	$10,000,000	$36,000,000
3	$27,000,000	$12,000,000	$39,000,000
4	$28,000,000	$14,000,000	$42,000,000
5	$30,000,000	$16,000,000	$46,000,000

Appendix

Guiding Principles for a Cooperative McIntire-Stennis Cooperative Forestry Research and Education Program

Enhanced Capacity for research—personnel and infrastructure

The capacity to conduct research and graduate education must exist for quality research to be undertaken. Over the course of its history, the McIntire-Stennis program has had as a central principle enhancing the capacity of the nation's forestry schools to conduct research and develop the next generation of scientists. This critical theme must be preserved in any program to ensure that forestry research capacity is sustained in the country.

Accountability

For a viable program one must be able to describe the relevance of the program and be able to ensure that resources allocated to it are well employed. Those responsible for a program must be prepared to stand accountable for its scope and effectiveness and for the results obtained from it.

Ethnic and cultural inclusiveness

In an ethnically and culturally plural society, it is essential to develop and have programs that include the values and voices of the members of the society. The McIntire-Stennis research and graduate education program embodies a principle of ethnic and cultural inclusiveness in its implementation.

Long-term capability

Forests grow for a long time, and forest-based research often must be conducted over decades. Capability for long-term projects dealing with growth and development of forests, long-term consequences of management, and sustainability of forests and their benefits must be provided.

Competitive benefits

Such benefits as being able to respond to rapidly changing forest and market conditions, foster integrative and collaborative research, and develop national topical programs are achievable by relatively short-term competitive research. They might best be attained through development of a competitive component within the McIntire-Stennis program.

Integration in a larger system

The McIntire-Stennis program is clearly one part of a much larger forest research program involving partners at all levels of government and the private sector and stakeholders at all levels of organization. Activities of the McIntire-Stennis program, to the extent practical, need to be carried out in collaboration with other research entities and to be viewed in the context of a larger whole. They are critical to the development of long-term research capacity, to continuity and long-term research, and to the leveraging of other research funds. As such, they are critical to a larger forestry research enterprise.

Fundamental and applied research

Both fundamental and applied research are necessary and appropriate for the McIntire-Stennis program. Fundamental research provides theory and building blocks for applied research that focuses on areas such as policy; management; and product, service, and market development.

Seamless integration with transfer of knowledge and technology

The McIntire-Stennis program will incorporate a clear focus on the transfer of knowledge and technology wherever applicable.

Options for integration across geography, administration, and disciplines

Forests are inherently integrated systems, and the forests of the U.S. span a wide range of geography, administration, and ownership and the many academic disciplines of the world. Given this inherent nature of forests, it is important for the McIntire-Stennis research program to ensure that artificial boundaries do not constrain the type and quality of research undertaken and, where appropriate, to encourage integrative research and development.