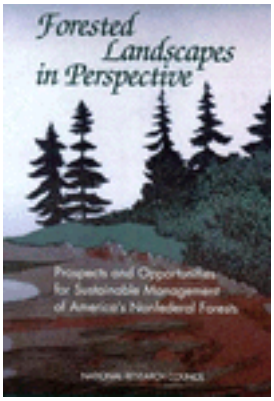


**Forested Landscapes in Perspective: Prospects and Opportunities for Sustainable Management of America's Nonfederal Forests**

Committee on Prospects and Opportunities for Sustainable Management of America's Nonfederal Forests, National Research Council

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# *Forested Landscapes in Perspective*

## Prospects and Opportunities for Sustainable Management of America's Nonfederal Forests

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Committee on Prospects and Opportunities
for Sustainable Management of America's
Nonfederal Forests

Board on Agriculture

National Research Council

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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. This study was supported by the Forest Service of the U.S. Department of Agriculture, under Agreement No 53-3187-5-11.

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## COMMITTEE ON PROSPECTS AND OPPORTUNITIES FOR SUSTAINABLE MANAGEMENT OF AMERICA'S NONFEDERAL FORESTS

PAUL V. ELLEFSON, *Chair*, University of Minnesota, St. Paul
JAMES K. AGEE, University of Washington, Seattle
KEITH A. ARGOW, National Woodland Owners Association, Vienna, Virginia
JEANNE N. CLARKE, University of Arizona, Tucson
PRESTON D. COLE, City Forestry Services, Milwaukee, Wisconsin
DOMINICK A. DELLASALA, World Wildlife Fund, Washington, D.C.
HENRY GHOLZ, University of Florida, Gainesville
J. KEITH GILLESS, University of California, Berkeley
PERRY R. HAGENSTEIN, Institute for Forest Analysis, Planning, and Policy, Wayland, Massachusetts
NEIL D. HAMILTON, Drake University Law School, Des Moines, Iowa
JAMES E. HUBBARD, Colorado State University, Fort Collins
KEITH ROSS, New England Forestry Foundation, Groton, Massachusetts
JOHN T. SHANNON, Arkansas Forestry Commission, Little Rock
RONALD L. TROSPER, Northern Arizona University, Flagstaff

STAFF

CHARLOTTE KIRK BAER, *Project Director*
ERIC A. FISCHER, *Project Director**
SHIRLEY B. THATCHER, *Senior Project Assistant*
JULIEMARIE GOUPIL, *Project Assistant*

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*Through December 1996.

# Preface

Forests are an important part of everyday life for most Americans. They provide timber, soil, wildlife, recreation, beauty, and relief within rural and urban environments. An issue of increasing concern is the management of forestlands for diverse objectives, including economic returns, biological and ecological integrity of forest resources, and quality of life for populations in rural and urban areas. Thoughtful management of forests is clearly becoming crucial to achieving multifaceted goals and ensuring a productive future for forests.

Traditionally, forestlands in the United States have been categorized as forests owned by the government (public) and forests that are privately owned. The focus of this report is nonfederal forests, or those forests owned by industrial private landowners, nonindustrial private landowners, Native Americans, and state and locally owned forestlands. The issues addressed in this report are primarily those of private forests and private forestland owners, with special attention to nonindustrial private forests and nonindustrial private forestland owners.

At the request of the U.S. Department of Agriculture's (USDA) Forest Service, the National Research Council's Board on Agriculture convened a 14-member Committee on Prospects and Opportunities for Sustainable Management of America's Nonfederal Forests to assess the status of the nation's nonfederal forests and to examine the role of the federal government in contributing to sustainable management of nonfederal forestlands. This study responds to the recognized need for evaluating the current programs and policies directed toward the nation's nonfederal forests and integrates information on the management and use of nonfederal forests while accounting for trends in ownership, location, composition, and condition of forestlands.

The committee began its work in March 1996, seeking to understand the overarching industrial, environmental, social, programmatic, and policy contexts of nonfederal forest management. Issues were analyzed by bringing together views of experts in the general areas of forest policy and private land ownership as well as those of environmental, ecological, economic, legal, and social sciences. Throughout the course of this study, a close examination of the relationship between forest management issues and public needs was carried out through the conduct of public forums held in several regions of the United States. Invitations were extended for submission of written comments to the committee; responses were received from representatives of the forest industry, Native Americans, environmental organizations, consulting foresters, federal, state, and local

governments, nonindustrial private landowners, and concerned citizens of all contiguous states and Hawaii and Alaska.

This report, *Forested Landscapes in Perspective: Prospects and Opportunities for Sustainable Management of America's Nonfederal Forests*, might make its most significant contribution by bringing to light those issues related to private forestland inventory, ownership, and management that have gone unrecognized and that deserve attention today. The information contained in this report improves the knowledge base for directing the role of the federal government in nonfederal forest management. In addition, the report articulates issues for consideration regarding a policy for our nation's forests, options for improving sustainable management of nonfederal forests, and recognizes a variety of approaches for a federal role in sustainable management of nonfederal forestlands.

As a basis for the committee's deliberations, several aspects relevant to its task are defined. Part One of the report focuses on concepts of sustainability, which are presented in Chapter 1. In Part Two, general descriptions of the U.S. forest landscape are provided. The overall status and characteristics of the nation's nonfederal forests are reviewed in Chapter 2. Benefits and values that are attributable to forests in the United States are outlined in Chapter 3. Current policies and programs directed at America's nonfederal forests are described and defined in Chapter 4. Part Three of the report begins with a detailed analysis of the ecological aspects of nonfederal forest management presented in Chapter 5. Chapter 6 examines public and private institutions and their role in nonfederal forest management. Current programs and policies, including education, management, technical assistance, tax policies, regulatory programs, and various incentives that affect nonfederal forests, are described in Chapter 7. A discussion of public and private investments in nonfederal forests is provided in Chapter 8. Information needs with regard to research, monitoring, and technology transfer are outlined in Chapter 9. In Chapter 10, resource owner responsibilities and rights are addressed. In the final chapter of the report, management of U.S. nonfederal forestland in an international and global context is discussed.

Throughout the report, the committee focused on emerging environmental issues such as forest fragmentation and biodiversity as well as other prominent issues such as the availability of timber supplies. Particular attention was given to current program and policy initiatives, the institutional setting within which they are pursued, and the information base for evaluating effectiveness and deficiencies. This information was used as the basis for evaluating ways in which the federal role might be modified to meet emerging needs and issues.

The context for this evaluation the apparently ever-growing demand for the goods and services provided by nonfederal forests on the one hand, and limited federal and state budgets, and a political climate that favors reduction of government spending on the other. Emerging issues, such as global climate change and threats to biodiversity, for which nonfederal forests may help provide solutions, lack the immediacy of the wildfires that did much to galvanize support for the

federal role in nonfederal forests. The committee hopes that this report stimulates action for improved, coordinated partnerships between public and private interests in the management of these forests.

The recommendations provided by the committee in this report are the result of many hours of careful listening, coordinated planning, painstaking analyses, thoughtful deliberations, cooperative efforts, and a continuous flow and exchange of resourceful ideas. The wish of the committee, whose membership is as diverse as the issues related to nonfederal forests, is that these recommendations will be implemented in the manner and spirit in which they were developed.

Paul Ellefson, *Chair*
Committee on Prospects and
Opportunities for Sustainable
Management of America's
Nonfederal Forests

The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce Alberts is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Kenneth I. Shine is president of the Institute of Medicine.

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Bruce Alberts and Dr. William A. Wulf are chairman and vice-chairman, respectively, of the National Research Council.

# Acknowledgments

We gratefully acknowledge the many people who provided information and insight to the committee by participating in the regional public forums held in conjunction with this study during the spring of 1996. The wealth of input received from a vast array of stakeholders at these public forums assisted the committee in shaping its views and preparing the recommendations presented in this report.

The committee also expresses thanks to those who took time from their busy schedules to attend various committee meetings. We offer our gratitude to the following invited speakers who shared their expertise and experience at these meetings:

Oluf Aalde
Royal Norwegian Ministry of Agriculture
Oslo, Norway

Thomas Birch
USDA Forest Service
United States Department of Agriculture

Joan Comanor
Natural Resources Conservation Service
United States Department of Agriculture

Charles H. W. Foster
John F. Kennedy School of Government, Harvard University
Needham, Massachusetts

Jan Heino
Ministry of Agriculture and Forestry
Helsinki, Finland

David Kittredge
Department of Forestry and Wildlife Management
University of Massachusetts

Thomas Larson
Integrated Urban Forestry, Inc.
Laguna Hills, California

Robert Moulton
USDA Forest Service
United States Department of Agriculture

Eric Oldar
California Department of Forestry and Fire Protection

David Perry
Oregon State University

Jeffrey Romm
University of California

Gerald Rose
Minnesota Department of Natural Resources
St. Paul, Minnesota

Henry Swan
Wagner Forest Management Ltd.
Lyme, New Hampshire

Courtland Washburn
Hancock Timber Resource Group
John Hancock Mutual Life Insurance Company

It is with most sincere appreciation that we acknowledge the outstanding contribution and wealth of information provided to the committee by Donald G. MacKay, Research Associate, Department of Forest Resources, University of Minnesota. Without his efforts, the work of this committee would not have been possible.

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# Executive Summary

## EXTENSIVE AND IMPORTANT FORESTS

America's nonfederal forests are extensive and important. Two-thirds of the nation's forestland—nearly 490 million acres—are owned and managed by nonfederal entities. These owners include: state, county, and tribal governments; corporations; and millions of individual private citizens, including more than nine million who each own fewer than 100 acres. This latter group is referred to as nonindustrial private forestland owners. An estimated 20 million acres of nonfederal forest are considered to be urban and community forestlands, which are especially important, given that nine of ten Americans live in urban areas. Forest industries own about 71 million acres of forestland, with particularly heavy concentrations in the South.

About 75 percent of the nation's nonfederal forests are located in the eastern part of the nation. Four of 10 acres are in the South, and about one-third of nonfederal forestland is located in the North. The remaining portion spreads across the western United States, where the dominant landowner is the federal government. Between 1987 and 1992, nonfederal forestland decreased slightly in parts of the West and Southeast regions of the United States, while increasing in the North and South Central regions. Given their diversity in location and ownership, generalizations about the use, management, and condition of nonfederal forests must be made with caution.

The extent of nonfederal forests in America and the many entities that own and manage them are, in and of themselves, reason for wide public attention. But nonfederal forests also should be recognized for the many goods and services they provide. A significant portion of the 1.2 million persons employed by the

nation's forest industry is dependent on timber supplied by nonfederal forests. Native American tribal forests alone provide employment for 40,000 persons, who produce products valued at more than $280 million. Nonfederal forests also provide a setting for many Americans to pursue their recreational interests; more than 50 million acres of state-owned forestland are available for recreational activities. In addition, nonfederal forests provide a wide range of important ecological services. They protect soil, ensure quality water, store carbon, and provide habitat for wildlife. More than 90 percent of the nation's threatened and endangered species have some or part of their habitat on nonfederal forests.

The nation's nonfederal forests are the focus of many federal and private programs. The federal programs most often involve the provision of education and technical assistance, and fiscal and tax incentives, as well as the application of regulations. These programs are typically linked to state agencies that are ultimately responsible for delivering important services and incentives to owners of nonfederal forests. State forestry agencies are prominent, annually investing $1.1 billion, of which the largest portion goes to fire management activities. Private program initiatives commonly focused on nonfederal forests include service initiatives of forest industry, forestry advice and counsel by forestry consultants, and management assistance from various nonprofit organizations. In recent years, public attention to the use and management of federal forests, especially national forests, has frequently overshadowed many public and private programs directed at nonfederal forests.

## FEDERAL ROLE IN SUSTAINABILITY

The federal government has had an interest in promoting sound forestry practices on nonfederal lands at least since the passage of the Clarke-McNary Act in 1924. This historic legislation charged the U.S. Department of Agriculture's (USDA) Forest Service with assisting state and private concerns to carry out programs that would ensure the sustainability of these important forests. Over the years, many other federal departments, agencies, and bureaus have developed a wide range of programs that provide education and technical forestry services, regulate certain practices or conditions on nonfederal forests, and purchase private lands that are deemed unique or of critical national importance.

The federal role in ensuring the sustainability of the economies, communities, and environments that rely on the nation's nonfederal forests can be as diverse as the nonfederal forests themselves. As they have in the past, the components of the federal role in nonfederal forests will change with time. The federal government is an important but not exclusive participant in ensuring investments leading to sustainability. Its role can be viewed as one of convening and promoting leadership and investment opportunities within the private sector and other units of government. This role can include building institutional and managerial capacity within regional, state, and local forestry organizations; pro-

moting the integration of environmental and economic policies and programs; developing a coherent set of national principles of forest resource sustainability; fostering strategies that lead to regional integration across a spectrum of forestry interests; promoting a blend of economic and information incentives; and encouraging multiple stakeholder decision-making processes at all decision levels. These roles imply a manageable number of governmental programs and policies that promote long-term investments, and a respect for the mixture of public and private ownerships that comprise the nation's nonfederal forests.

Federal investments to sustain the contributions of nonfederal forests to American society will require a broad-based social and political desire to do so. Furthermore, these investments will occur only if certain fundamental issues are acknowledged and carefully addressed. These issues include the condition of nonfederal-forest resources; the rights and responsibilities of nonfederal forest landowners; the type and implementation of programs focused on nonfederal forests; the institutional relationships available to guide the use, management, and protection of nonfederal forests; the management of research and information on nonfederal forests; the sources and levels of investments available for nonfederal forests; and the international and global circumstances that influence the sustainability of nonfederal forests and investments in them.

## CHALLENGES FOR THE FUTURE

Overall, the nation continues to enjoy and derive benefits from an abundance of nonfederal forests. Their use and management are important considerations for future sustainability and during the course of the committee's deliberations and the public forums held during this study, common areas of concern were expressed. The committee identified seven challenges for future investment in the sustainability of nonfederal forests:

- promotion of public and private resolve and commitment to ensuring the long-term fundamental health and integrity of forest ecosystems that make up the nation's nonfederal forests;
- development of national policies and programs for nonfederal forests that are grounded in a comprehensive policy for the nation's forests (these policies should clearly reflect the important contributions of nonfederal forests to the nation's well-being);
- improvement of coordination and simplification of existing federal programs for nonfederal forests and the fostering of cooperation among the many public and private partners with interests in nonfederal forests;
- strengthening of federal assistance and protection programs for nonfederal forests, and encouragement of innovative approaches to emerging issues involving the use, management, and protection of nonfederal forests;

- reinforcement of the information base on which informed decisions can be made about the use, management, and protection of nonfederal forests, and improvement of the transfer of information to owners, managers, and citizens with interests in nonfederal forests;
- encouragement of economic conditions and innovative programs that will result in high levels of investment in sustaining nonfederal forests (the levels should be consistent with the benefits provided by nonfederal forests); and
- enhancement of the ability of nonfederal forests to provide important economic, social, and environmental contributions in a global context to the world community.

## COMMITTEE RECOMMENDATIONS

### Long-Term Forest Health and Integrity

**RECOMMENDATION 1.**

*Ensure the long-term integrity of forest ecosystems that comprise the nation's nonfederal forests, actively addressing conditions that diminish their ability to contribute to the well-being of the nation's citizens (Chapter 5).*

Fundamental sustainability of the ecosystems that are a part of nonfederal forests is critical to the ecosystems' provision of the range of goods and services that Americans expect both now and in the future. The ecosystem stress that can be caused by forest fragmentation, land conversion, air pollutants, climatic change, insects and diseases, and the like must be addressed if the long-term viability of nonfederal forests is to be sustained. Failure to anticipate and to take action to deal with conditions such as these will certainly impede the ability of nonfederal forests to make continuous and important contributions to the nation. This consideration points to the following specific recommendations:

- *The federal government should strengthen programs that monitor nonfederal forest health, with special focus on early detection of conditions that could lead to catastrophic consequences.*
- *Federal assistance to states should be strengthened for wildfire suppression and fuel management technologies, while recognizing fire as critical to functioning, healthy ecological processes.*

### Policies, Planning, and Organizing

**RECOMMENDATION 2.**

*Improve the ability of the federal government to focus on the national interest in nonfederal forests, especially the ability to identify national interests in nonfederal forests and to deliver programs and support that will enable accomplishment of these national interests (Chapter 6).*

The ability of the federal government to effectively participate and coordinate with interests in nonfederal forests is critical to the sustainability of these forests and to their ability to provide a wide array of goods and services to the American people. At present, this ability is hindered by at least four major institutional issues: (1) the lack of a clear, well-directed national policy on nonfederal forests; (2) ineffective strategic planning processes for identifying national interests in nonfederal forests; (3) a high number of agencies, bureaus, and divisions in the federal government that are involved wholly or in part in nonfederal-forest programs; and (4) the many policy and program linkages between the federal government and various public and private organizations at state and regional levels.

## National Goals and Policy

Although owned and managed by a diverse group of landowners, both public and private, there is little dispute over the broad national goals for the use, management and protection of nonfederal forests. In addition, the federal government has a role in facilitating and pursuing attainment of these goals. The difficulty in attempting to accomplish these goals is the lack of a clearly defined policy for the nation's forests, of which nonfederal forests are an integral component. This deficiency has resulted in a lack of consistency in purpose and direction needed for effective support of federal policies and programs for nonfederal forests. At the very least, a national policy for nonfederal forests should lead to the maintenance and, as appropriate, the expansion of area covered by forests; a broad and well-balanced range of forest values and uses; contributions to social, economic, and community well-being; beneficial global consequences; cooperation among multiple owners of forest ecosystems; decisions about forests based on sound scientific evidence; and sustained investments in forests that are commensurate with the values and benefits provided.

## Strategic Planning Processes

Effective strategic planning processes that are capable of drawing attention to emerging issues involving nonfederal forests are also lacking, at least in part because of the fragmentation of major programs affecting nonfederal forests among several federal agencies. In response to the Forest and Rangeland Renewable Resources Planning Act (RPA), the USDA Forest Service prepares a strategic plan (RPA Program) at five-year intervals. But this strategic plan is only for USDA Forest Service programs and does not incorporate major programs of other federal agencies, such as the Fish and Wildlife Service and the Army Corps of Engineers, that have major implications for nonfederal forests. Furthermore, the plan concentrates on National Forest issues and largely neglects many issues that are relevant to nonfederal forests. Features of an effective planning function

for federal involvement in nonfederal forest issues include a planning scope sufficiently broad to help in coordinating major program elements of different federal agencies; capability to alert federal agencies in advance to emerging issues needing creative policy solutions; and mechanisms, such as regional planning and programming councils, that can effectively make the bridge between national emphases and regional or state-by-state differences in program needs. Nonfederal forest programs at the federal level do not currently incorporate these features.

## Federal Programs and Organization

The number of federal agencies with programs that affect nonfederal forests is substantial; individually, the agencies often lack visibility, resulting in little coordination among them. Multiple agency and program activities are not necessarily an indication of duplication of effort or serious conflicts among programs; however, forest owners and managers often face a confusing array of programs and directions from those responsible for program implementation. For example, multi-agency activities have resulted in multi-agency responsibilities for threatened and endangered species and for prevention of water pollutants from nonpoint forest sources. From a national perspective, the nation's interest in nonfederal forests is most clearly articulated by the State and Private Forestry unit of the USDA Forest Service. However, the unit's programs and magnitude of investments ($137 million in 1996) are modest and are unlikely to be commensurate with the national interest in nonfederal forests and the benefits they could provide to the nation. The State and Private Forestry unit's current position does not make it capable of providing the federal leadership needed for investments in the sustainability of nonfederal forests. The unit's visibility within federal forestry and natural-resource agencies is slight, its programs within the USDA Forest Service are overwhelmed by federal national forest programs, its purpose and mission is increasingly unclear, and its many program responsibilities and associated interest groups has limited the unit's ability to become the nation's principal organization for federal activity involving nonfederal forests.

## Federal-Nonfederal Linkages

The federal government attempts to address the national interest in nonfederal forestry through a variety of public and private organizations. Federal linkages through state governments are especially notable. In many respects, however, the appropriateness of existing purposes and resulting linkages between the federal government and other public or private organizations that have an interest in nonfederal forests has become a concern to many in an era of federal reductions. For example, historically the federal government has helped to build the states' capacity to carry out forestry programs (especially wildfire management and

professionally guided forestry practices). These efforts have been remarkably successful. At issue now is what role the federal government should assume in the future. The narrow scope of federal assistance to states (e.g., timber, water, recreation, and water pollutants) appears to be inconsistent with the more holistic ecosystem approach that is currently being suggested for forest resource management in general. Perceptions of federal management and allocations are also often at issue, including inconsistencies with the trend toward grass-roots, locally generated initiatives; inflexible allocations of technical and financial assistance to states; and uncertainty over federal and state linkages as reflected, in part, by the way the federal government has organized regional offices to interface with states. These considerations point to the following specific recommendations:

- *A national policy for nonfederal forests that is grounded in a comprehensive policy for the nation's forests should be established.*
- *Federal strategic-planning processes should identify national interests in nonfederal forests and subsequently set forth a strategic plan for federal action.*
- *Organization and coordination among federal agencies and programs focused on nonfederal forests should be improved, and administrative and organizational links among federal programs focused on nonfederal, public, and private forests should be simplified to be more effective.*
- *Institutional partnerships that foster the coordinated use, management, and protection of large forested landscapes involving public and private forest landowners should be promoted.*

## Programs for the Future

**RECOMMENDATION 3.**

*Coordinate and suitably strengthen incentive, technical-assistance, and regulatory programs for nonfederal forests, and broaden their application to a wider variety of individual and societal interests (Chapter 7).*

The history of federal involvement in nonfederal forestry has been one of providing leadership for private concerns and for state and local units of government to establish and apply progressive forestry programs. In so doing, the federal government has played a significant role in building the policy and program capacity of those entities. However, many of the policies and programs, especially those focused on nonindustrial private forests, have been developed in response to single concerns (for example, timber, wildlife, and water quality) and assigned to many different agencies for implementation. Hence, there is substantial opportunity for enhancing the exercise of the federal role in nonfederal forests, especially by more clearly specifying program goals and purposes, improving the coordination of program implementation within the federal government

and with private concerns and state and local units of government, and broadening program purposes to include accomplishment of a broader array of interests in nonfederal forests. This opportunity points to the following specific recommendations:

- *Privately-initiated programs that lead to investments in nonfederal forests should be promoted.*
- *Coordination of federal incentive, regulatory, and technical assistance programs should be improved, and these programs as well as tax policies and programs should be periodically evaluated to improve effectiveness. Technical assistance, fiscal incentive, and tax programs that target special landowner categories should be considered.*
- *A clear set of purposes for educational programs focused on nonfederal forests should be established with a well-defined statement of federal agency responsibility for attaining these goals.*
- *Tax policies and programs that discourage investments in the sustainable management of private nonfederal forests should be eliminated.*
- *Federal and state regulatory programs for nonfederal forests should be designed to honor public and private interests in nonfederal forests.*

## Investments in Sustainability

**RECOMMENDATION 4.**

*Promote public and private investments in nonfederal forests by establishing innovative investment policies and fostering healthy national and regional economies. Investment should be broadly construed to include financial, intellectual, human, and ecological resources (Chapter 8).*

The magnitude of social and ecological benefits provided by the nation's nonfederal forests is directly related to the willingness of public and private organizations to invest wisely in the use, management, and protection of these forests. If one were to add up the current budgets for the various federal programs focused on nonfederal forests, the national interest—as measured by federal expenditures—would be on the order of $500 million to $1 billion. This interest amounts to less than one percent of the total $1.6 trillion federal budget. Given the potential significance of the nearly 490 million acres of nonfederal lands, the federal investment is quite modest.

Most investments in nonfederal forests are made by owners in the form of holding land. They invest in their properties for a variety of reasons, including interest in recreation and wildlife, production of timber, and pursuit of property and residences. Public investments in nonfederal forests generally take the form of protection, technical assistance, and fiscal incentives. In many cases, these public investments occur at the margin, where their effectiveness in increasing landowners' willingness to invest further in their forests might

not be adequate. This consideration points to the following specific recommendations:

- *Major deterrents to private investments in forestry that affect investment by nonindustrial private landowners, especially lack of sufficient advance capital and low expected rates of return, should be eliminated.*
- *Federal fiscal and technical assistance programs leading to investments in private nonfederal forests should be sufficiently large to affect the use and sustainable management of nonfederal forests.*
- *Innovative public and private revenue sources for investments in nonfederal forests, including general obligation bonds and various forms of private trusts, should be established.*

### Information Needs for Decisions

**RECOMMENDATION 5.**

*Improve the quantity, quality, and timeliness of information about nonfederal forests and enhance access to this information (Chapter 9).*

Sustaining the important social and environmental benefits from nonfederal forests is challenged by many unknowns regarding ecosystem complexity, diverse ownership objectives, and program effectiveness. Particularly troublesome are the information void and inconsistencies that often plague analyses of major issues involving nonfederal forests. The information available to describe the latter is often out of date, gathered by agencies with conflicting interests, and inconsistent in form and presentation, making its aggregation across regions impossible. The 1978 and 1994 nationwide reviews of private forest owners have been helpful in this respect. More frequent compilations of this sort could prove especially useful in anticipating issues involving nonfederal forests and in designing suitable program responses by public and private organizations.

Challenges to research and information management programs range from limited understanding of landowners' concerns about risk, uncertainty, and capital requirements to public apprehension about appropriate combinations of educational, technical-assistance, and regulatory programs. Adequate response to information needs is complicated by the diversity of landowner objectives assigned to these forests. The lack of available information needed to address concerns of this nature diminishes the possibility of even greater contributions by nonfederal forests to the nation's economy and environment. These concerns warrant significant attention to investment in research, information and technology transfer, and monitoring and information management. The need for these activities points to the following specific recommendations:

- *Research focused on nonfederal forests should be strengthened by expanding public and private investments in research, improving the organization*

*and management of research, and guiding research with a strategic research plan for nonfederal forests.*

- *Programs for transferring information about nonfederal forests to landowners, managers, and citizens should be strengthened. Cooperative partnerships should be used to assist in this effort.*
- *Programs for monitoring the condition and use of nonfederal forests and systems for managing this information should be strengthened, with emphasis on establishing consistent information gathering protocols for monitoring activities.*

### Diverse Ownership Considerations

**RECOMMENDATION 6.**

*Acknowledge public and private rights and responsibilities associated with nonfederal private forests and the multitude of ways that these rights and responsibilities are exercised by various landowners (Chapter 10).*

Very different interests and management circumstances often are associated with the major landowner categories that make up nonfederal forests. For example, the governing structure of state forests, industrial forests, tribal forests, nonindustrial forests, and urban and community forests are very different. State forests are administered by agencies responsible to state legislatures and governors. These agencies often assumed trust responsibilities when the federal government granted the lands to the states for support of schools. Industrial forests are managed by executives responsible to boards of directors and stockholders. Tribal governments are ultimately responsible to their tribal members for governance of their forests, within the parameters of the trust responsibility of the federal government for Native American lands. Both urban forests and nonindustrial private forests have private owners who have a wide variety of objectives and interests and strongly held views regarding property rights. Federal initiatives to foster investments in the sustainability of nonfederal forests must reflect this diversity of management interests and circumstances. This consideration points to the following specific recommendations:

- *Federal program goals and objectives should build on the variety of interests and objectives of nonfederal forest landowners.*
- *Federal regulatory programs should be designed to reflect public and private rights, responsibilities, and interests in sustained management of nonfederal forests, especially private forests.*

### The Global Context

**RECOMMENDATION 7.**

*Exercise federal leadership, counsel and, as appropriate, resources to sustain positive contributions from U.S. nonfederal forests to the world (Chapter 11).*

Nonfederal forests of the United States are part of larger biological, economic, and political systems throughout the world. Because they account for two-thirds of the nation's forested area, nonfederal forests will be called on to play a larger role than other ownership categories in meeting the nation's expected contributions to healthy global economies and environments. Therefore, U.S. public and private investments in the nation's nonfederal forests will make an important contribution to the sustainability of these larger systems. Public and private organizations in the U.S. government have a responsibility to exercise leadership, counsel, and, as appropriate, resources to sustain positive contributions from nonfederal forests to the world. This responsibility points to the following specific recommendations:

- *Federal policies and programs for nonfederal forests should be consistent with international environmental and trade agreements to which the United States is a party.*
- *The United States should advance scientific understanding of the role of forests, and nonfederal forests in particular, in mitigating global pollutants and climate change. The effects of global climate change on nonfederal forests should continue to be monitored.*

# PART ONE

## Sustainability and the Federal Role in Nonfederal Forests

# 1

# Investing in Sustainability of Nonfederal Forests

## INTRODUCTION

The nation's forests are commonly considered to be either public (government-owned) or private. This study makes the unique distinction between federal and nonfederal forests. Nonfederal forests include forests owned by state and local governments, Native Americans, private industry, and individual citizens. In reality, attention should be directed to the vigor and contributions of all forests regardless of ownership because the forest ecosystems seldom coincide with human-imposed ownership and political boundaries. For purposes of study and analysis, however, the federal-nonfederal distinction is a useful one.

Sustainable management of the nation's nonfederal forests is important because these forests are an important part of the nation's economic, community, and environmental landscape. Nonfederal forests have served the nation well throughout history by providing a variety of goods and services in the amounts and of the qualities demanded by the nation's citizenry. They can continue to serve the nation well, provided that their condition and productivity are maintained into the future.

In this chapter, the report's purpose and organization are presented, and underlying major problems with nonfederal forests are introduced. A discussion of sustainability, the committee's view of sustainability, and potential federal roles in contributing to sustainable management of nonfederal forests are also described.

## INSUFFICIENT INVESTMENTS

Citizens and governments are becoming increasingly aware of the unique properties, problems, and value of nonfederal forestlands. Scientific understand-

ing of nonfederal forests has expanded, appreciation of their biological contributions has intensified, and the vital role they play in the functioning of national and global social and economic structures has increased. Expectations of the potential human and ecological benefits provided by these forests are growing. If these expectations are to be met in a sustainable manner, the general public, forest industry, and government face important challenges, the most critical of which is the need for greater financial and human investments in these nationally important forests.

Why are sufficient investments lacking, how does this deficiency affect national interests, and by what means can greater levels of investment in nonfederal forests can be achieved? This report provides the background necessary to consider these questions (Part Two, Chapters 1–4) and provides a number of recommendations, based on analysis of key issues, to address important problem areas (Part Three, Chapters 5-11).

## SUSTAINABILITY AS A FOCUS

### Potential Concepts

Sustainability of natural resources has become a focal point for public and private actions. Policy and management actions on sustainability are often vigorously advocated and promptly adopted. Although a socially and politically powerful concept, sustainability is often not well defined. Therefore, clarification of sustainability as applied to nonfederal forests and assessment of the federal role in fostering conditions associated with sustainability are important tasks.

The World Commission on Environment and Development was one of the first to suggest a definition of sustainable development, namely, "sustainable development is development to meet the needs of the present without compromising the ability of future generations to meet their own needs" (1987) (Box 1-1).

Acknowledging that sustainability must have a focus or goals to be operational, the President's Council on Sustainable Development (1996) recently suggested that notions of sustainability are genuinely worthwhile only in the context of attaining certain goals. Those goals include benefits accruing to all people from a healthy environment, an economy that affords opportunities for a high quality of life; equity of opportunity for achieving well-being, environmentally sound (protected) natural resources for future generations, stewardship of environmental and natural resources, teamwork to create healthy communities, opportunities for citizens to influence decisions that affect them, a stabilized U.S. population, worldwide application of sustainable development policies, and greater citizen understanding (through education) of sustainable development. Principles of sustainable forestry that incorporate many of these goals have been suggested.

**Box 1-1**
**Definitions of Sustainability, Sustainable Management, and Sustainable Development**

"The greatest good for the greatest number in the long run" (Pinchot 1947).

"If sustainability means anything more than a vague emotional commitment, it must require that something be conserved for the very long run. It is very important to understand what that something is: I think it has to be a generalized capacity to produce economic well-being" (Solow 1993).

"The use of resources today in such a way to allow for a full range of options for utilization by future generations" (Northern Forest Lands Council 1994).

"Forest management practices for which the outcome will be sustained yield" (Northern Forest Lands Council 1994).

"Although defined differently by different people, sustainability [nevertheless] represents a growing concern about the adequacy of mineral resources to meet future demands and do so without unacceptable environmental degradation" (National Research Council 1996).

"Since sustainable forest management is only possible within the ultimate constraints and limits imposed by the ecosystem, sustainability should be viewed as the degree of overlap between ecological possibilities and socially desired benefits of forests" (Noss 1993).

"Sustainable development is development to meet the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987).

"Sustainable forestry means managing our forests to meet the needs of the present without compromising the ability of future generations to meet their own needs by practicing a land stewardship ethic which integrates the growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air, and water quality, wildlife and fish habitat, and aesthetics" (American Forest and Paper Association 1995a).

## Committee Perspective

Concepts of sustainability encourage strategic thinking about the long-term effects of decisions and guide the design of policies and programs that will result in the better use and management of nonfederal forests (Box 1-2). Sustainable management of America's nonfederal forests means caring for these forests in a manner that will allow them to continue contributing to the future well-being of the nation to the extent consistent with their ability to provide benefits at accept-

**Box 1-2**
**Principles of Forest Resource Sustainability: Two Perspectives**

*American Forest and Paper Association Principles for Sustainable Forestry* (AFPA 1995a)
The members of the American Forest & Paper Association support the following principles:

1. To practice sustainable forestry to meet the needs of the present without compromising the ability of future generations to meet their own needs by practicing a land stewardship ethic which integrates the reforestation, managing, growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air and water quality, wildlife and fish habitat, and aesthetics.
2. To use its own forests, and promote among other forest landowners, sustainable forestry practices that are economically and environmentally responsible.
3. To protect forests from wildfire, pests, diseases, and other damaging agents in order to maintain and improve the long-term forest health and productivity.
4. To manage its forests and lands of special significance (e.g., biologically, geologically, or historically significant) in a manner that takes into account their unique qualities.
5. To continuously improve the practice of forest management and also to monitor, measure and report the performance of our members in achieving our commitment to sustainable forestry.

*Forest Stewardship Council: Principles of Forest Management* (FSC 1994)

1. Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.
2. Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.
3. The legal and customary rights of indigenous peoples' to own, use and manage their lands, territories, and resources shall be recognized and respected.
4. Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.
5. Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.
6. Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.
7. A management plan—appropriate to the scale and intensity of the operations—shall be written, implemented, and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.
8. Monitoring shall be conducted—appropriate to the scale and intensity of management—to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.
9. Primary forests, well-developed secondary forests and sites of major environmental, social or cultural significance shall be conserved. Such areas shall not be replaced by tree plantations or other land uses.
10. Plantations should be planned and managed in accordance with Principles 1 through 9, and the following criteria. Such plantations can and should complement natural forests and the surrounding ecosystem, provide community benefits, and contribute to the world's demand for forest products.

able costs. Just as they have in the past, the components of what the nation understands as "well-being" will change with time. For much of the last 100 years, forests have been said to be sustainable if the periodic growth of commercially useable timber at least equaled timber harvests or removals. In recent decades, this idea has been expanded to include other uses of the forest such as recreation or other services without a significant decline in quantity or quality. In the past decade, sustainability has come to include maintainance of well-functioning ecological processes, a broader definition that could be viewed as incorporating a range of ecosystem services.

Each of these definitions, appropriate in its own context and time, is unlikely to stand the test of time. As knowledge of forest processes and uses expands, conceptions of sustainability and the components of national well-being also will change. For the present, however, sustainability as strategically applied to nonfederal forests involves the formulation and implementation of manageable governmental programs and policies that (1) promote a long-term investment in the nation's nonfederal forestlands, (2) recognize and respect a mixed public-private system of ownership, (3) encourage multiple forest uses consistent with the long-term integrity of forest ecosystem functions and processes, (4) promote citizen participation in determining the care and management of forest resources, and (5) maintain the productivity of forest ecosystems for a full range of values, functions, and services.

Nonfederal forests are a major contributor to the quality of life experienced by Americans. This contribution is dependent on the nation's ability and willingness to ensure biologically and socially the sustainability of nonfederal forests. Sustainability of nonfederal forests can only be accomplished by investment in human capital, biological capital, biological integrity, financial soundness, and institutional strength. The federal government, an important participant in ensuring investments in sustainability, has the role of carefully fabricating leadership capabilities and investment opportunities within other units of government and the private sector.

Investments that further the contribution of sustainable nonfederal forests to the social fabric of America will require broad-based social and political support, and will be made only if fundamental issues are acknowledged and addressed. These issues, addressed in Part Three of this report, include the condition of nonfederal-forest resources (Chapter 5); institutions and organizations available to guide the use, management, and protection of nonfederal forests (Chapter 6); type and implementation of programs for nonfederal forests (Chapter 7); sources and levels of investments available for nonfederal forests (Chapter 8); research and information management on nonfederal forests (Chapter 9); rights and responsibilities of those owning nonfederal forests (Chapter 10); and international and global circumstances that influence the sustainability of nonfederal forests and investments in them (Chapter 11).

More assertive action to enhance the contribution of America's nonfederal forests is needed. Additional investments, including those in human resources, providing access to information on maximizing the value of forests to landowners and the public alike, and assisting landowners with skills and knowledge to effectively understand and utilize this information are necessary if America is to realize the potential of nonfederal forest resources. These investments will require contributions by all segments of the nation's public and private forestry community, including the federal government.

## FEDERAL ROLE IN SUSTAINABILITY

The federal role in sustaining nonfederal forests has taken various forms over the years and has been aimed at various perceived problems during specific time periods. In the early days, attention focused mainly on protection of timber supplies from wildfire, insects, and disease. Subsequently, federal interest turned to water quality, wetlands, air quality, and endangered species. Now these concerns have expanded to include biodiversity. The federal role has been mainly to prompt the states to take action to meet goals defined by federal law (e.g., Clean Water Act) or to address identified problems such as wildfires and insects. The prompting has often been in the form of technical and financial assistance to states. But the federal government also has provided more direct assistance to forestland owners in the form of financial incentives, including special income tax treatment. In the past 25 years, the relationship between federal and state government has changed substantially, with more responsibility for program development and implementation shifting to the states and federal agencies increasingly serving as facilitators or catalysts. Thus, the federal government's role has changed dramatically and in some instances, the implementation of federal policies on private lands has substantially eroded the relationship between private landowners and the federal government.

Today, the federal role in ensuring the sustainability of the economies, communities, and environments that rely on the nation's nonfederal forests is as diverse as the nonfederal forests themselves. The many federal programs and agencies that currently target nonfederal forests reflect this diversity. Some major federal roles that can foster sustainability of the nonfederal forests are:

- Building institutional and managerial capacity within state and local forest-resource organizations;
- Promoting the integration of environmental and economic policies at all levels of decision making;
- Developing a coherent set of national principles of sustainability, while encouraging, facilitating, monitoring, and ensuring the effectiveness of clearly defined, responsible roles for implementation of these principles by public and private interests at state and local levels;

- Fostering strategies that focus on regional integration of a broad spectrum of environmental, economic, and social interests and jurisdictions, instead of on a few special interests, agencies, or political jurisdictions;
- Promoting a blend of economic and information incentives, including regional and local planning for sustainability; and
- Encouraging decision-making processes at national, regional, and local levels that involve multiple stakeholder approaches operating within the context of sustainability.

Three current federal activities could facilitate the initial implementation of the federal roles described above. Key federal activities addressed in this report include forest inventory and analysis, education and technical assistance, and the potential for the federal government to be a catalyst for innovation and initial source of financial investment and incentives to accomplish sustainability goals. Federal agencies are capable of providing thorough, comprehensive, and up-to-date data on forest inventory and analysis, which is critical for informed assessment and decision making at all levels. Similarly, federal agencies could provide leadership in education and technical assistance to landowners. Finally, federal agencies could be catalysts for innovation and could facilitate and encourage nonfederal landowners in developing the infrastructure required to achieve objectives consistent with sustainability.

## SUMMARY OF FINDINGS

Sustainable management of the nation's nonfederal forests is important because nonfederal forests are an important part of the nation's economic, community and environmental landscape. Expectations for the human and ecological benefits these forests are capable of providing are growing. If these expectations are to be met in a sustainable manner, greater financial and human investments in these nationally important forests must be made. The federal role in ensuring the sustainability of nonfederal forests and high levels of investments in them is critical. This role should include building institutional and managerial capacity within regional, state, and local organizations; promoting the integration of environmental and economic policies and programs; developing a coherent set of national principles of sustainability; fostering strategies that lead to regional integration of forestry interests; promoting a blend of economic and information incentives; and encouraging multiple stakeholder decision-making processes at all decision levels.

# PART TWO

## Nonfederal Forest Resource and Program Landscape

# 2

# Resource and Ownership Characteristics

## INTRODUCTION

The nation's nonfederal forests are important for a variety of reasons, including the reality that they are widely distributed over a large area of the country. Further highlighting their importance are the millions of individuals and organizations that have an ownership stake in nonfederal forests. Development of effective policies and programs for nonfederal forests implies an understanding of their size, location, composition, and ownership. Unfortunately, this information is not always readily available or consistent across sets of data. For example, information-gathering agencies often describe nonfederal forests in different ways: some present information on land use, others on vegetative cover. Descriptions of nonfederal forest resources often relate to timberland, a subcategory of forestland. Information about the resource and ownership characteristics of private, especially nonindustrial private forests and Native American forests, is limited and narrowly focused. Recognizing these limitations, resource and ownership information on nonfederal forests is described in this chapter.

## RESOURCE CHARACTERISTICS

### Forestland Area

Nonfederal forests comprise 488 million acres of land, accounting for approximately 66 percent of the nation's forestland area (Table A-1). Nonfederal forests are concentrated east of the Great Plains, while federal forests are concentrated west of the Great Plains. Specifically, 40 percent of the nation's nonfederal

forestland is located in the South Central and Southeast regions of the United States, and a substantial portion (32 percent) is located in the North Central and Northeast regions (Figure 2-1). Nearly one-fifth of the nation's nonfederal forestland is located in the Pacific Northwest and Pacific Southwest regions.

These proportions have generally remained stable between 1987 and 1992 (Table A-2). Nonfederal forestland area is 4.7 million acres less than in 1982 and 2.8 million acres more than in 1987 (Table A-2). The acreage of nonfederal forestland in the Rocky Mountain region declined nearly 7 percent between 1987 and 1992. The amount of nonfederal forestland in the South Central and Southeast regions changed substantially during this same period. The acreage of nonfederal forestland in the South Central region increased by nearly 7 million acres, but declined by more than 3 million acres in the Southeast region.

The estimate of 488 million acres of nonfederal forestland in the nation is based on information gathered and analyzed by the U.S. Department of Agriculture's (USDA) Forest Service. The USDA Forest Service defines forestland as land that is at least 10 percent covered with trees. The area of nonfederal forestland has also been estimated by the USDA Economic Research Service (ERS) and the USDA Natural Resources Conservation Service (NRCS). Both define forestland in terms of land use. The former estimates nonfederal forestland to total 488 million acres in 1992, whereas the latter estimates this acreage (excluding that in Alaska) to total 395 million acres (USDA Natural Resources Conservation Service 1995, USDA Economic Research Service 1995).

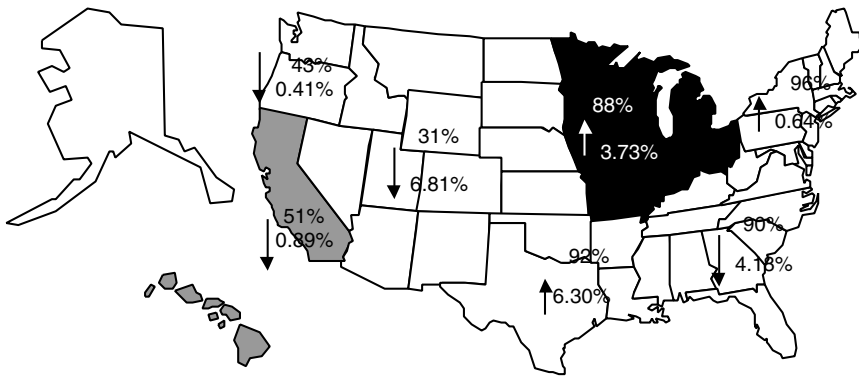


FIGURE 2-1 Nonfederal forestland ownership in the United States by region (designated by different patterns), percentage of total forestland owned by nonfederal forestland owners, and percentage change in forestland acreage between 1987 and 1992 (increase and decrease indicated by arrows).

## Timberland

In 1992, nearly 393 million acres of timberland, or about four-fifths of the nation's total, was considered to be nonfederal timberland (Table A-3). Nonfederal timberland is forestland that is capable of producing more than 20 cubic feet of wood per acre per year and that is not withdrawn from timber utilization by statute or regulation. The nation's nonfederal timberland has increased modestly since 1952, having peaked at slightly more than 396 million acres in 1962. Regionally, nonfederal timberland is concentrated in the South, with 183 million acres or 47 percent of the national total. The Northeast and North Central regions contain 20 percent and 18 percent of nonfederal timberland, respectively. The least amount of nonfederal timberland is located in the Rocky Mountain region, with about 23 million acres or 6 percent of the total.

## Conversion to Non-Forest

A variety of conditions can influence the size of nonfederal forestland area. Afforestation and reforestation can increase the area; urbanization might simply change the character of the forest and its predominate use without diminishing its size. But habitat conversion and forest fragmentation can affect forest size and character.

According to USDA NRCS estimates of land use (not forest cover), the net amount of forestland in the conterminous 48 states has remained relatively constant between 1982 and 1992 (Table A-4). However, of the estimated 395 million acres of nonfederal forestland in 1982, nearly 5.6 million acres was diverted to developed uses, 2.9 million acres to pastureland, and 1.5 million acres to cropland. Developed uses include urban and built-up areas and rural land used for transportation-related purposes (USDA Soil Conservation Service 1991). Another 2.4 million acres were converted to water areas or diverted to federal lands. In all, 14.8 million acres, or 4 percent, of nonfederal forestland were converted to other uses during the decade from 1982 to 1992. During the same period, an additional 15.4 million acres became part of the nonfederal forestland base (Table A-4). The vast majority of the additions came from pastureland (8.2 million acres) and cropland (3.1 million acres). Smaller additions came from water areas and federal land (0.8 million acres) and developed land (0.2 million acres).

## Urban and Community Forestland

Urban and community forestland is increasingly recognized as an important component of the nation's forestland. However, the actual amount of forest cover in urban and community areas is uncertain, in part because of disagreement about what constitutes an urban and community forest. For example, forest ecosystems located in the center of urban areas, in the suburbs around these areas,

and in the communities in more rural areas differ significantly. Moll (1987) estimated urban forestland to be "70 million acres of municipal land and an unaccountable number of acres in suburbs and small towns . . . our urban forest has expanded by about three million acres in the last 10 years." On the basis of information from the Natural Resources Inventory (NRI) on nonfederal, urban land (65 million acres considered urban or built-up), and on forestland (land whose canopy cover, when viewed vertically, is 25 percent or greater) urban and community forestland is estimated to exceed 20 million acres (Table A-5). Most of this land is located in the North Central and Northeast regions (43 percent) and South Central and Southeast regions (47 percent).

### Tree Planting and Plantations

In 1995, trees were planted or seeded on more than 2.4 million acres of land, 88 percent of them on nonfederal forestland (Table A-6). Private owners planted more than 2 million acres, or 85 percent of the total. Although the area planted by the federal government decreased between 1991 and 1995, annual planting on nonfederal forestland remained fairly constant during that period, averaging about 2.2 million acres per year. More than 77 percent of tree plantings on nonfederal forests were in the Southeast and South Central regions. A substantial amount of tree planting, including seeding, also occurred in the Pacific Northwest (USDA Forest Service 1996d).

Approximately 36.4 million acres (5 percent) of the nation's forestland is in plantation forests. More than 85 percent of these acres are located in the Southeast and South Central regions; another 8 percent are in the North Central region. The amount of plantation forestland in the southern United States increased 60 percent between 1977 and 1990 and continues to grow. The annual rates of increase in pine plantation area on forest-industry and other private lands were estimated to be 8 percent and 6 percent per year, respectively, from 1952 to 1992 (USDA Forest Service 1993c). Based on analysis of most recent forest inventory and analysis information, approximately one-fifth of the nonfederal timberland area in the Southeast region is of artificial origin (Table A-7). In the South Central region, 16 percent of all timberland is in plantation forest (Rosson 1995). The area of plantation forest on private land in the Southeast and South Central regions is expected to increase substantially in the coming years, although the exact amount of increase is uncertain. One projection, which assumes that current policies affecting forests and their management will remain unchanged, suggests that southern pine plantation area will increase by more than 9 million acres between 2000 and 2030 (USDA Forest Service 1995a) (Table A-8). Another projection suggests that the total area of private plantation land in the South Central and Southeastern regions would more than triple between 1990 and 2010 (Table A-9) (Alig et al. 1996). The increase would come mainly through forest-industry and nonindustrial private landowners, however, the most dramatic in-

crease would be in nonindustrial private forestland. An increase in the amount of planted land is also forecast for the Pacific Northwest region (Table A-9).

## OWNERSHIP CHARACTERISTICS

### Private Ownership

Private businesses and individuals are the primary owners of the nation's nonfederal forest. In 1992, they owned more than 424 million acres (87 percent) of nonfederal forests, an amount that increased by nearly 6 million acres between 1987 and 1992 (Table A-1). Nearly 353 million acres (79 percent) of nonfederal private forestland are held by nonindustrial private forestland owners, of which approximately 70 percent is owned by non-farming individuals; 30 percent by farmers. Forty-nine percent of nonindustrial private forests are located in the South, and 40 percent in the Northeast and North Central regions. The forest industry and Native Americans own the remaining private nonfederal forestland (17 percent and 4 percent, respectively). Of the 71 million acres of industrially owned timberland, an estimated 2.5 million acres (valued at about $2.5 billion) are owned by institutional investors (Binkley et al. 1996). The forest industry acquired 11.5 million of the 358 million acres of privately owned timberland between 1952 and 1992, while timberland held by farmers and other private owners decreased by 16.8 million acres during the same period (Table A-3).

The bulk of private nonfederal forests—317 million acres or 75 percent—is located in the eastern United States, with 55 percent of forest-industry-owned land nationwide concentrated in the Southeast and South Central regions (Table A-10). Although management direction for industrial ownerships varies, focus is primarily on the production of wood fiber often in the form of plantation forests (especially in the South and Northwest).

Native Americans are major owners of forested lands, with 16 million acres located on 214 reservations in 23 states in 1992. An estimated 5.6 million acres are commercial timberland, 1.7 million acres are noncommercial timberland, 4.4 million acres are commercial woodland, and 4.2 million acres are noncommercial woodland (Intertribal Timber Council 1993). Not all Native American forestland is on reservations. Native American ownership of forestland takes five forms: Tribal Trust (14, 488,000 acres held in trust by the U.S. government for tribes), Individual Trust (865,000 acres held in trust for specific individuals), Individual Restricted Fee (868,000 acres owned by Native Americans but protected from alienation and encumbrance by the U.S. government), Tribal Restricted Fee (6,000 acres owned by the tribe, free from all restrictions, and not held in trust by the U.S. government), and Tribal Simple (820,000 acres owned by the tribe fee simple).

The characteristics of private forestland ownership (especially nonindustrial private forests) have recently been comprehensively assessed by the USDA For-

est Service (1996a). The range in number and size of private owners is large to the extent that generalizations can be misleading. The service estimated the total number of private forestland ownership units, the majority of which are located in the eastern United States (Table A-11), to be 9.9 million. Fifty-nine percent of these units range from one to nine acres. Although owners of these small tracts make up the majority of landowners, together they own less than 5 percent of U.S. forestland (Tables A-12 and A-13). Forty-five percent of the nation's private forestland is made up of tracts of at least 500 acres; 80 percent is made up of tracts of at least 50 acres. Studies indicate a shift toward more owners of smaller forestland parcels. In 1978, approximately 22 percent of the nation's private forestland was made up of parcels of 99 or fewer acres; in 1994, about 32 percent was made up of parcels this size (Table A-13).

Between one-fifth and one-quarter of the nation's private forestland has changed ownership since 1978 (Table A-14). Forty percent of private ownership units were acquired since 1978; only 10 percent were acquired before 1950 (Table A-15). Although they are responsible for 39 percent of the private forestland, only 5 percent of these owners have written forest management plans (Table A-16). Only 3 percent of the owners hold land primarily for timber-production purposes; however, these owners control approximately 29 percent of private forestland (Table A-17). Forestland held primarily for land investment accounts for about 10 percent of the total private forestland area and 9 percent of the owners. Increasingly, timberland also is managed for institutional investors. Binkley et al. (1996) estimated that the timberland acreage held primarily for institutional investors was in excess of 2.5 million acres in 1994. The estimated market value of these lands was nearly $2.8 billion.

## Nonfederal Public Ownership

Public nonfederal owners control 13 percent of the nation's nonfederal forestlands, an amount that declined by approximately 3 million acres between 1987 and 1992 (Table A-1). Nearly 81 percent (52 million acres) of public nonfederal forestland is located in the Northeast, North Central, and Pacific Northwest regions. Public nonfederal ownership of timberland, a subset of forestland, increased from 27 million acres in 1952 to an all-time high of 35 million acres in 1992 (Table A-3). This increase is attributable to a slight decrease in county and municipal timberland area and to the acquisition of more than 8 million acres by state governments between 1952 and 1992.

The importance of nonfederal public forests should not be underestimated, nor should the variety of directions that guide their management. Of the nearly 64 million acres of nonfederal public forests, 84 percent is owned by state governments (Table A-10). Some states acquired forestland through statehood grants (e.g., Washington), whereas others obtained it through acquisitions or possibly tax delinquency (e.g., Pennsylvania and Minnesota). Alaska received major

tracts of forestland through grants authorized by the Alaska Native Claims Settlement Act. County-owned forests, located primarily in the Lake States region, were acquired primarily through tax delinquency.

## SUMMARY OF FINDINGS

Nonfederal forests occupy about two-thirds of the nation's forestland area. During the decade 1982 to 1992, a modest increase in the area of nonfederal forests occurred. Urban and community forestland exceeds 20 million acres. Nonfederal forests are owned primarily by individuals and forest industry. Data sets describing nonfederal forests are frequently inconsistent and incomplete.

# 3

# Forest Values and Benefits

## INTRODUCTION

Nonfederal forests provide a wide variety of benefits that are important to the sustainability of the nation's economies, communities, and natural environments. For example, nonfederal owners of forests often benefit directly from the income they receive from forests and from the pleasure they experience when using and managing their forests. In a broader context, society may be the recipient of benefits provided by nonfederal forests, namely income and employment for its citizens and opportunities for them to exercise their interests in leisure and recreational activities. Obtaining these and many other benefits depends on the nation's willingness to invest in the sustainable management of nonfederal forests. A brief description of the many benefits provided by these forests is presented in this chapter.

## EMPLOYMENT AND INCOME

Forests are sources of employment and income for the nation's citizens. However, with the exception of data on Native American forests, there is little information that directly links these benefits to nonfederal forests on a national scale. For all forest ownerships in the United States, the U.S. Bureau of the Census estimates that nearly 1.3 million people were employed by U.S. wood-based industries in 1992 (GAO 1992) (Table A-18, Figure 3-1). The total payroll received by these employees was $33.9 billion, while the value of shipments made by the industries was estimated to be $209 billion. The American Forest and Paper Association (1995b) also has estimated the economic importance of

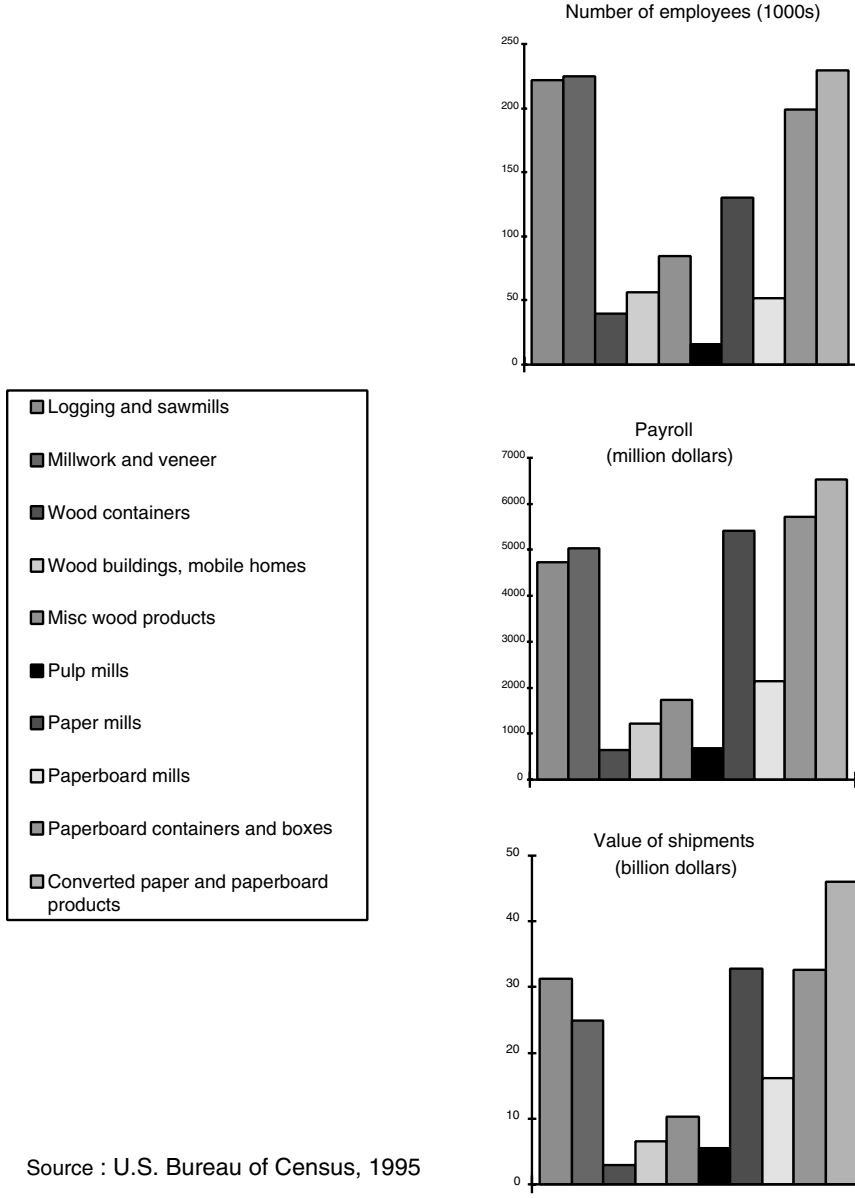


FIGURE 3-1 Economic characteristics of wood-based industries in the United States.

the nation's wood-based industries. In 1990, they employed more than 1.6 million people, of whom 59,100 worked in forestry, 701,800 in the paper industry, and 852,200 in the lumber industry.

Tribal forests are a source of considerable economic wealth for Native Americans. In 1991, these forests and associated programs provided more than 3,000 full-time and 28,000 part-time jobs for Native Americans. The Intertribal Timber Council (1993) estimated that economic benefits accruing from tribal forests were more than $284 million to Native Americans and an additional $180 million to nonNative Americans. Most of these economic benefits result from the harvesting of timber—nearly 810 million board-feet of timber in 1990—on tribal lands. Fuelwood, pinyon nuts, range forage, and other products also have provided a substantial portion ($38 million annually) of the economic benefits provided by tribal forests (Intertribal Timber Council 1993).

The public sector is also an important source of employment for citizens. For example, the U.S. Department of Agriculture (USDA) Forest Service had 31,135 permanent and excepted conditional employees on its payroll as of September 30, 1995. When seasonal and other types of employees are added, total USDA Forest Service employment in that year was the equivalent of full-time employment for 38,330 individuals (USDA Forest Service 1996b). Information from the National Association of State Foresters indicates that in 1994 the state forestry agencies in the 50 states plus the District of Columbia and Guam employed 16,865 permanent employees. This total includes managerial, professional, technical, and clerical employees. Another 7,680 seasonal and temporary employees were employed by these state agencies in 1994. Other forest-related employment can be found within counties, municipalities, private consulting firms, colleges and universities, and nonprofit organizations.

## TIMBER AND WOOD PRODUCTS

Timber and wood products are major contributors to the high quality of life experienced by the nation's citizens. More often than not, these materials come from nonfederal forests. In 1991, the softwood and hardwood timber harvest in the United States exceeded 16.3 billion cubic feet (Tables A-19, A-20, A-21, and A-22). Of this total, 82 percent (13.4 million cubic feet) originated from industrial and nonindustrial private forestland. Timber harvested from city, state, or county land would increase this amount. [Estimates of timber harvest commonly are made available for four major ownership categories: national forest, other public forest, forest industry, and farm and other private forest. The "other public forest" category is a diverse group of federal (for example, Bureau of Land Management, and Department of Defense) and nonfederal public (for example, city, county, and state) land management agencies. A breakdown of timber supply and demand information for the nonfederal public portion of this category is not readily available from existing sources.] If timber taken from this land is

included, harvests from nonfederal forests would likely be in the range of 13.7 to 14.0 billion cubic feet. Since 1952, timber harvested from forest industry and farm and other privately owned forestland has decreased from 86 to 83 percent of the nation's total. More recently (1986–1991), the proportion has increased, primarily as a result of increased harvesting on industrial forestlands (USDA Forest Service 1995a).

Nationwide harvest of timber is expected to increase from slightly more than 16 billion cubic feet in 1991 to nearly 22 billion cubic feet in 2040 (Table A-19). Timber harvest from nonfederal forests is expected to rise through 2040 by 47 percent over 1991 levels, an additional 6.3 billion cubic feet of harvested wood. Expected declines in harvest from national forests and other public ownerships will temper the overall increase in harvest from all ownerships. More than 80 percent of the increase in harvest from nonfederal forests (5.0 billion cubic feet) will originate from nonindustrial private forests. Softwood timber harvest from industrial forests is expected to steadily increase as industrial softwood inventories increase through 2040.

Regional shifts in harvested timber volumes are likely to occur during the next four decades. (Table A-20). By the year 2020, the Southern United States, a region with a large proportion of the nation's nonfederal forests, will produce more than half of the nation's harvested timber volume. Southern timber harvest is expected to rise sharply in response to harvest reductions on Western public lands. Of special concern is the anticipated temporary reduction in harvestable acres on nonindustrial private forests between 2000 and 2010—the result of sharply reduced planting and accelerated loss of nonindustrial forestland to nonforest uses in the 1970s; this activity did not occur on Southern industrial forestlands. Because of the age structure of industrial forests in the South, these forests will not augment the expected reduced harvest on nonindustrial private forests. Timber management will become more intense on industrial forestlands, with the intent of reducing delays in stand regeneration and increasing tree growth once stands are established. This activity will accelerate site occupancy and hasten closure of stand canopies (USDA Forest Service 1995a). As a result of federal timber harvest cutbacks, harvests in the Pacific (Northwest and Southwest) region are projected to decline from 21 percent (1991) to 14 percent (2020) of the nation's total volume harvested. This regional shift is in large part caused by the substantial reductions in harvest that occurred on federal public forestland in the Pacific Northwest and Southwest.

In 1991, growing stock inventories nationwide exceeded 785 billion cubic feet, of which 491 billion cubic feet (62 percent) was situated on nonfederal forest-ownerships (Table A-21). Of the latter, 316 billion cubic feet were held on nonindustrial private forestland.

Nearly 70 percent of industrial growing stock is softwood, and more than 60 percent of nonindustrial growing stock is hardwood. Growing-stock inventories (hardwoods and softwoods) are projected to increase by 21 percent (165 billion

cubic feet) nationwide between 1991 and 2040 (Table A-21). Forest-industry softwood inventories are expected to decline between 1991 and 2000 but increase by nearly 47 percent between 2000 and 2040. In contrast, softwood inventories on nonindustrial private lands will fluctuate minimally between 1991 and 2040 because of an approximate balance between timber removal and growth. The trend for private hardwood inventories is unclear; however, industrial and nonindustrial hardwood inventories are anticipated to be lower in 2040 than in 1991. On industrial and nonindustrial lands, inventories will be concentrated in timber ages near or below minimal merchantable limits. Although regional variations will occur, private forests will be younger and, on average, smaller in diameter than in the past. In addition, (USDA Forest Service 1995a).

Nonfederal forests accounted for more than 75 percent of the nation's net annual growth of growing stock in 1991 (Table A-22). Of the nonfederal portion (16 billion cubic feet), one-quarter was held on industrial forestlands. In general, hardwood net annual growth is expected to decline and softwood growth to rise through 2040 on industrial and nonindustrial forestland.

Growth and inventory trends on nonfederal forests are likely to have important impacts on water quality, wildlife populations, and recreation values. For example, on private lands, habitat will shift to favor species that can use early- and mid-successional stages of forest development; on public nonfederal forestlands, mid-to-late successional habitat will become more abundant.

## NONTIMBER FOREST PRODUCTS

Nonfederal forests are also a source of nontimber products, such as pine cones, honey, mushrooms, and maple syrup. Currently, more than 450 special forest products in 18 categories are harvested from American forests (USDA Forest Service 1993). In the Northeast, for example, the gathering of pine cones for seed or decorative purposes is common on private forestland. From state-owned public forestland, Minnesota has sold between $8,000 and $10,000 worth of pine cones annually. Traditional food products (pine nuts, camas, and huckleberries) are gathered by tribal members, wildcrafters (Box 3-1), and recreational visitors on nonfederal forestlands. In 1990, the value of honey production in Florida was an estimated $10 million, most of which is attributable to an apiary in the Apalachicola National Forest near Tallahassee (USDA Forest Service 1993a). Forest industry leases bee rights on substantial portions of the Atlantic Coastal Plain and Flatwoods, providing a significant base of honey production.

In the Pacific Northwest, harvesting of mushrooms is an economically and socially important activity in many nonfederal forests. For example, the Washington Department of Natural Resources leases land to individuals to harvest mushrooms. Mushrooms are currently generating sales over $125 million in the Pacific Northwest, with a work force of over 10,000 people. Little is known about the conditions that produce these fungi, yet harvests continue to increase.

**Box 3-1**
**Wildcrafting Uses of Forest Resources**

Wildcrafting use of forests is rapidly expanding, particularly in areas where logging on public lands has recently and sharply declined. For example, in northern California, lichens, decorative boughs, burls form the bases of trees, and mushrooms have partially replaced timber as a major regional source of revenue. In Trinity County, an area with about 90 percent Federal forestland, over 50 herbs are now collected and marketed by wildcrafters. While not by any means a complete economic substitute for timber, wildcrafting brings in hundreds of millions of dollars nationally and is growing at about 20 percent per year. Concerns that over-harvesting may place these resources in jeopardy have prompted researchers to begin collaborative work with wildcrafters and local Native American tribes, where much of the historic expertise in using forest products other than timber resides.

Source: Adapted from the New York Times 1996

Much of the production of maple syrup, including the tapping of trees, is carried out on nonindustrial forestlands, especially those that are privately owned. Nationwide, the value of maple syrup production in 1991 was in excess of $39 million (USDA Forest Service 1993a). Floral greenery is an established special forest product, and forestlands can be managed specifically to encourage favored species and environmental conditions. Basket weaving by Native peoples, such as the basket weavers of California, is another important example of the production of nontimber forest products.

Nontimber forest products are easily identified with particular land parcels or regions of the United States. These products present landowners with commercial opportunities or opportunities to use the activities of gatherers as management tools to manipulate vegetation by species or by product quality. Harvest of special forest products on federal and nonfederal lands is likely to increase. Annual income from visually nonintrusive harvesting of such products is an incentive for nonfederal landowners to be involved.

## URBAN AND COMMUNITY BENEFITS

Although urban residents use wildlands beyond city limits, they spend comparatively more time in urban and community forests (Miller 1988). This is especially true for the disabled, the elderly, young, or those who have low incomes. Urban and community forests provide a variety of important social and environmental benefits (Box 3-2), the economic value of which has been estimated to be $3 billion per year nationwide (McPherson and Rowntree 1991).

Urban and community forests moderate climate; protect air quality; control rain runoff; lower noise levels; provide wildlife habitat; improve the aesthetics of

**Box 3-2**
**Urban and Community Forest Values:**
**Tree Canopies in Milwaukee, Wisconsin**

Milwaukee has begun to quantify the costs and benefits of trees in its urban ecosystem. Reductions in storm-water flow, conservation of energy, and improvements in air quality were studied to determine the financial contribution of the tree canopy to the city.

An analysis using a Geographic Information System (GIS) indicated that only about 16 percent of Milwaukee has tree canopy cover and of this 80 percent is on private property. This relatively low tree cover, which varies from 1 to 42 percent per ownership unit, can be attributed to human development and Dutch Elm Disease.

The existing tree canopy cover reduces storm-water flow by up to 22 percent and provides an estimated $15.4 million in savings. If all the trees in Milwaukee were removed, the additional storm-water would require the construction of an estimated 357,083 cubic feet of water retention capacity.

The city's trees also sequester an estimated 1,677 tons of carbon annually, a benefit valued at $1.5 million. By maximizing urban tree canopy cover to match existing well-canopied sites, 4,793 tons of carbon could be sequestered annually. The resulting summer energy savings are estimated to be $650,000.

Currently, benefits from trees in urban areas are not derived primarily from marketed products or raw materials but from improvements in temperature and other environmental measures, such as storm-water flow, water quality, energy use, real estate values, pollution control, and health and psychological benefits. Whether they are on publicly or privately owned land, trees in the urban ecosystem provide unique benefits.

cities; and, in some instances, conserve energy, carbon dioxide, and water. They also provide social benefits, which include medical, psychological, social, and managerial benefits (Schroeder 1991). Medical benefits accrue from reduced stress and general improvement in public health. Psychological benefits result from the improved aesthetics of residential streets and community parks as well as from communities' enhanced sense of social identity and self-esteem, particularly in areas with active community involvement in tree-planting programs (Kaplan 1995a,b).

Urban and community forests also provide benefits that are directly appropriable by landowners, such as the value of timber located near urban areas. For example, in Alabama, Florida, Georgia, South Carolina, North Carolina, and Virginia approximately 26 percent of the timberland is located in Metropolitan Statistical Areas (DeForest et al. 1991). Landowners also benefit from increases in real estate value, increases that are directly attributable to trees. A conservative estimate is that the value of trees surrounding detached housing units in the United States is the source of an additional $1.5 billion per year in property tax revenue (Dwyer 1991). Various studies also suggest that property owners benefit from energy conserved as a result of properly located and sized trees.

## RECREATIONAL OPPORTUNITIES

Nonfederal forests provide citizens with a wide variety of recreational benefits, particularly on public nonfederal forestland. In 1989, an estimated 52.6 million acres of state land was available for recreational use, nearly half of which was managed by state forestry agencies (English et al. 1993). State park and state fish and game agencies managed 19 percent and 31 percent of this area, respectively. Despite their relatively small land base, local governments managed the other half of outdoor recreational use. This is due to the close proximity of recreational public-land sites to people's homes.

Recreational pursuits are also available on private forestland. In the contiguous United States, for example, an estimated 23 percent of nonindustrial private forestland is available for recreational use by the general public (USDA Forest Service 1989). In addition to the 23 percent of nonindustrial private forestland that is accessible by the general public, another 45 percent is open to people personally acquainted with the landowner, and 26 percent is open only to landowners and their immediate families (USDA Forest Service 1989b). The aesthetic values of nonindustrial forestland are also important to landowners and citizens alike (Moulton and Birch 1995). Along major travel corridors, private groups have coordinated efforts to manage forest landscapes in manners that will preserve important scenic amenities.

Fishing and hunting in forested environments provide substantial personal enjoyment to citizens and economic returns to rural communities. Fishing and hunting rights are sold on many nonfederal forestlands. Nonconsumptive uses of forest wildlife are expected to grow twice as fast as the nation's population to 2000, with all forms of cold-water fishing activity to increase at about the same rate as the population (USDA Forest Service 1989, 1994). Citizens are also experiencing benefits from increases in wildlife species that thrive in forest-edge environments (e.g., deer, elk, turkey) (MacCleery 1995). Public lands, including nonfederal public forestlands, are expected to become relatively more important for big-game hunting and cold water fishing, assuming that access remains generally unrestricted and free. Hunting on private forestlands for a fee is also expected to increase (USDA Forest Service 1989, 1994).

Tribal forests are sanctuaries for worship and religious ceremonies and contain burial sites and other culturally significant areas for Native Americans. Forest wildlife contributes to the religious, cultural, and medicinal needs of many tribal members (IFMAT 1993).

Although not necessarily focused on securing recreational benefits, citizens frequently seek to preserve forests, including certain nonfederal forests, as a means of ensuring that future generations will be in a position to make choices about their use, management, and protection. Citizens' general interest in preserving forests that they will probably never lay claim to is an indication that they value these forests and the benefits provided by them.

## ECOLOGICAL BENEFITS

Nonfederal forests provide a wide variety of ecological services and benefits. For example, they are storehouses of large amounts of carbon. In the continental United States, nonfederal forests store an estimated 38.6 billion metric tons of carbon (90 percent of the national total), and Alaskan forests store an additional 16 billion metric tons. Approximately 90 percent of this continental storage capacity is provided by timberland—55 percent in nonindustrial private forests and 15 percent in industrial forests. Between 1987 and 2000, nonindustrial private timberland is projected to sequester an average of 61 million metric tons of carbon annually in living trees and understory vegetation. Carbon sequestration from removals (for example, wood products) is estimated to be 58 million metric tons annually during the same period-although the fate of carbon stored in these products is unclear (Heath and Birdsey 1996).

Nonfederal forests provide habitat for important threatened and endangered species. Of 712 listed species, 609 (86 percent) have their habitat on private individual or corporate property, much of which is forested. Public nonfederal lands provide habitat to 516 species (72 percent), while nonprofit-owned land and tribal land provide habitat to 181 and 61 species (25 and 9 percent), respectively. Fifty-two species are found on other nonfederal lands (GAO 1994a). Considering all ownerships, forests provide approximately half the habitat for the nation's threatened and endangered species (USDA Forest Service 1994d). More than 90 percent of these listed species have some or all of their habitat on nonfederal lands, although not necessarily on forested lands (GAO 1994a). Nearly three-quarters have at least 60 percent of their habitat on nonfederal lands; 37 percent are completely dependent on nonfederal lands.

Forests are also the source of approximately 60 percent of the nation's total stream flow, the primary means by which high-quality water is provided for industrial, municipal, and recreational uses. As the nation's major forest ownership category, nonfederal forests play an especially important role in this respect. Analyses suggest that precipitation on all types of land currently provides enough surface and ground water (1.4 trillion gallons per day) to meet not only present but also prospective withdrawals: 500 billion gallons—only 10 percent of precipitation—by 2040. However, these estimates mask important regional supply-demand imbalances, which are caused primarily by geographic, seasonal, and annual variations in supplies. These are areas of the nation where ground water development, instream use (e.g., navigation, recreational activities, and hydropower generation) and surface water development (e.g., municipal and industrial uses) are expected to be especially demanding (USDA Forest Service 1988a). In areas where these conditions occur, nonfederal forests will be called upon to play an especially important role in providing quality water in sufficient quantities.

The quality of water flowing from forested land has been of special concern since the early 1970s when federal laws began to emphasize activities to deal

with nonpoint sources of water pollutants. The quality of water flowing from forest and rangelands is good (USDA Forest Service 1993)—in large measure, this is because of federal programs that encourage states to initiate plans and programs for addressing water quality issues. In response to these federal programs, state governments, in cooperation with private concerns, have established a wide variety of water-quality best management practices that are being delivered to landowners and timber harvesters via educational, technical assistance, financial, and regulatory programs. In general, landowner and timber harvester compliance with these best management practices is quite high, often exceeding 90 percent.

The positive condition of water quality flowing from forests should not imply a lack of opportunities for improvement. With regard to fish and wildlife generally, it is estimated that about 80 percent of the nation's flowing water from forest and nonforest sources can be improved in terms of quantity and quality, fish habitat, or composition of the fish community (USDA Forest Service 1994d). However, an estimated two-thirds of U.S. streams have habitat conditions that are adequate for sports fish. Considering only forests as a land cover type, there continues to be concern over the impact that forestry activities have on nitrate levels, water temperature, and suspended sediment. The latter is of special concern, especially following road construction and the application of some harvesting and grazing practices (Brown and Binkley 1994). Some practices in riparian areas also have raised concerns, especially removal of overstory along streambanks, which can raise water temperatures enough to adversely affect fish survival.

## SUMMARY OF FINDINGS

Nonfederal forests provide a wide variety of benefits to the nation's citizens. These include employment and income opportunities, timber and wood products, nontimber forest products, urban and community benefits, recreational opportunities, and ecological benefits. In many cases, information regarding these benefits is limited because information on the type, magnitude, and value of benefits is not often collected or made available.

# 4

# Policies and Programs

## INTRODUCTION

In recognition of the values and benefits provided by nonfederal forests, a variety of public and private organizations provide services to the nation's nonfederal forest landowners. Many programs have been developed to enhance management on these lands, and some have had a lasting influence. As with forestland conditions, a substantial amount of information is available on federal programs and expenditures, less information is available on state programs and expenditures, and little information is available on county and municipal programs and expenditures. These federal, state, and local programs affecting nonfederal forests are described in this chapter.

## FEDERALLY DIRECTED PROGRAMS

Although a variety of federal agencies have responsibility for the administration of programs for nonfederal forests (Box 4-1), the bulk of these programs are administered by agencies within the U.S. Department of Agriculture (USDA). These agencies include the USDA Forest Service, the USDA Natural Resources Conservation Service, the USDA Cooperative State Research, Education, and Extension Service (CSREES), and the USDA Farm Services Agency. Other agencies with programs for the use, management, and protection of nonfederal forests are the U.S. Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers, the U.S. Department of the Interior (USDI) Bureau of Land Management, Bureau of Reclamation, and the U.S. Fish and Wildlife Service.

**Box 4-1**
**Federal Agencies Involved in the Administration of Programs with Implications for Nonfederal Forests**

*U.S. Department of Agriculture*

- *Forest Service*. Forest Research Program and Information Management Program, and State and Private Forestry programs such as Rural Forestry Assistance, Forest Stewardship Program (FSP), Stewardship Incentives Programs (SIP), Forest Legacy Program, Forest Health Protection Program; Urban Forestry Program; Cooperative Fire Program; and regionally site-specific programs such as Forest Ecosystem Management Assessment Team (FEMAT) and Interim Strategies for Managing Anadromous Fish-Producing Watersheds (PACFISH) in the Pacific Northwest.
- *Cooperative State Research, Education, and Extension Service.* Renewable Resources Extension Act (RREA) Programs; Smith-Lever Extension Programs; Natural Resources and the Environment Competitive Grants Research Program; Hatch Act; McIntire-Stennis Cooperative Forestry Research Program.
- *Natural Resources and Conservation Service*. Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), Wildlife Habitat Incentives Program, Resource Conservation and Development Program (RC&D), and Small Watershed Program.

*U.S. Department of Commerce*

- *National Oceanic and Atmospheric Association.* Coastal Zone Management Program (CZM), National Estuarine Research Reserve System (NERRS), Great Lakes Environmental Research Laboratory (GLERL), Louisiana Sea Grant Program, and Chesapeake Bay Program; and National Marine Fisheries Service (NMFS): National Marine Sanctuary Program and regulatory authority under the Endangered Species Act.

*U.S. Department of the Army*

- *Corps of Engineers*. Section 404 of the CWA/Wetlands Delineation and Regulatory Program; Watershed Planning Program; participant in PACFISH; Everglades Restoration Program; and other regionally specific programs.

*U.S. Department of the Interior*

- *Bureau of Indian Affairs*. National Indian Forest Resources Management Act Programs/Integrated Resource Management Plans (IRMPs).
- *Bureau of Land Management*. Bring Back the Natives Program; Riparian Area Management Program, Partners in Flight (PIF) Program; and regionally-specific programs such as FEMAT and PACFISH.
- *Bureau of Reclamation*. Site-specific programs such as “Club Fed” in the Mid-Pacific Region, Colorado Ecosystem Partnership, and PACFISH.
- *Fish and Wildlife Service*. Endangered Species Protection Program; Private Lands Program; North American Waterfowl Management Program; Coastal Ecosystem Program; Sport Fish Restoration and Wildlife Restoration Programs; Partners in Flight (PIF); Great Lakes Initiative; Land Acquisition Priority System (critical areas acquisition program); and National Wetlands Inventory (NWI).

*Federal Agencies...continues*

*Federal Agencies…continued*

- *National Park Service*. Regionally specific programs such as the Greater Yellowstone Ecosystem, Mammoth Cave, and South Florida/Everglades Restoration.
- *U.S. Geological Survey*. Critical Ecosystem Research and Assessment (CERA) Program, Federal State Cooperative Program (water information), GIS Program, GAP Analysis Program, and National Minerals Assessment Program.
- *Land and Water Conservation Fund*. Fund for state and federal land acquisitions.

*U.S. Department of Labor*

- *Occupational Safety and Health Administration*. Timber industry workplace safety program.

*U.S. Department of the Treasury*

- *Internal Revenue Service*. Federal tax system, including estate taxes, capital gains tax, management cost deductions, and reforestation investment tax incentive.

*U.S. Environmental Protection Agency*

- *EPA Programs*. Environmental Monitoring and Assessment Program (EMAP); Clean Water Act Programs (nonpoint pollutant sources); Clean Air Act Programs (controlled burn air pollutants; programs authorized by Toxic Substances Control Act (TSCA), Resource Conservation and Recovery Act (RCCRA), and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); Wetlands Regulatory Program (shared with Corps of Engineers); Research Grants Program; Watershed Planning Program; and regionally-specific programs such as Great Lakes National Program, Mid-Atlantic Highlands Assessment Program, Great Plains Project, San Franciso Bay and Delta Estuary Initiatives, Pacific Northwest Forest Plan, and Chesapeake Bay Program.

## Assistance and Incentive Programs

The State and Private Forestry unit of the USDA Forest Service is involved with three major types of programs that deliver assistance and incentives to owners and managers of nonfederal forests: Forest Health Management, Cooperative Forestry, and several transfer programs. The total State and Private Forestry budget of $136.8 million is 6 percent of the total USDA Forest Service budget, $2.167 billion, which does not include Cooperative Work Trusts, the Reforestation Trust Fund, and Permanent Appropriation.

### Forest Health Management

Forest Health Management appropriations totaled $49.9 million in 1996, having steadily declined between 1992 and 1996 (Table A-23, A-24). Forest Health Management includes the Federal Lands Forest Health Management, Co-

operative Lands Forest Health Management, and Cooperative Lands Fire Management programs. The functions of these programs are described in Appendix B. In the past, forest health efforts have been focused on insects, diseases, and fires. The USDA Forest Service is expanding the concept of forest health to include ecosystem composition, structure, and function and maintenance of biological diversity.

### Cooperative Forestry Programs

Cooperative Forestry appropriations totaled $86.9 million in 1996 (Tables A-23, A-24). These appropriations increased between 1992 and 1996, when they decreased substantially. Cooperative Forestry programs provide funding and direction for the strengthening of rural communities, resource and conservation education, stewardship cost-shares, conservation easements, and urban and community forestry initiatives. Specific program details of these federal assistance and incentive initiatives are presented in Appendix B.

### Transfer Programs

Transfer programs allocate funds to organizations other than the USDA Forest Service, which plays a role in the programs. Examples include emergency watershed protection, resource conservation and development, and watershed protection and flood prevention programs. Under the 1996 farm bill, many transfer programs have been consolidated under the Environmental Conservation Acreage Reserve Program (ECARP), which was established as the umbrella program encompassing the Conservation Reserve Program (CRP) and the Environmental Quality Incentives Program (EQIP). Cost-share programs that are relevant to the nation's nonfederal forestland owners are described in Appendix B.

In 1993, four federal transfer programs provided substantial cost-share assistance to the nation's nonfederal forest landowners (Table A-24). These programs were the Agricultural Conservation Program (ACP; replaced by EQIP), the Forestry Incentives Program, the Stewardship Incentives Program, and the Tree Assistance Program. The total amount of federal cost-share spending under these programs was $32 million in FY 1993. In that year, the South Central and Southeast regions received nearly two-thirds of the financial assistance provided by these programs, in part because nearly 81 percent of the cost-share dollars provided under the Forestry Incentives Program (FIP) were expended in these regions.

## Extension and Outreach

Although many federal agencies and programs have extension and outreach implications for nonfederal forests, major federal responsibility for extension

programs is the USDA-CSREES. Among its many educational programs, the most discernible for nonfederal forests are those authorized by the Smith-Lever Act and the Renewable Resources Extension Act (RREA). In 1996 and 1997, appropriations in each year to implement these programs totaled $3.291 million. These funds are partnered with state funds that enable program implementation by over 300 cooperative extension forestry specialists and agents.

### Federal Regulatory Programs

Few federal statutes have regulatory implications for use and management of nonfederal forests; these statues are complex and their administrative focus is controversial. Federal laws and regulations can prohibit or severely limit certain practices on private forestland. For example, the Occupational Safety and Health Act sets conditions for felling and skidding and the Federal Insecticide, Fungicide, and Rodenticide Act sets conditions for the application of pesticides in forested areas. These laws can also require state actions that foster conditions favorable to the establishment of forest regulatory programs. For example, the Clean Water Act requires programs for controlling nonpoint-source pollution, and the Coastal Zone Management Act requires adoption of enforceable procedures to protect coastal resources. Examples of federal laws that either directly regulate forestry activities or provide an atmosphere encouraging such regulation are discussed in Appendix B (American Forest and Paper Association 1994).

## STATE-LEVEL PROGRAMS

Federal forestry agencies and programs usually have a counterpart in state government. Through these state linkages, the federal government often is able to express the national interest in nonfederal forests. In 1994, state forestry agencies invested $1.1 billion in a variety of forest resource management and protection programs, an increase of nearly $500 million compared with 1984 levels (Lickwar et al. 1988) (Table A-25). Nearly 59 percent of this sum originated from state general revenues, 14 percent from fees for goods and services (for example, timber sales and recreational fees), and 7 percent from various federal sources. The remaining 20 percent was provided by other sources, including private-sector and nonfederal government sources. State agency funding varies considerably by region. Fire management is the largest single budget item. Funds for this activity are expended mostly in the South and West regions (Table A-26). Activities related to state forests were the second largest budget item ($102 million), followed by cooperative forestry expenditures ($77 million).

State forestry agencies use these programs to accomplish societal goals in the use and management of private forests. The goals include maintenance of biodiversity, protection of endangered species, and promotion of aesthetic values. The usefulness of any one program is dependent on its ability to positively

influence the application of specific forestry practices, such as reforestation after harvest, the creation of buffer zones along sensitive waterways, and the practice of soil-sensitive timber harvesting techniques. Program selection is influenced by contextual factors, including the geographical variability of a state's forest resources; economic importance of the forest-based sector within a state; historical traditions of governmental intervention in the private sector; and limits on available financial and human resources. Program choices also are swayed by the capacity of potential programs to achieve social and political objectives for the use and management of private forest resources.

## Assistance and Incentive Programs

State governments assume a variety of roles when addressing the use and management of private forestland. States can implement information or service-oriented programs that involve the transfer of technical assistance and information to landowners. States also can influence private forestry practices by offering financial incentives, which can take the form of direct cost-sharing of forestry practices or the granting of tax credits or property tax assessments. If service-oriented programs and fiscal incentives fail to result in private forestry practices that complement societal interests in private forests, state governments can implement regulatory measures. These measures force uniform application of socially acceptable forest practices on all private lands within a state.

Programs used by state forestry agencies to directly influence the use and management of private forests can be grouped into the following major categories: educational, technical assistance, voluntary guideline, tax incentive, fiscal incentive, and regulatory (Appendix B). Of the many programs implemented by the lead state forestry agencies in 1992, most fell into the technical assistance category (28 percent of the program applications listed in Table A-25), followed closely by programs that were primarily educational (27 percent) (Table A-27). These programs rank similarly high in the number of states that have such programs. Depending on the forestry objectives to be met, technical-assistance programs exist in 88 to 96 percent and educational programs in 84 to 94 percent of all states (Ellefson et al. 1995).

### Program Focus

Among the major objectives that lead state forestry agencies promote are protection of water quality (vegetative buffer strips, skid trail design, road construction and maintenance); promotion of reforestation (silvicultural regeneration systems, and artificial regeneration practices); improvement of timber harvesting procedures (harvest engineering systems, location of landings, and size of harvest area); protection from wildfire, insects, and diseases (forest health) (treatment of slash, appropriate application of pesticides, and silvicultural prescriptions for

insect and disease control); management of wildlife and protection of rare and endangered species (vegetation management, and exclusion of competing uses); and enhancement of recreational and aesthetic qualities (trail design and construction, and scenic buffer prescriptions).

Protection of wildlife and threatened and endangered species is a common subject for educational and technical assistance programs, although more than half of the states also use fiscal incentive programs for these purposes (Table A-27). Regulatory programs are used by 20 states to accomplish these objectives. Tax-incentive programs are used by only three states as a means of protecting wildlife and endangered species on private forestland.

State forestry agencies are unlikely to rely on a single type of program to influence the forestry practices of private landowners. For example, to protect water quality, educational and technical assistance programs are used by 46 and 47 states, respectively; 34 states also have chosen to use voluntary-guideline programs and 28 states employ regulatory measures for this purpose (Table A-27). Educational and technical assistance programs dominate as means of accomplishing reforestation objectives, but 39 states also use fiscal incentive programs to this end (Ellefson et al. 1995).

**Regional Differences**

Regional physical characteristics, the importance of forestry in state economies, and past traditions of state involvement in private land-management activities are the primary variables affecting the types of programs each state implements to influence private forestry activities. Educational and technical assistance programs account for 23 to 31 percent of a region's total application of programs (Table A-26). Voluntary guideline programs tend to comprise a larger proportion of total program applications in the South Central (16 percent) and the Rocky Mountain (17 percent) regions than in other regions (9 to 14 percent). The West region has the lowest rate of application of voluntary guideline programs (9 percent) (Ellefson et al. 1995).

The Mid-Continent region has the highest application of tax incentive programs (14 percent), whereas the Southeast region has the least (1 percent) (Table A-27). In general, such programs are less commonly used in the Great Plains region (3 percent), the Rocky Mountain region (2 percent), and the West region (3 percent). Applications of fiscal incentive programs applications as a proportion of a region's program applications are highest in the Mid-Atlantic (18 percent), South Central (18 percent), and Rocky Mountain (17 percent) regions (Ellefson et al. 1995). In the northern states, where private landowners are the dominant forest landowner category, the relatively flat topography and the modest impact of timber harvesting generally has fostered state government involvement in private forest landowners' activities primarily by providing extension education, technical assistance, and financial incentives. In the southern states,

the role of state government in private forestry has historically been nonintrusive. With 90 percent of all forestland in private ownership, the attitude regarding government intervention in private property matters has been traditionally conservative. Many attribute the success of the intensive management of the southern pine forests as evidence of the forestry community's ability to effectively use nonregulatory programs to provide a range of forest-based benefits (Ellefson et al. 1995).

## Regulatory Programs

### State Programs

The first major state efforts to regulate the forestry practices of private landowners occurred in the 1930s and 1940s with the establishment of seed-tree laws, all of which have been repealed and replaced with more modern regulatory programs (Ellefson and Cubbage 1980). Fostered by heightened social and political concern over natural environments, the second generation of forest practice(s) regulatory programs arose during the 1960s and 1970s. Between 1971 and 1974, California, Nevada, Oregon, Idaho, and Washington became the first states to establish comprehensive forest practice(s) regulatory laws. Alaska and New Mexico followed suit in 1978. In 1982, Massachusetts's legislative assembly substantially expanded the regulatory authority granted by the state's Forest Cutting Practices Act (Henly and Ellefson 1986). Maine enacted a comprehensive forest practice(s) law in 1989, as did Connecticut in 1991. No southern or midwestern state has adopted a comprehensive forest practice(s) regulatory law.

Since the mid-1980s, a third generation of forest practice(s) regulatory laws and programs has evolved. In some states (for example, California and Washington), these laws and programs are concerned with the long-term, cumulative effects of forest practice(s) on the sustainability, productivity, and biological diversity of forest ecosystems. In other states (for example, Florida, Maryland, Montana, and Virginia), forestry practice is only one component of a broader state regulatory system that is designed to reduce nonpoint sources of water pollution from agricultural, forested, and urban areas or to promote natural resource conservation generally. In many states (for example, Georgia), forest practice(s) regulatory laws are a statewide mosaic of rules and ordinances promulgated by local units of government.

Regional differences in the rate of application of forest practice(s) regulatory programs help explain the programs' national presence (Table A-27). These programs comprise the smallest share of regional regulatory programs in the Mid-Continent (2 percent), Great Plains (2 percent), Southeast (4 percent), and South Central (5 percent), and the largest share in the Northeast (17 percent) and the West (29 percent) regions. In the western states, the large forest industry, the rugged topography, and a politically energetic public have spurred the develop-

ment and implementation of regulatory programs. Although state regulation of forest practices exists in some northeastern states, this approach to influencing private landowner forestry activities has not yet been firmly established throughout the region. Although regulation is widely regarded as unacceptable in the South, the region has the highest acreage enrolled in cost-share assistance programs, indicating private landowners' interest in governmental assistance and tolerance for ensuing government involvement (Ellefson et al. 1995).

Interest in state initiatives to regulate the forestry practices of private owners relates to circumstances unique to a particular state. In some states, this interest is reflected by the high level of activity to amend, revise, and update existing statutes, rules, and regulations. Since 1989, all states with comprehensive forest practice(s) regulatory programs (most notably, California, Oregon, and Washington) have revised their acts, rules, or standards. Interest in adopting regulatory programs can also be the result of certain forest management practices, heightened public interest in natural environments, a regulatory climate fostered by federal environmental laws, sentiment favoring greater accountability, proliferation of local ordinances, landscape value of forests, and a desire to emulate the actions of other regulating entities.

In most states, individuals and organizations with forestry interests oppose the adoption or expansion of regulatory programs, but some states are actively considering regulatory approaches. In 1992, seven state legislatures were considering legislation to establish a regulatory program as part of a state forest practice(s) law; ten states have contemplated such a law in the past. State government managers of private forest management programs in five states suggest that a regulatory program, in the form of a state forest practice(s) law, is needed now in their state; nine additional states will need such a law within 5 years, 10 states within 10 years, and three states within 20 years. Managers in seven states suggest that a regulatory program focused on private forestry practices will never be needed in their state (Ellefson et al. 1995).

Some circumstances discourage adoption of programs to regulate forestry practices. In the opinion of state forestry program managers involved in managing private forests, a major deterrent to the establishment of new or expanded regulatory programs is the perceived resistance of private landowners to compliance with the rules and regulations that might be embodied in such programs. Many states consider the financial burden on private landowners as an obstacle, as well as the cost of administering a regulatory program.

### Local Programs

County and city governments have also taken the initiative to regulate the forestry practices of private landowners (Cubbage and Raney 1987, Cubbage and Siegel 1988, Cubbage 1989). Most local regulation occurs in the East; forest

practice(s) laws in the West often preclude local regulation. As of 1991, nearly 400 local ordinances regulated forestry practices (Hickman and Martus 1991). More than 70 percent of these ordinances have been established since 1980 — 50 percent since 1985. Nearly three-quarters of the ordinances have been enacted in the Northeast.

Some state forest practice(s) laws prohibit or severely restrict local governments from regulating forest practice(s). For example, Oregon's Forest Practices Act states that "no unit of local government shall adopt any rules, regulations or ordinances or take any other actions that prohibit, limit, regulate, subject to approval or in any other way affect forest practices on forest lands located outside of an acknowledged urban growth boundary" (Oregon Forest Practices Act 1993). Pennsylvania and New Hampshire prohibit municipal zoning and planning authorities from limiting timber harvesting activities. California permits local governments to regulate forest practice(s), but only after review and approval by the State Board of Forestry; five counties have special board-adopted rules.

However, some states explicitly give local governing units authority to adopt forest practice(s) rules. In Maine, for example, "nothing in this subchapter [forest practice act] shall be construed to preempt or otherwise limit the existing authority of municipalities to regulate harvesting, except that [they] shall adopt definitions of forestry terms . . . that are consistent with forestry terms adopted by the commissioner." Similarly, in Connecticut, "municipalities may regulate forest practices in a manner consistent with the purposes of the [Connecticut Forest Practices Act]."

## PROGRAM EFFECTIVENESS

Studies have been conducted to examine the effectiveness of programs directed at nonindustrial private landowners. Some studies have analyzed the biological result of these programs. For example, Kurtz et al. (1994) examined the retention of trees planted through three cost-share programs, namely the Soil Bank Program (SBP), the ACP, and the FIP. Under FIP, 95.7 percent of acres were retained in forest cover; the percentages of acres retained under ACP and SBP were 87.1 51.1, respectively. The differences in the percentages are due to the period of time in which each program operated. For instance, FIP is a relatively new program, and therefore FIP plantations are all relatively young and most trees have not reached harvestable age. Moulton et al. (1991) examined the impact of the tree planting on biological diversity and found that trees replaced what had once been continuous cropland or extensions of cropland, and therefore tended to increase cover-type diversity. Also, plantings were judged to be often comparatively small in size, and more than 70 percent of them were not adjoined by existing pine stands on any side.

Other studies have analyzed the influence of these programs on landowner behavior (Table A-28). Alig et al. (1990) reviewed and summarized the variables

affecting tree-planting decisions and, after a review of the relevant literature, concluded that

> (1) cost-sharing correlates with increased tree planting, (2) cost-share plantings are typically not liquidated when support payments end, (3) technical assistance with harvesting tends to increase stumpage revenues for owners and results in residual timber stands that are in better condition, and (4) technical assistance is correlated with increased harvesting.

In a review of FIP by Gaddis et al. (1995), public and private rates of return were found to average about 10 percent for the various public and private accounting criteria, and program benefit-cost ratios consistently exceeded 1.0 by a substantial margin. Federal income taxes on timber harvests from FIP planting eventually would be more than double annual FIP expenditures. Some studies found that FIP could create social welfare losses by public intervention, which is consistent with economic theory. Several researchers have examined the possibility that public funding could substitute for private funding (capital substitution), but only one study found any measurable effects.

The experiences of program administrators (state foresters, directors of forestry divisions or bureaus, or directors of private forest management programs) can be useful in determining the effectiveness of educational, technical assistance, voluntary guideline, tax incentive, fiscal incentive, and regulatory programs. When asked to rate the capacity of different types of programs to influence private forestry practices in manners considered necessary to accomplish various forestry activities or objectives, program managers consistently judged educational and technical assistance programs to be the more effective means of influencing private forestry activities (Table A-29). They judged voluntary guideline and regulatory programs to be less effective or ineffective. Technical assistance programs were rated most effective for accomplishing five of six specified forestry activities or objectives. Only educational programs were considered more effective for protecting wildlife, including threatened and endangered. Voluntary guideline, regulatory, and tax incentive programs were determined to be least effective in addressing one or more of the objectives. Voluntary guideline programs were judged least effective for promoting reforestation; regulatory programs for improving timber harvest methods and enhancing recreational qualities; and tax incentive programs for protecting water quality, forest health, and wildlife (Table A-29).

Many studies examining the effects of various public policies, landowner characteristics, and market factors on the forest management practices of nonindustrial private forestland owners indicate that cost-share assistance provides the greatest motivation for owners to reforest their lands (Cubbage et al. 1996). Technical assistance is a significant variable in encouraging reforestation but is less important than cost-share payments in influencing decisions.

## SUMMARY OF FINDINGS

Programs affecting nonfederal forests are administered by federal, state, or local governments. The bulk of these programs are administered by the USDA. Within the USDA, the Forest Service has major responsibility for programs focused on nonfederal forests, especially programs involving forest health, cooperative assistance, and transfer of funds to states. Federal agencies usually have a counterpart in state government. Various efforts have been made to assess the effectiveness of programs directed at nonfederal forests. Although study results are at times mixed and vary by region, technical assistance and cost-share programs have been judged effective in promoting forest productivity and stewardship; voluntary guidelines, tax incentive, and regulatory programs are considered less effective.

# PART THREE

## Major Policy and Program Level Issues Across the Landscape

# 5 Changing Conditions of the Forest

## INTRODUCTION

The ability of nonfederal forests to provide a variety of benefits to the nation's citizens depends on the biological and physical conditions of these forests. For example, the U.S. Department of Agriculture's (USDA) Forest Service has identified potentially deteriorating and serious conditions of the nation's forests, which may be of concern when considering the future sustainability of forests, including nonfederal forests (Box 5-1). These conditions include loss of biological diversity, diminished water quality, effects of global climate change, and increased timber mortality. An assessment of these ecological trends and conditions is provided in this chapter. In addition, the effects of management intensity, forest fires, air pollution, climatic change, insects and disease, alien plants, and watershed characteristics on forest conditions are discussed.

## ISSUES INVOLVING FOREST CONDITION

### Biodiversity

The term "forest" encompasses an enormous diversity of forest types and structures. The United States contains some of the most magnificent and biologically diverse forests of the world (Box 5-2). The particular kind of forest that occupies an area is determined by the interactions of several elements: the frequency and intensity of natural and anthropogenic disturbances, local environmental variability, and the available gene pool. Interactions among these ele-

**Box 5-1**
**Condition of the Nation's Forests:**
**Perspective of the USDA Forest Service**

*Potentially Deteriorating Situations*

- Decreasing forest health, as shown by an increase in timber mortality of 24.3 percent from 1986 to 1991.
- Continued loss of biological diversity as a result of increasingly intense land use.
- Diminished water quantity and quality that affects fish habitats and populations, in the face of increased fishing pressure.
- Less intensive management of nonindustrial private forests than needed to meet expected increases in timber consumption.
- Insufficient recreation opportunities to meet expected increases in demand from an increasingly old, urban, and diverse population.

*Potentially Serious Situations*

- Tight softwood timber supplies, especially for the next 20 years, as a result of reduced harvests on federal lands.
- Increased regulation of forest practices on private forests.
- Increased timber mortality and tight timber supplies on private forests generally.
- Possible effects of expected global climatic changes.
- Increased conflicts among uses of private forests, including those resulting from protection of threatened and endangered species.

Source: USDA Forest Service 1993

ments influence the species composition and structure of the vegetation and the nature of the ecological processes that characterize a particular forest ecosystem.

Forestland area in the United States (737 million acres) is about two-thirds of the forested area present during the 1600s (Darr 1995). Since the seventeenth century, approximately 124 million acres of forests have been converted to other uses, primarily agricultural. More than 75 percent of this conversion has occurred in the last century (Darr 1995). Noss and Cooperrider (1994) estimated that roughly half of the conterminous United States was forested at the time of European settlement. Forest area decreased between the late 1700s and World War I, stabilized at less than one-half of its presettlement area after the war, and today has been recovered in large part in the Southeast, Northeast, and Upper Great Lakes regions, mainly on private land. Only about 15 percent of the original forests remain, mostly in Alaska; the structure and composition of other forests appear to differ from pre-European settlement forests. Even where forest cover has returned, for example in the Northeast, residential development has intruded on recovering forest areas and reproductive success of neotropical migratory bird species remains low (Friesen et al. 1995).

Forest management has notable effects on animal biodiversity. Populations of certain game species, such as white-tailed deer (*Odocoileus hemionus vir-*

**Box 5-2**
**Definitions of Biodiversity**

Biodiversity is one of several indicators used to assess the ecological health and sustainability of forests. Among the suggested definitions of biodiversity are:

The variety of life and its processes; it includes the variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting (Noss and Cooperrider 1994).

The variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur. It also refers to ecological structures, functions, and processes at all of these levels. Biological diversity occurs at spatial scales that range from local through regional and global. (Society of American Foresters 1990).

The variety of organisms considered at all levels, from genetic variants belonging to the same species through arrays of species to arrays of genera, families, and still higher taxonomic levels; includes the variety of ecosystems, which comprise both the communities of organisms within particular habitats and the physical conditions under which they live (Wilson 1992).

*ginianus*, a forest-edge species), have increased greatly, largely as a result of more forest cover of early successional forests and a reduction in natural predators. In this case, high deer population levels are affecting changes in plant species composition and success of reforestation efforts. Forest management also often has resulted in the simplification of forest structure and composition, most notably where older forests have been replaced by even-aged stands (Noss 1993). Many of the remaining old-growth forests that are currently susceptible to fragmentation resulting from forest management activities are located on public lands (Robbins et al. 1989, Norse 1990, Henjum et al. 1994).

The potential of nonfederal forestlands to contribute to the maintenance of biodiversity is great, given their extent, variety, potential management flexibility, and that they are the primary forest category subject to conversion to nonforest uses. The critical role of nonfederal forests was made evident in the first Habitat Conservation Plan for the northern spotted owl (Murray Pacific Corporation, Wash.) and Florida's statewide wildlife conservation plan (Cox et al. 1994).

## Forest Fragmentation and Habitat Isolation

Fragmentation of forests and other habitats is considered one of the greatest threats to biodiversity worldwide (Ehrlich and Ehrlich 1981; Harris 1984; Diamond 1984; Wilson 1988, 1992; Soule 1991a,b; Noss and Cooperrider 1994). Primary

effects of fragmentation include reduction in remaining habitat area, alteration of the microclimate of the fragment site, and increasing isolation from other remnant patches (Saunders et al. 1991). Effects of increased fragmentation and isolation on biodiversity have been detected in several taxa in a variety of settings.

Numerous studies of breeding birds in small urban woodlots and woodlots of the eastern United States have shown severe population declines, particularly of neotropical migrants, between the late 1940s and the late 1980s. Although the specific ecological mechanisms responsible are poorly understood, the studies attributed the decreases, in part, to forest fragmentation (Finch 1991). In areas where large forest tracts have been fragmented into smaller isolated parcels, forest-interior species reproduce less successfully, resulting in population declines and local extirpations (Finch 1991). Robbins et al. (1989) found that 75 percent of the forest neotropical migrants experienced population declines between 1978 and 1987 in eastern deciduous forests, apparently caused by loss of wintering habitat in the tropics and fragmentation of breeding habitat. In the West, where fragmentation has been studied less, resident bird species appear to be more susceptible to fragmentation effects than neotropical migrants (Rosenberg and Raphael 1986, Sharp 1996). These effects include increased vulnerability of nests situated along forest edges and small forest fragments to predation and brood parasitism from brown-headed cowbirds (*Molothrus ater*) (Gates and Gysel 1978, Wilcove 1985, Yahner and Mahan 1996). Severe effects have been observed on nonfederal lands in Oregon where cutting intensities have been high (Sharp 1996). Birds in highly fragmented landscapes have less pairing success than birds in less fragmented areas (Gibbs and Faaborg 1990, Vilard et al. 1993). These isolated habitats might function as population "sinks," attracting birds to areas where reproductive success is comparatively low.

Populations of many organisms exist as metapopulations (subpopulations) linked to one another through dispersal (Harrison 1994). Although even less information is available on the demographics of metapopulations, dispersal among metapopulations is believed to play a key role in maintaining genetic variability and would be expected to be adversely affected by fragmentation of large forest tracts (Harrison 1994). Such fragmentation affects the population in addition to the recruitment necessary to prevent population extirpation (Donovan et al. 1995).

### Rare and Endangered Species Habitat

Increasing attention is being paid to continued losses of whole types of ecosystems, beyond changes or losses of individual species, and possibilities of at least their partial restoration. For example, freshwater ecosystems in California and old-growth forests in the Pacific Northwest are being altered faster than most tropical systems and stand to lose as great a proportion of their species (Noss et al. 1995). Biodiversity at this scale can be affected by losses in total area through

conversion to other uses and by reductions in structure or composition. If the latter is sufficiently severe, it could be considered as habitat loss.

In some cases, conversion of original forests has been extensive. For instance, using satellite image analysis, Beebe (1991) found only one unharvested watershed of more than 30,000 acres in the coastal temperate rainforest region of Oregon and Washington. Similarly, Henjum et al. (1994) reported that 75 to 90 percent of the late-seral and old-growth forest patches that remain east of the Cascades in Oregon and Washington are less than 100 acres in size, and that no patches on three national forests in Oregon are larger than 5,000 acres.

Types of original forest ecosystems that have suffered extensive losses in the United States were grouped into three categories: critically endangered (more than 98 percent reduction), endangered (85 to 98 percent reduction), and threatened (70 to 84 percent reduction) (Noss et al. 1995, Noss and Peters 1995). Of six types of habitat suffering the greatest losses, most (30 percent) were forests, of which 15 percent were forested wetlands.(Noss and Peters 1995). Most of the habitat losses have occurred in the South, Northeast, Midwest, and California; these areas also have the highest proportions of nonfederal forests in the United States. The 10 most endangered forest types are southern Appalachian spruce-fir forest, longleaf pine forest and savanna, southeastern riparian forests, Hawaiian dry forest, California riparian forests and wetlands, old-growth eastern deciduous forests, old-growth Pacific Northwest forests, old-growth white pine forests, old-growth ponderosa pine forests, and southern forested wetlands. Each has experienced dramatic reductions in area, is highly fragmented, contains relatively high numbers of endangered species, and faces continued threats from a variety of sources (Noss and Peters 1995). For instance, the Southeastern longleaf pine wire-grass (*Aristida stricta*) community, perhaps the most reduced forest type in the United States, contains 27 federally listed and 99 candidate species. The former include 18 plants, 4 reptiles, 4 birds, and 1 mammal; the latter include 70 plants, 10 insects, 4 amphibians, 7 reptiles, 4 birds, and 4 mammals (Noss et al. 1995).

Nonfederal forestlands, therefore, have a critical role to play in biodiversity conservation. Conservation planning and programs should incorporate all owners across the various landscapes, which together support the nation's biodiversity.

## Forest Management Intensity

The intensity with which management practices are applied can have implications for the sustainability of nonfederal forests. Timber (solid wood) harvests from U.S. federal lands have decreased during the past 10 years and will continue to be substantially lower than harvests between World War II and about 1990 (Table A-19). The reduction in harvests is a result of changes in policies governing national forests, for example, the move toward ecosystem management (Box

5-3) (Jensen and Everett 1994), and the depletion of remaining old-growth stands, which are high in volume and biomass relative to other forests but are comparatively low in their rate of biomass accumulation (Harmon et al. 1990). In the short term (for example, 5 years), increased rates of timber harvesting from private forestlands, primarily in the South, might make up the shortfall.

One way to increase wood flow from forests is to increase removals of biomass from each site. However, the effect of this action is debatable. Recent reviews conclude that increased removals of nutrients in the biomass will likely reduce long-term yields (Mann et al. 1988, Johnson et al. 1988, Dahlgren and Driscoll 1994). The shortening of cutting cycles will have similar effects. A potential reduction in long-term yields suggests that other forest management activities might be intensified so that higher yields from all lands could be expected to last indefinitely. Other ways to make up for the shortfall in wood are to (1) increase use of small log utilization technology and engineered wood, (2) increase use of composites to substitute for solid-wood products, (3) increase wood recycling, (4) increase area of private land devoted to timber production, (5) decrease use of (decrease demand for) timber products, and (6) increase use of wood substitutes such as plastics and steel studs. Demand does not appear to be declining, but most of the other changes are likely to occur to some extent. However, they are not expected to make up for the potential shortfall (USDA Forest Service 1995). An additional constraint to shifting the timber harvest from federal to private lands is that many industrial private forestlands in the southern United States already are heavily devoted to producing pulp fiber for paper production, and nonindustrial forestlands of the region are decreasing in area (Table A-3).

**Box 5-3**
**Definitions of Ecosystem Management**

- Involve regulating internal ecosystem structure and function plus outputs, in order to achieve socially desirable conditions (Agee and Johnson 1988).
- Integrate scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long term (Grumbine 1994).
- Have a primary objective to sustain the integrity of ecosystems (i.e., their function, composition, and structure) for future generations while providing immediate goods and services to an increasingly diverse public (Jensen and Everett 1994).
- Blend social, economic, and scientific principles to achieve healthy ecosystems and maintain biological diversity over long periods of time, while at the same time allowing production of the many valued resources our society seeks from its forests (Brunson et al. 1996).
- System composed of socially defined goals and management objectives; integrated, holistic science; broad spatial and temporal scales; collaborative decision building; and adaptable institutions (Cortner and Moote 1994).

What does "increased management intensity" mean? Although the specifics will vary greatly from one forest area to another and from one ownership to another, in general it means that fossil-fuel inputs are increased, possibly through additional labor, machinery use, fertilizers, pesticides, or even irrigation, to increase tree growth and, hence, timber removal per acre. The average stocking (volume of timber) per acre on industrial forestlands is already almost 40 percent greater than the national average for all forests (Powell et al. 1993), primarily reflecting investments in management intensity. Most timber-stand improvement is occurring on nonfederal forestlands, 70 percent on industrial lands alone. Long-term forecasts are for more management changes on industrial lands, but for small changes on nonindustrial forestlands (Haynes et al. 1995). Currently, only 20 percent of nonindustrial private landowners have a written management plan for their forests (Birch 1996).

Under any definition of "sustained yield management," increases in yield resulting from more intensive management should offset the additional inputs, and wood harvested over multiple harvest intervals should at least remain constant. One recent change in management practice that is viewed as positive according to most criteria is the enhanced training of loggers and the adoption of "reduced-impact harvesting," whereby residual trees and other aspects of long-term ecosystem functioning are minimally affected by logging operations (MacKay et al. 1996).

One common method of intensifying management is through planting genetically improved tree seedlings or cuttings, rather than relying on natural regeneration. This method ensures that little or no time is lost in the tree-growth cycle, assuming adequate success in establishment. In some cases, tree planting is accompanied by chemical or mechanical removal or suppression of competing vegetation. A measure of the changes expected from tree planting is the projected steady increase in planted area on private lands in the Southeast, South Central, and Pacific Northwest regions during the period 1990-2040 (Tables A-8 and A-9). The area of federal land that has been planted has consistently decreased in all regions through 1995 (Table A-6), a trend projected to continue. The tree-planting trends are also highly regional, the greatest decreases occurring on federal lands in the Pacific Northwest and the greatest increases occurring on industrial and nonindustrial private lands in the South (Table A-6). In addition, changes in incentive programs (for example, in the Conservation Reserve Program between 1986 and 1989) have led to intervals during which substantially greater numbers of acres have been planted, confusing the long-term picture.

Increased management intensity for tree-fiber production creates greater uncertainty, if not actual decline, in the delivery of other natural and societal benefits from forest ecosystems. Forests managed with greater attention to tree growth and harvest removals will be simpler in terms of structure (spatial heterogeneity within a stand) and biodiversity than unmanaged forests. For example, reductions in coarse woody debris, such as standing dead trees and downed logs,

and complex living vegetation structures, such as large older trees, have potentially negative consequences for some wildlife, especially specialist insectivores (Maser 1994). These reductions also decrease the long-term nutrient and organic-matter (carbon) storage of forest sites.

## Forest Fires

From 1990 through 1996, approximately 1.7 million acres of state and private forest and rangeland burned each year in the United States. Wildfires in nonfederal forests can result in immediate catastrophic losses, including loss of timber, wildlife habitat, recreational opportunities, and aesthetic values of land. Although the total area burned by wildfire has declined nationwide during this century, that statistic masks disturbing trends: the total area burned is increasing in the West, and the average severity of these fires is increasing (Agee 1993). Long-term wildfire trends are difficult to predict because of potential changes in climate, particularly altered patterns of precipitation.

Management of fire is paradoxical: long-term protection of resources through fire suppression results in fuel accumulation and associated risks to resources because the wildfires that do occur are more severe (Brown and Arno 1991). Many forest types evolved with wildfire as a natural periodic disturbance, and those types, sometimes called fire-dependent forests, benefit from the use of fire as well as its control. Fire should be recognized as an important ecological process to maintain the diversity and productivity of wildlands. It can be used as an effective management tool to maintain fuel loads at manageable levels, particularly in ecosystems where fire was historically frequent and low in intensity. Trade-offs between prescribed fire smoke and wildfire smoke might be necessary to defend prescribed burning because of the air-quality effects. In addition, proposed changes in EPA air-quality standards at the national level to restrict fine particulates (less than 2.5 micrograms) could have a major impact on open burning because much of the smoke produced by prescribed fires contains particles within this range. Strategies for managing fire effectively are expensive and require substantial technical assistance. Because the costs of mistakes can be high in terms of property and lives lost, fire management likely will be used more by large nonfederal-forest landowners, such as tribal landowners or cooperatives of private or public landowners, than by small nonindustrial-forest landowners.

Fire at the wildland and urban interface, defined as the zone, area, or line where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels (SAF 1990), will be a critical issue on nonfederal forestlands. Residents of these areas, which are located across all parts of the United States, benefit from a close association with wildlands, but also face the potentially substantial costs of property damage from wildfires. Such fires can move from residential communities into surrounding wildlands or from wildlands to intermingled residences. The problem is growing for two

reasons: (1) urban residents are moving in greater numbers to urban-interface property, and (2) accumulation of highly flammable fuels is increasing partly because of the success of past fire-suppression efforts.

Six of the 10 urban-interface wildfires with the highest losses of structures in California history have occurred since 1990; similarly increasing losses are occurring in Michigan, Florida, Colorado, and Washington. The problem is national, and it is growing. Many of the intermingled lands are privately owned, and fire protection for both structures and wildlands is the responsibility of state and local agencies. Federal agencies have long been requested to assist local forces in these crisis situations, even when there is no threat to federal lands. Priority has been given to scattered structures, resulting in considerable sacrifice of natural-resource values and the threat of loss of structures elsewhere. Substantial costs to all levels of government and insurance carriers are increasing, and urban-interface residents have suffered financial and emotional losses.

As the problem increases, the response capability of government is decreasing. Federal policy defined fire-protection priorities as (1) life, (2) property, and (3) resources. The 1995 Federal Wildland Fire Management Policy and Program Review redefined these priorities as (1) life, and (2) property and natural and cultural resources based on relative values to be protected, commensurate with suppression costs. That redefinition implies a cutting back of urban-interface structural protection by federal fire fighting forces and a shifting of cost to state and local agencies. The federal government would continue to be involved operationally in urban-interface fire fighting, hazardous-fuels reduction, cooperative fire prevention and education, and technical assistance. A major challenge is to develop a uniform national approach to hazard and risk assessment and fire prevention and protection in the urban and wildland interface.

A successful approach to wildfire prevention and control, urban-interface fire problems, and intelligent use of prescribed fire should shift the focus away from emergency fire fighting efforts to an emphasis on enhancing preventive approaches that are well-established as successful methods to avoid loss. Primary fuel-management approaches are reducing fuel in wildlands and around structures and decreasing the flammability of structures. Technical assistance can improve the implementation of these and other approaches and will complement fire prevention, fire suppression, and prescribed fire efforts.

## Air Pollution

In addition to changes in fire regimens for nonfederal forests in the United States, changes have occurred in the air quality and environmental conditions of these forests during the past decade, although the ecosystem consequences are harder to determine. Issues involving climate or air quality will be resolved only through the involvement of the federal, state, and local government, and the nongovernmental sector.

Some measures of air quality have demonstrated marked improvement since 1985, and in general, rural air quality over the United States has improved over the past decade. In both rural and urban areas, substantial progress has been made in reducing carbon monoxide and sulfur dioxide emissions and atmospheric concentrations. However, several major cities still have not complied with the ozone air quality standards of the U.S. Environmental Protection Agency. A major accomplishment has been the marked reduction in acid rain over forestlands of the northeastern United States (EPA 1994). However, reduced acidity, per se, might not accomplish as much as initially thought in terms of forest health. Chronic nitrogen additions might continue after $SO_4$ concentrations (and hence pH) in rainfall have been reduced and might lead to nitrogen saturation of soils and increased cation leaching, conditions that emissions controls and sulfur reductions originally were designed to mitigate (Aber 1992).

Air quality definitely is affecting tree and forest health in many urban forests and in forests in airsheds surrounding large urban areas. These areas deserve special attention, because they vividly show the acute long-term effects of air pollution on trees and forests (for example, ozone damage to ponderosa pine trees in the San Bernadino Mountains outside Los Angeles; Miller and Evans 1974). These areas illustrate conditions that could become more common for forests in general. However, even chronic low-level exposure to ozone in rural ambient air may be negatively affecting forest productivity over much of the United States (Reich and Amundson 1985).

Urban forests are exposed to more altered environmental conditions than most rural forests. Concentrations of some agents, such as hydrocarbons, carbon dioxide, dust, or ozone, are higher in urban than in rural air. Major cities form what are known as "heat islands," where the temperature of the city center may be as much as 10° F higher than that of the surrounding countryside (Oke 1982, Lein 1989). The consequences of this temperature difference for tree health and forest dynamics are difficult to predict.

Trees and forests in urban areas can respond to changes in environmental conditions, but they also can contribute greatly to their amelioration. A study of metropolitan Atlanta showed that the urban forest has decreased by 65 percent since 1972. During the same period, average summer temperatures increased nine degrees more than those of the surrounding countryside (American Forests 1996). Increases in ambient temperatures might also contribute to Atlanta's ozone problem, and necessitate greater use of fossil-fuel energy to offset the increased environmental temperatures. In urban air, ozone is a highly reactive substance that breaks down on contact with most surfaces. Because trees have a higher surface area than other ground covers, provided primarily by leaves, they enhance the breakdown of ozone (Cavender and Allen 1991), even if they are damaged at high ozone concentrations. In addition, trees store carbon, filter particulates, absorb nitrogen from rain as $NO_3$ in solution and from dry air as $HNO_3$ vapor and $NH_4$, and provide shade and other benefits,

thus contributing greatly to the general amelioration of poor environmental conditions.

Atmospheric carbon dioxide has increased monotonically worldwide during the past century and might continue to do so for decades to come. Some circumstantial evidence indicates that forests in the temperate zone are responding to increased atmospheric $CO_2$ through increased carbon fixation and growth (Ciais et al. 1994). That is an area of intensive research, and it is not yet possible to conclude whether the effects of elevated $CO_2$ will be positive, negative, or neutral for trees, forests, or forested ecosystems in the United States.

However, forest management in some areas might be affected by the perception, if not the reality, that trees might also contribute to environmental quality problems. That notion is primarily based on the fact that many trees emit volatile organic hydrocarbons (VOCs) known to interact with $NO_x$ produced during fossil-fuel combustion to generate ozone in the presence of light (Corchnoy et al. 1992). Chameides et al. (1988) determined that hydrocarbon emissions from pine forests in the southeastern United States could account for the fact that, although hydrocarbon and sulfur emissions from automobiles had been greatly reduced, $NO_x$ was still emitted in sufficient amounts to combine with biogenic hydrocarbons from pine forests so that ambient air concentrations of ozone in Atlanta had essentially not changed. It is important to note that many other plants besides trees also emit hydrocarbons and that very little quantitative information exists on this subject.

Trees present one other potential problem. Because many trees use high amounts of soil water to support their growth, their presence in marginally dry areas might be a drawback if less water is available for other valuable vegetation or humans. However, the water intake of different tree species (conifers versus hardwoods) varies considerably, and quantitative values for water consumption are surprisingly rare in the literature.

The collective benefits of trees, in terms of enhancing environmental quality, far outweigh their potential negative effects. Land management with a focus on environmental quality must include trees.

## Carbon Sequestration

The expansiveness of nonfederal forests in the United States suggests that they have implications for issues involving carbon sequestration. Given that organic matter is approximately 50 percent carbon and that living trees accumulate more carbon in their biomass than they respire, mature forests contain more organic matter per unit of ground area than any other potential form of cover (United Nations 1992). For example, although closed-canopy forests are estimated to occupy only about one-third of the global land area, they contain about 90 percent of all the carbon in vegetation and 40 percent of all of that in soil. Thus, forest management has a great potential to positively affect carbon balances by sequestering carbon from the atmosphere. In the United States, 50

percent of the carbon in timberlands is estimated to be in the mineral soil of forests, 33 percent is in tree biomass, 10 percent is in woody debris, 6 percent is in the forest floor, and 1 percent is in understory vegetation (Turner et al. 1995). On the other hand, clearing forests and converting land to other uses annually release large amounts of carbon back to the atmosphere, especially in the tropics (IPCC 1996). Tree and forest management and carbon sequestering are therefore inextricably connected.

Currently, the United States is a net sink for atmospheric $CO_2$, largely because of the recovery from earlier periods of extensive harvesting, agricultural conversion, and mis-management (Turner et al. 1995). About two-thirds of the carbon stored on timberland in the United States is stored on private forestland. Nonindustrial private forestlands offer the greatest opportunity for increasing terrestrial carbon storage in the United States, because of their availability (compared with land currently in cultivation) and underuse as illustrated by their low stocking density and volume estimates (Powell et al. 1993). Clearly, carbon storage on many nonindustrial private forestlands can be increased. The extent to which this can occur will depend on the motivation of landowners and the degree to which they take advantage of incentive programs.

The overall greatest potential for increasing biological carbon sequestration is through the forestation of areas currently without forest cover. Carbon sequestration policies and programs must focus on agricultural lands and marginally used lands. Fewer opportunities exist for sequestering additional carbon on currently forested lands, but conservation programs are important in maintaining current forests, stores of carbon—particularly in the remaining large, older forests—and rapid reforestation of cutover areas. Additional sequestration can also occur if wood is harvested using reduced-impact logging techniques and the wood removed from forests is used in longer-lived products.

Urban areas can also have an important role in carbon sequestration (Nowak 1994). Urban tree cover, biomass, and carbon storage can be expanded and fossil-fuel consumption can be reduced for additional carbon savings.

## Forest Insects and Diseases

Forest insects and diseases at endemic levels are natural components of healthy forest ecosystems. They thin stands, provide food for wildlife, and control other biota. Epidemic levels of insects and diseases have occurred for millennia in U.S. forests and have caused substantial mortality in forests from the Northwest to the Southeast. Currently, 4-5 billion cubic feet of timber are lost to insects and disease each year in the United States. The mortality of a tree or group of trees occasionally is part of a healthy forest ecosystem and might not appear in routine forest inventories. When mortality becomes substantial, however, the impact affects large areas and multiple ownerships.

Three factors have increased attention to forest losses resulting from insects

and disease: (1) fragmentation of forest ownership and substantial increases in the number of owners of nonfederal forestland, making even minor insect or disease epidemics a substantial problem for individual forest owners; (2) inadequate management by forest landowners and unthrifty forests, resulting in substantial areas of susceptible forest; and (3) introduction of alien insects and diseases with no natural controls that attack native species. Many nonfederal-forest landowners, particularly nonindustrial forest landowners, do not have the technical knowledge or assistance to design prescriptions to protect against native insects and diseases.

In the West, native forest insects and diseases are increasingly attacking old forests at epidemic levels, which, in many cases could be protected against through appropriate management. Because many organisms are species-specific or group-specific and attack trees of low vigor, selection of appropriate species or management of a stand to provide adequate vigor might prevent epidemics. Thinning is often effective at reducing competition among trees and results in increased vigor of the residual trees (Waring and Pitman 1980). High-vigor trees are often successful at repelling attacks by insects, such as pine beetles. High-vigor trees that have adequate nitrogen also have been shown to be more resistant to pathogens, such as laminated root rot (Matson and Boone 1984). In such cases, active management can increase protection against insects and disease. For example, in the South, early cultural practices intensified fusiform rust incidence through the planting of infected seedlings, intensive site preparation, fire control, selection for fast-growing genotypes without consideration of disease resistance, and expansion of the range and extent of susceptible species. Today this particular problem has been mitigated partially through the development of rust-resistant tree genotypes and improved stand management (Schmidt 1978).

During the twentieth century, numerous insects and diseases have been introduced in the United States. Many did not find appropriate ecological niches and disappeared. Others found ideal conditions to flourish, at the expense of native species. Among the worst have been the European gypsy moth, Dutch elm disease (American elm), white pine blister rust (white pines), pine shoot beetle (conifers, especially pines), phytophthora root rot (Port Orford cedar), and chestnut blight (American chestnut).

Biotic diversity and wildlife habitat are seriously impaired by these organisms. Some, such as chestnut blight, have resulted in near extirpation of native species by killing the host. Other organisms will affect future losses: white pine blister rust damages mature and kills young whitebark pine, the seeds of which are a critical source of food for grizzly bears in the Rocky Mountains.

## Alien Plants

Plants that are nonindigenous to a geographic locality are called "alien," as well as "exotic," which does not convey the ecological risk posed by the more

aggressive term "aliens." Some invade only disturbed areas; others invade healthy and normally functioning ecosystems. An example of the former is cheatgrass, which typically invades overgrazed rangelands. The knapweeds are examples of the latter, which are capable of moving into high quality rangelands and deteriorating the range condition.

Aggressive nonindigenous plants are well-adapted to a variety of sites and are resilient to disturbance. Invasions of nonindigenous species are among the most pervasive influences on the biodiversity of ecosystems (Coblentz 1990). Among some of the alien plants affecting nonfederal forestland are scotch broom, gorse, kudzu, haole koa, melaleuca, Australian pine (*Casuarina*), poka vine, cogon grass, pampas grass, and ivy. Most are well-adapted to fire, and wildfire often results in their continued spread. These problems are likely to increase. Management controls are often ineffective because nonindigenous plants are so well-adapted to disturbance, often more so than indigenous plants. As effective strategies to control some aliens are implemented, others will continue to be introduced.

## Watershed Integrity

Ecologically healthy watersheds located within nonfederal forests are maintained by natural disturbance processes (Naiman et al. 1992). A dynamic, rather than a steady-state, equilibrium is characteristic of resilient and productive watersheds. Changes in riparian forests, wildlife habitat, water quantity and quality, and sediment are all part of healthy watersheds from the headwaters to the estuaries. As the watershed increases in scale, more landowners are likely to be involved in the improvement, maintenance, or degradation of watershed quality. State regulations and voluntary Best Management Practices (BMPs) are almost always associated with watershed quality, and federal cost-share programs. Watershed integrity has been of concern to programs administered through the USDA and have often focused on watershed restoration (Agricultural Conservation Programs [ACP] and Conservation Reserve Program [CRP]), as well as the programs of the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the National Marine Fisheries Services, and the Bureau of Reclamation. Watershed integrity includes more than just chemical measurements of water quality (Box 5-4).

The cyclic nature of natural disturbances of the past have set into motion complex sediment routing patterns from smaller to larger-order streams (Benda 1990). One of the primary lessons from this behavior is that watershed maintenance and restoration must include a long time frame, whether the focus is for natural forests, transitions from natural forests to plantations, subsequent rotations of trees, conversions of old fields to new forests, or conversions of forests to agricultural or urban uses. Each of those uses will affect watershed integrity in positive or negative ways, and some effects might have considerable time lags, particularly in large-order watersheds (Swanson et al. 1992). The value of water-

**Box 5-4**
**Watersheds: Measures of Their Integrity**

| Component | Factors considered |
|---|---|
| Basin Geomorphology | Physiography, geology, natural disturbance regimes |
| Hydrologic Patterns | Discharge pattern, flood characteristics, water storage, bedload and sediment routing, subsurface dynamics |
| Water Quality | Biogeochemical processes, nutrient load |
| Riparian Forests | Light, temperature, stream inputs, woody debris |
| Habitats | Fish habitats and communities, woody debris, wildlife |

Source: adapted from Naiman et al. 1992

shed integrity to the public is often expressed for large-scale watersheds across many ownerships (Box 5-4) but the value is derived from the processes occurring at smaller scales.

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

Fundamental sustainability of the ecosystems that are a part of nonfederal forestlands is critical to the production of goods and services that Americans are likely to expect from these forests in the future. The problems caused by forest fragmentation, land conversion, intensive land management, fire, pollution, climatic change, insects, disease, and alien plants are landscape-level and cross the boundaries of many ownerships. From a social and an environmental perspective, it is important that the adverse affects of catastrophic levels of fires, winds, mammals, and insects and diseases be addressed. An enhanced, coordinated approach involving the federal government and nongovernmental landowners is needed for the management or mitigation of these impacts on forest health and sustainability.

**RECOMMENDATION:**

*Ensure the long-term integrity of forest ecosystems that comprise the nation's nonfederal forests, actively addressing conditions that diminish their ability to contribute to the well-being of the nation's citizens.*

This recommendation points to the following specific recommendations:

- *The federal government should strengthen programs that monitor nonfederal forest health, with special focus on early detection of conditions that could lead to catastrophic consequences.*
- *Federal assistance to states should be strengthened for wildfire suppression and fuel management technologies, while recognizing fire as critical to functioning, healthy ecological processes.*

# 6

# Investment for Better Institutional Relationships

## INTRODUCTION

An array of federal, state, and local government and private organizations affect the sustainable management of nonfederal forests. These organizations and their associated programs are described in this chapter. Programs have been established to address a wide range of perceived problems, including wildfire and insect and disease protection, timber supplies, soil conservation, water and air quality, and endangered species protection. Each major program area is often the responsibility of a single federal agency, which usually has a counterpart in state government. Some of the programs provide technical and financial assistance while others are regulatory in nature.

Investments in the careful design of federal agency responsibilities and linkages to other units of government is critical to the sustainability of nonfederal forests and their ability to provide a wide variety of goods and services for the American people. At present, that ability is frustrated by at least four major institutional issues: (1) the lack of a clear, well-directed national policy on nonfederal forests; (2) ineffective strategic planning processes for identifying national interests in nonfederal forests; (3) a high number of agencies, bureaus, and divisions in the federal government that are involved wholly or in part in nonfederal-forest programs; and (4) numerous policy and program linkages between the federal government and various public and private organizations at state and regional levels.

## NATIONAL POLICY FOR NONFEDERAL FORESTS

The nation's nonfederal forests make up more than 66 percent of the nation's forested land and account for a large number and range of benefits that are

important to the American people (see Chapters 3 and 5). However, a clear and comprehensive national statement of policy concerning nonfederal-forest use, management, and protection does not exist. Segments of policy direction appear in hundreds of congressionally established environmental and natural resource laws, but the overall policy direction lacks clarity and consistency. Much more attention has been devoted to national policy for federally owned resource land, which, in nearly all cases, is guided by congressional policy (for example, by the National Forest Management Act, the National Wildlife Refuge System Administration Act, the National Wildlife Refuges, the Federal Land Policy and Management Act, and the National Resource Lands). Clearly, national interest in federal lands deserves of a national policy, and equally important is national interest in nonfederal forests, an interest similarly deserving of a well-articulated statement of federal intent.

The lack of a cohesive national policy on nonfederal forests is a reflection of various conditions. Since the 1930s, attention to these forests has been directed primarily through the forestry community; these forests have not received widespread national attention, which might have led to a comprehensive policy concerning their use and management. Prolonged political battles over the future of National Forests have largely been responsible for displacing nonfederal forests from national policy-making agendas. Also contributing to the lack of national direction on nonfederal forests is the sparse and inconsistent information on nonfederal forests. The information needed to develop and articulate a national policy on nonfederal forests is inadequate. State and regional information exists, but when combined nationally, it results in an unclear picture of the nonfederal forest landscape.

A further deterrent to articulating a national policy on nonfederal forests has been the inability of existing strategic-planning processes to promote national interests in nonfederal forests. The planning process that offers the greatest potential for identifying nonfederal forests nationally is the Forest and Rangeland Renewable Resources Planning Act (RPA). Yet, nonfederal forests barely appear on the RPA program's agenda. The portion of the U.S. Department of Agriculture's (USDA) Forest Service's total costs for state and private expenditures (a major avenue for federal investment in nonfederal forests) is only 7.1 percent (1993) and is expected to increase to only 9.0 percent by 2045 (USDA Forest Service 1995). These expenditures are not considered commensurate with the importance of the nonfederal forests.

Also detracting from the establishment of a national policy for nonfederal forests has been the lack of well articulated principles that might be part of a policy. Principles have been suggested, in several different forms and formats. The Seventh American Forest Congress sought to deal with the dilemma, suggesting a variety of principles that might be part of a comprehensive policy for the nation's forests (including nonfederal forests). The principles included: the area covered by forests should be maintained and, as appropriate, expanded; the

range of values and uses provided by forests should be broad and well-balanced; forests should contribute to social, economic, and community well-being; use and management of forests should have beneficial global consequences; decisions about public forests should involve affected persons and organizations; multiple owners of forest ecosystems should be encouraged to cooperate; decisions about forests should be based on sound scientific evidence; and investments in forests should be sustained and commensurate with the values and benefits provided (Bentley and Langbein 1996, Ellefson and MacKay 1996).

The lack of a comprehensive national direction on forests in general and nonfederal forests in particular has a multitude of implications, not the least of which is the federal government's inability to focus (financially and otherwise) on owners of nonfederal forests throughout the nation. In addition, the lack of such direction has resulted in numerous agencies, bureaus, and programs within the federal government that might not be addressing the national interest in forests in general, and most assuredly are not addressing the nation's interest in nonfederal forests. The void in national direction might be deterring clear and effective linkages between the federal government and the many public and private interests that exist at the state, regional and local level. As complex as these issues might be, they must be addressed if nonfederal forests are to contribute fully to the nation's economic, social, and environmental condition.

## NATIONAL FOCUS AND STRATEGIC DIRECTION

The nation has failed to articulate an overall national strategic plan for addressing nonfederal forests. That failure is due in part to the fragmentation of major programs affecting nonfederal forests among several agencies. It also is due to the serious weaknesses in the design and application of the major planning process available to the federal government, namely, the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) and the National Forest Management Act of 1976 (NFMA). Other federal agencies with programs that address forests, including nonfederal forest issues have their own strategic-planning processes. None, however, appears to have formalized its planning process to the same degree as the USDA Forest Service.

The USDA Forest Service is charged in the RPA with preparing a national strategic plan for its programs at 5-year intervals. Its plan, known as the RPA Program, is to be based on an assessment of resource conditions, which is known as the RPA Assessment, and prepared at 10-year intervals and updated every 5 years. The periodic assessments present information on all forests and rangelands, public and private, in the United States. The periodic programs are tied to the periodic assessments to the extent that proposed actions during the 10-year planning period respond, at least in part, to the problem situations identified in the assessment.

The strategic plan presented in the RPA Program poses a number of difficul-

ties for federal-government action directed at nonfederal forests (Sample and LeMaster 1995). First, while the periodic assessments provide information on all forest and rangeland resources and identify problems generally across all ownerships, the periodic programs deal only with existing and proposed USDA Forest Service responsibilities in addressing at the problems. Second, the RPA Program addresses only USDA Forest Service programs and does not incorporate major programs that have major implications for nonfederal forests from other federal agencies, such as the Fish and Wildlife Service and the Army Corps of Engineers. Third, the RPA Program concentrates on federal-forest issues and in doing so, largely neglects those issues that are most relevant to nonfederal forests, including major emerging issues, such as global climatic change and maintaining biodiversity. Fourth, the RPA Program does not provide any clear sense of urgency individually or collectively about the issues identified in the program or assessment. Fifth, the RPA Program does not provide any mechanism for defining actions based on regional differences relevant to nonfederal forests, a role served by forest plans in the case of federal forests.

The planning requirements of the NFMA focus on federal forests, although they have implications for nonfederal forests. During public forums held in conjunction with the current study, interested parties expressed their concern over the lack of effort (or limited effort) to coordinate federal-forest plans with the plans of nonfederal-forest owners who also have an interest in federal forests. A common perception was that NFMA's planning process often excluded the strategic use and management interests of nonfederal-forest owners. As NFMA revises its forest plans, some federal-forests plans appear to be increasingly sensitive to the implications of their activities on owners.

The ability of the federal government to develop agreement on the national direction for nonfederal forests depends on access to the latest planning recommendations (USDA Forest Service 1990, Gray and Ellefson 1987, Sample and LeMaster 1995, Minnesota Forest Resources Council 1996). For example, more interactive planning, more cooperative implementation of plans, greater emphasis on monitoring accomplishments, greater incorporation of science and scientific evidence, and more engagement of nonfederal-forest interest in planning processes are needed. Better structures are also needed for citizen articulation of national interests nonfederal forests, an example being the Seventh American Forest Congress (Bentley and Langbein 1996).

Development of a national strategic plan for nonfederal forest management requires a sound planning process. It will also require a concurrent process at the state level. Research suggests that federal actions to build state capacity to carry out programs is important and beneficial to states and the federal government (Gray and Ellefson 1987). A clearer sense of direction, broader interest-group support, increased awareness of investment opportunities, and more adequate funding of programs are some of the positive outcomes. The federal government has an important and continuing role in maintaining state capacity. In summary,

no overall strategic plan guides federal actions on nonfederal forests. Features of an effective plan for federal involvement in nonfederal-forest issues include the following:

- The scope of the plan is broad enough to help coordinate the major program elements of different federal agencies.
- Application of the plan leads to responsible actions with regard to interest-group desires for governmental action.
- Capacity of nonfederal-forest entities, especially state forestry agencies, to develop strategic plans that are useful to many interests, including the federal government.
- Attention to emerging issues in sufficient time will help federal agencies respond to early indications of problems.
- Mechanisms such as regional planning and programming councils, that can effectively make the bridge between national emphases and regional or state-by-state differences in program needs.

## ORGANIZATION WITHIN THE FEDERAL GOVERNMENT

The federal government is complex with respect to the number of discrete programs impacting the nonfederal forests. However, as Landau noted (1969), it is important to distinguish between an institutional condition of "efficient redundancy" and one of "inefficient profusion" (Landau 1969). Consider the following examples.

In 1996, the USDA implemented 18 water-quality programs that were administered by five agencies. An additional 55 water-quality assistance programs were administered by 10 agency or bureau-level units within other federal departments or independent agencies. Not all the programs have implications for nonfederal forests; however, a large number do (GAO 1996a). A similar plethora of federal programs focus on rural development. From 1983 through 1992, 109 federally sponsored agricultural and natural-resource programs focused on rural areas where most of the nation's nonfederal forests are located (GAO 1994c).

Some institutional complexity (and possibly duplication and overlap) is inevitable in a federal system that operates within a complex, highly differentiated society. Nevertheless, in an era of constrained budgetary resources, having 16 federal agencies in 7 departments administer over 50 distinct programs that affect the nonfederal forest owner and manager results from the lack of a clear national focus (see Box 4-1 and Appendix B).

### Major Reviews

National policymakers are cognizant of the complex institutional setting in natural-resources management: "The steady, gradual accretion of federal, state,

regional, tribal, and local environmental laws has resulted "not in a well-designed cabin but in a pile of logs" (Schroeder 1995). Policymakers are cognizant of this trend towards increasing institutional complexity. Efforts have been made to examine and resolve issues concerning the management of landscape-level ecosystems whose boundaries are not consistent with existing property boundaries. These efforts include the following:

- *CRS Review*. At the request of six congressional committees, the Congressional Research Service convened a 2-day symposium in March 1994 where 18 federal agencies discussed their ecosystem-management activities with legislators (Congressional Research Service 1994). Agency spokespersons were candid in noting where major institutional problems lay (see Box 6-1).
- *Interagency Ecosystem Management Task Force*. In August 1993, the Clinton Administration established the Interagency Ecosystem Management Task Force to investigate how federal agencies could adapt "a pro-active approach to ensuring a sustainable economy and a sustainable environment through ecosystem management" (Interagency Ecosystem Management Task Force 1995). Personnel from 11 departments, plus the EPA, the Office of Management and Budget, and the Office of Science and Technology Policy made up the task force. Its report, issued in June 1995, included the following suggestions (Interagency Ecosystem Management Task Force 1995):

> What we need now is a mechanism for coordinating the implementation of the many laws, programs, policies, and regulations that affect natural resources. We also need a mechanism for resolving conflicts that protects our national economy and the resources on which it is based. The ecosystem approach can help . . .
>
> The Federal Advisory Committee Act (FACA) imposes procedural requirements on federal agencies . . . and makes it more difficult for agencies to establish partnerships with stakeholders and involve the public in ecosystem activities.
>
> Natural resource management and regulatory agencies should work with the Office of Management and Budget and Congress to revise their budget structures and organizations, where needed, to facilitate the ecosystem approach.
>
> There are several institutional factors that limit the ability of federal agencies to coordinate their budgets. First, agency budget structures . . . reflect narrow, program-specific perspectives that differ from agency to agency . . . Second, agency budgets are often linked to the production of tangible outputs or commodities . . . or to permits and environment requirements, rather than to ecosystems. Third, no single appropriations committee has jurisdiction over the budgets of all federal agencies cooperating in any particular ecosystem . . .
>
> Several [federal] managers were concerned that integrated ecosystem-based budgets proposed at the local level may not retain their ecosystem identity if the budget requests are combined with other requests at successive review levels of the appropriations process.

**Box 6-1**
**Key Issues Identified at the Congressional Research Service Symposia, March 1994**

"Although the Forest Service can implement ecosystem management under the current budget structure, the present structure does have complexities that make implementation considerably more difficult . . . The current budget structure evolved in response to highly functional resource management programs which parallel constituent groups. The highly detailed budget structure establishes fiscal controls on the input side of management through numerous budget line items. This structural detail has resulted in extremely functional, costly, and complex accounting and reporting systems that hamper the agency's ability to implement the highly integrated resource approaches needed to support ecosystem management" (USDA Forest Service presentation, Congressional Research Service 1994, p.19).

"The BIA does not have a working definition of ecosystem management, nor is that appropriate. Indian tribes are leaders in ecosystem management . . . The principles of ecosystem management [or sustainable development] existed long before the term was accepted and recognized by the scientific community. These principles can be expressed in simple terms. Food, clothing, shelter, water, spirit, culture, seven generations before us, seven generations after us, all things are connected" (Bureau of Indian Affairs presentation, Congressional Research Service 1994, pp. 51-52).

"The principles of ecosystem management require Federal agencies to integrate management actions at various scales including landscape and watershed perspectives. The boundaries of the Forest Service forests and BLM districts, however, were not drawn to facilitate the accomplishment of ecological objectives. The agencies have developed coordinating mechanisms to initiate interagency efforts such as PACFISH and rangeland reform. Yet, implementation of these efforts are often confounded by the two agencies' differing missions. The BLM and the Forest Service are attempting to integrate administrative processes and planning regulations to streamline interagency coordination. In addition, the agencies are working to employ comparable data standards and resource classification systems to simplify the exchange of information. The current budget structure is inflexible and does not facilitate an integrated or coordinated approach to resolving resource issues. The present budget process is also complex and costly to administer; not responsive enough to meet rapidly changing demands; has too many individual sources of funding; and focuses too much on individual programs" (Bureau of Land Management presentation, Congressional Research Service 1994, pp. 62–63).

The report diagnosed the problem but stopped short of recommending major institutional reform. The task force assumed that ecosystems management can be achieved without significant federal reorganization. That is not likely to be the case, if only because of the significant budgetary constraints at the federal level.

• *Watershed Planning Conference*. Representatives from 13 federal agencies and numerous stakeholders convened in June 1996 for a 4-day conference to

discuss watershed planning. The 1,165-page report of this conference is titled *Proceedings: Watershed'96. Moving Ahead Together* (EPA 1996). Topics addressed included the following: Citizen Involvement in Watershed Management, Partnership Approaches to Watershed Management, Analytical Techniques Applied to Watershed Management, Funding Approaches to Watershed Programs and a variety of case study experiences.

- *GAO Review*. The 1996 GAO report, *Federal Land Management: Streamlining and Reorganization Issues*, noted, "Reconciling differences among laws and regulations is further complicated by the dispersal of authority for these laws among several federal agencies and state and local agencies. Disagreements among the agencies on whether or how these requirements can best be met sometimes delay projects and activities" (GAO 1996b).

Although the reports, and others like them, have been vital in disseminating information on how to focus natural-resources policy, federal-agency officials appear to be spending increasing amounts of time on agency coordination rather than on service delivery to the public.

## Federal Leadership

The national interest in nonfederal forests is most clearly articulated by the state and private forestry unit of the USDA Forest Service. The unit's programs and magnitude of investments are modest ($137 million in 1996) and are supposedly commensurate with the national interest in nonfederal forests and the benefits that such forests are capable of providing to the nation. The State and Private Forestry unit's current position and financing does not make it capable of providing the federal leadership for sustainability of nonfederal forests. Its position within the federal forestry and natural-resource agencies is negligible; its programs within the USDA Forest Service are overwhelmed by federal-forest programs; its mission is increasingly unclear (increasing the capacity of states to protect forests is no longer a key mission); and because of its many program responsibilities and associated interest groups, the unit has been unable to be the nation's principal organization for federal activity involving nonfederal forests. Potential solutions to federal leadership problems in nonfederal forestry do exist. One solution would be to make the USDA Forest Service more responsible for programs affecting nonfederal forests.

## Improving Federal Organization

Federal agencies and programs that have implications for the use, management, and protection of nonfederal forests can be overwhelming. The federal government's 1979 proposal for federal natural-resource reorganization stated

(Convery et al. 1979) that "the present federal organization for managing our natural resources is scattered, cumbersome and wasteful . . . [is] no longer suited to the complex role of government in the wise development of natural resources [and] fails to take account of the extensive physical interactions among our natural resources."

Over the years, more single agencies, bureaus, and departments have been established for special purposes involving forest and natural resources or for broader purposes (e.g., economic development) that have implications for forestry. Program and agency expansion began with the passage of the National Environmental Policy Act (NEPA) in 1969. Subsequent legislation, such as the Federal Water Pollution Control Act of 1972 and its amendments, the Endangered Species Act of 1973, the Clean Air Acts of 1977 and 1990, the National Forest Management Act of 1976, the Federal Lands Policy Management Act of 1976, the Farm and Agriculture Acts of 1985 and 1990, and others, has contributed to an enlarged federal bureaucracy engaged in some aspect of natural resource management. Today, the state forester and the private forest landowner no longer interact principally with a federal forester employed by the USDA Forest Service. A wide network of federal agencies, bureaus, and departments, each administering its own programs, now affects nonfederal-forest owners and managers.

The large number of programs and agencies devoted wholly or in part to private-forest issues suggests some need for reorganization. Arguments for doing so are generally in three categories, namely, improved efficiency (e.g., eliminating duplication and establishing clearer lines of authority), improved management (e.g., clearer focus and ability to resolve conflicts), and change in policy direction (e.g., elimination of programs and severance of interest-group ties) (Mann and Anagoson 1979). From a natural-resources perspective, many solutions have been suggested or carried out to accomplish those goals. One solution is to establish a federal department of natural resources and merge environmental regulatory programs and ultimately the EPA. Solutions not involving reorganization have entailed changing the agency or bureau names (e.g., from USDA Soil Conservation Service to USDA Natural Resource Conservation Service) or engaging in a variety of coordinating (e.g., memoranda of agreement between agencies) and administrative efforts (e.g., formation of boards and commissions) (Kilgore and Ellefson 1992).

Most reorganization proposals involving federal natural-resource agencies have rarely dealt with programs and agencies that involve nonfederal forests specifically. New institutional arrangements that clearly define the federal role in promoting sustainability of nonfederal forests might well be needed. Given the widespread interest in new forest-management directions (e.g., ecosystems management and sustainable management) (Clarke and McCool 1996), the time might be right to change the current federal-agency organization. The following possibilities are offered on this important topic.

- *Consolidate Programs Within Agencies.* The number of programs and line items within the USDA Forest Service's state and private forestry unit could be reduced from seven to three. Programs that could be combined into one bloc grant are Rural Forestry Assistance, Forest Stewardship, Stewardship Incentives, Forest Legacy, and Forest Health Protection; that would allow for greater flexibility for state foresters and private landowners. The Urban Forestry and the Cooperative Fire programs could remain separate. The USDA Forest Service is already moving in this direction. It has sought congressional approval to reduce its main appropriations from 13 to 8 and its line items from 72 to 42 (Congressional Research Service 1994).

- A new state, private, and tribal forestry bureau could be created that would be responsible for all current functions of the USDA Forest Service's State and Private Forestry unit. The new bureau within the USDA could have equal status with the USDA Forest Service and other bureaus within the USDA. Directors of nonfederal-forest programs in the federal agencies would be assigned to the new forestry bureau.

- *Consolidate Programs Within Departments.* Currently, at least three agencies within the USDA administer programs affecting the nonfederal-forest owner. They are the USDA Cooperative State Research, Education and Extension Service, the USDA Forest Service, and the USDA Natural Resource Conservation Service. Efforts could be made to consolidate these programs within one of the three existing agencies. The U.S. Department of the Interior (DOI) offers additional opportunities for program consolidation. Currently, six agencies or units, each with one or more programs, affect the nonfederal-forest owner. They are the Bureau of Indian Affairs, the Bureau of Land Management, the Bureau of Reclamation, the Fish and Wildlife Service, the Land and Water Conservation Fund, the National Park Service, and the U.S. Geological Survey. Clarke and McCool (1996) advocate merging the Bureau of Land Management, the Bureau of Reclamation, and the Fish and Wildlife Service into a single federal agency (Clarke and McCool 1996).

- *Consolidate Programs Across Departments and Independent Agencies.* One or two primary agencies could be designated to provide incentives (e.g., services, grants, and information dissemination) and regulations (e.g., wetlands preservation, pollution control, and endangered species protection) to nonfederal-forest owners and managers to achieve sustainability within a more highly targeted federal investment strategy. Most of the other existing agencies' programs could be merged gradually into these programs. Another possibility is that the USDA Forest Service could focus on wetlands regulations and nonpoint-source water pollution, which are now a major responsibility of the Army Corps of Engineers and the Environmental Protection Agency. Although the USDA Forest Service has no regulatory role with respect to nonfederal forests, its involvement in other matters affecting these lands, and its expertise about forest

resources, provide a rationale for giving it greater responsibility for coordinating the efforts of the other two agencies or for assuming their responsibilities.

The above initiatives (consolidation within agencies and departments and across departments and independent agencies) are examples of actions that could be undertaken to better focus federal concern with nonfederal forests. Reorganization activities are always difficult and can lead to substantial disruption. Furthermore, past efforts to reorganize federal natural resource agencies have met with limited success. Yet, the need for sustainability of nonfederal forests, and the federal government's role in accomplishing that, suggests that government should be organized to efficiently carry out the programs for which it is responsible. Accomplishing sustainability of nonfederal forests requires consideration of new organizational designs.

In summary, numerous federal agencies and programs are involved in the use, management, and protection of nonfederal forests. At the very least, the features of effective federal involvement in nonfederal-forest issues are the following (GAO 1993, GAO 1996b):

- Promote efficiency and effectiveness in the delivery of federal programs for nonfederal forestry by consolidating similar programs and organizations or initiating effective coordinating mechanisms. Any plan for reorganization, however, should seek to achieve specific, identifiable goals.
- Promote an organizational landscape that is capable of carrying out an agreed to federal policy concerning nonfederal forests.
- Promote an organizational landscape that can clearly link with nonfederal-forest interests at the state and regional level.
- Promote greater visibility of federal agencies and bureaus that are given major responsibility for dealing with issues involving nonfederal forests. For example, the USDA Forest Service's State and Private Forestry unit could be given special attention.
- Coordinate reorganization within and between agencies, supported by a solid consensus for change in the Congress and the Administration.
- Sustain oversight by the Congress to ensure effective implementation of agreed to reorganization or coordination activities.

## LINKAGES BETWEEN FEDERAL AND NONFEDERAL ENTITIES

### Federal Linkages

The federal government attempts to address the national interest in nonfederal forestry through a variety of public and private organizations. Federal linkages

through state governments are especially notable. For example, federal environmental laws frequently call for state development and implementation of plans to curb various types of pollutants (e.g., Clean Water Act and Clean Air Act). The federal role has been to provide general policy direction, technical assistance, and financial support to state governments. The State and Private Forestry unit of the USDA Forest Service interfaces with states in a similar manner (e.g., forestry cost-share programs). In many respects, however, the appropriateness of existing purposes and resulting linkages between the federal government and other public or private organizations that have an interest in nonfederal forests has become a concern to many in a era of federal reductions. These concerns are expressed in the following examples.

Historically, the federal government helped to build the states' capacity to carry out forestry programs. Federal efforts have been especially notable in enabling states to protect public and private forests from wildfire and to engage in forestry activities that are professionally guided. Those efforts have been remarkably successful. The question now is, "What next—if anything?" If the federal government has accomplished its mission in terms of helping states protect and manage nonfederal forest within state boundaries, what major role should the federal government now assume? The answer to that question is affected by larger political concerns over the role of government generally in a modern society. Recent proposals to transfer some federal forests to states to indicates the nature of the struggles over specifying an appropriate federal government relationship to state governments.

Further concerns over federal linkages to states involve the narrow scope of federal assistance to states (e.g., timber, water, recreation, and water pollutants), a narrowness that seems inconsistent with the more holistic ecosystem approach to forestry that is currently being advocated by the USDA Forest Service and other federal resource agencies. Perceptions of federal management and allocations are also of concern to many. This management is inconsistent with the trend toward grass-roots, locally generated initiatives. Inflexible allocations of technical and financial assistance to states also contradict that trend. Uncertainty over federal and state linkages is reflected, in part, by the way the federal government has organized regional offices to interface with states. Many regional offices of the federal government are remarkably different (e.g., EPA regions and U.S. Fish and Wildlife regions). Even the USDA Forest Service's state and private forestry programs are delivered inconsistently (one via a specific area office, others in affiliation with regional offices of the National Forest system).

Forestry-program linkages between the federal government and the entities that have an interest in nonfederal forests (especially states) are complex, confusing, and destined to become more uncertain as debates occur over the federal role in society. Within that context, the federal government's link to states and other entities that have an interest in nonfederal forests will be determined. Determining when the federal government has completed its mission in building state-

forestry capacity and determining what, if any, its new role should be will increase the confusion.

## State Organization

State governments, as well as the federal government, have a variety of programs and agencies that focus on forests, including nonfederal forests issues. The manner in which states structure their agencies and programs is important since states are often the primary vehicle through which the federal government attempts to secure the national interest in nonfederal forests.

States typically have four government agencies administering forestry programs within their state boundaries. The range includes 4 states that have a primary forestry agency responsible for forestry programs and one state that has 10 public agencies engaged in forestry programs. Specifically, 19 states have 1 to 3 agencies involved in forestry programs, another 19 states have 4 to 6 agencies involved, and 7 states have 7 to 10 agencies involved. In addition, two-thirds of the primary forestry agencies within states are responsible for programs not traditionally viewed as forestry in nature (e.g., economic development) (Kilgore and Ellefson 1992). In summary, when the large number of federal programs is matched with an equally diverse set of state agencies and programs, the organizational picture becomes extremely complex.

## Improving Federal Linkages to Nonfederal Interests

The ability of the federal government to work effectively with nonfederal public or private organizations is critical to accomplishing federal interests in nonfederal forests. In initiating and implementing programs, the federal government has the advantage of a national perspective and an ability to generate funding and other resources. At the same time it is limited by its need to address a wide variety of national issues, its inability to be knowledgeable about the great diversity of regional and local concerns and issues, and its fragmented approach to ecosystem issues due to a multiplicity of departments, bureaus, and agencies. The diversity of the nation's nonfederal forests, their owners, and their uses requires a national policy that is sensitive and supportive of these differences.

As is appropriate in a federal system of government, states have a major role in reflecting this diversity. The growing sense of regionalism in the nation reflects citizens' desires to be recognized as being different economically, politically, and culturally. An interest is also being expressed in ensuring the integrity of large- (landscape-level) scale ecosystems, an interest made especially challenging by the many owners that typically own parts of large ecosystems. Further, citizens are interested in designing actions that will affect them, namely, they are interested in discursive democracy where decisions are made by "equally competent individuals under conditions free from domination . . . [The] process

proceeds in nonhierarchical fashion, and so no cognitive burden is imposed on any decision center" (Dryzek 1990). Common procedures used in discursive design decision making are roundtables, environmental mediation, regulatory negotiation, and alternative dispute resolution (McAllister and Zimet 1994).

Within the above context, a new type of federal-program delivery system for nonfederal forests is needed that extends beyond political boundaries, that is the product of a so-called "ground-up" designation system, and that affords regions access to information and education on their natural resources. In many areas of the country, organizations have been or are being created to manage natural resources in their areas in a more holistic, less fragmented manner. For example, in the Northeast, the Northern Forest Lands Council was organized to conduct an extensive study of the region's forested areas (Northern Forest Lands Council 1994). In the Northwest, after years of gridlock over timber harvesting versus critical-habitat preservation, a variety of new institutions have been created, including the 144-million acre Interior Columbia Basin Ecosystem Management Project, the Upper Columbia Basin Project (USDA Forest Service 1996), the Montana Bitteroot Regional Agreement on the reintroduction of the grizzly bear, the Flathead Common Ground Project, and the Swan Valley Conservation Agreement. In the Southeast, Trees Atlanta and the Urban Resources Partnership were created.

Many institutional structures could improve the federal government's ability to interface with owners of nonfederal forests as shown above. Some additional examples are the following:

- *Private Forest Regions*. Establishment of private forest regions as a functional program delivery system for landowners and others within the designated region could be initiated. Regions would be designated by the USDA Forest Service's State and Private Forestry unit after sufficient requests have been made, and evaluations of the ecological importance of the proposed regions are documented. Once designated, the region would qualify for federal funding for GIS supported planning services to identify wildlife habitat, forest-cover types, productivity of soils, diversity of plant species, recreational opportunities and demands, and timber supply and demands. Participation would be voluntary. Incentive programs could be designed specifically for a region. For example, if regional analysis identifies a requirement for a specific extended-rotation forest area in the region to support a desired range of wildlife species, the region could design a cost-share program to promote that use among private forest landowners until the target figure was reached. The cost-share program could then be phased out.

- *Forest Development Centers.* Regionally established forest development centers (as currently proposed in Finland) are another structure by which the federal government might interface with the owners of nonfederal forests. A region would be multistate and would have boundaries consistent with the cul-

tural, political, and ecosystem characteristics of the area. Regional centers would be responsible for the sustainable management and use of regional forests. A management board would provide direction. Appointed by the Secretary of Agriculture, the board would be composed of representatives of state and federal government, private landowners, organizations, and other interests that are especially important to a region. The board would be responsible for the development of a regional plan that would guide the preparation and presentation of budget requests to the federal government (to one or more agencies). The requests would be consistent with regional interests but would accommodate national concerns as well. The federal government would implement its policy for nonfederal forests through the regional centers. A board would be supported by modest staff (Ministry of Agriculture and Forestry 1996).

- *Landscape Coordination Councils*. Other names for this example are ecosystem coordination councils and habitat coordination councils. In various parts of the country, organizations have developed that attempt to address problems that exist at the landscape ecosystem level (Lee and Black 1993). These attempts to address landscape-level issues face considerable barriers and these organizations have little recognition within either federal or state governmental structures (Williams and Ellefson 1996). Landscape coordination councils are a potential way for the federal government to work more effectively with these and other formally organized public and private organizations. Designating a council might involve a two-step process; namely, interested groups determining whether they meet a series of threshold tests that would qualify them as a council; and having met those qualifications, becoming eligible for federal support.

- *Private Cooperatives.* Cooperatives composed of owners and patrons also represent a potential structure for nonfederal-forest owners to interface with the federal government. Forestry cooperatives are widely used in European countries, often being the principal means by which the national government channels cost-share and technical assistance to nonindustrial private-forest owners (Grayson 1993). Interested parties could organize a voluntary forest cooperative (or association of woodland owners) that would provide services to members, including technical and financial assistance to encourage coordination of land use and management practices among owners of forest property that is part of a larger forested landscape. As in European countries, the federal government could channel financial and technical support to nonfederal-forest owners via cooperatives. By participating in a cooperative, landowners would be able to gain access to services that are not available to them individually (Demspey and Markeson 1969).

- *Public and Private Landowner Partnerships*. Public and private partnerships composed of landowners (federal and nonfederal) are another possible approach for regional interfacing with the federal government. Landowners could coordinate the implementation of environmental and forest resource polices and programs across ownerships. To ensure commitment to a partnership,

operations would be funded by annual member dues. Many types of government and private organizations could channel financial resources through partnerships for the purpose of insuring the sustainability of forests, including nonfederal forests, at the larger multiowner level (Box 6-2).

- *Other Possible Structures*. Other kinds of institutions through which the federal government might interface with owners of nonfederal forests are the following: (1) Organizations of forest landowners formed to accumulate capital and invest it efficiently. These organizations would include firms in the forest-products industries. They also could include landowner associations and

**Box 6-2**
**Minnesota Institutions for Cooperative Engagement of Interests in the Development and Implementation of Major Forest-Resource Policies and Programs**

*Forest Resources Council*

*Structure*: A 13-member governor-appointed council representing a broad range of organizations with interests in the use and management of the state's public and private forests.

*Responsibilities*: Major responsibility is to secure interest-group engagement in the development of forestry programs and concurrent commitment to their implementation. Specifically responsible for development and application of comprehensive timber harvesting and forest-management guidelines, and the establishment of mechanisms to facilitate coordination and planning across large forested landscapes with diverse ownership patterns. Also responsible for providing oversight to programs involving timber-harvester education, statewide information management, continuing education of natural-resources professionals, broad statewide public-education activities, coordination of priority forest-research efforts, and monitoring of resource conditions and guideline application. Advise governor and various levels of governments on major forest resource issues.

*Measure of Success*: The state's forests, communities, and economies sustained by effective application of programs developed and implemented by persons and organizations with interests in the sustainability of the state's forest resources.

*Forest Resources Partnership*

*Structure*: A 25-member nonprofit private organization representing timber harvesters and major public- and private-forest landowners.

*Responsibilities*: Help ensure the implementation of Forest Resources Council recommendations in a timely and coordinated manner, by fostering coordination between forest managers and landowners in addressing landscape-level management and operational concerns. Serve as a forum for discussing operational and implementation issues related to forest-resource planning and management. Advises council on forest operational issues.

*Measure of Success*: Coordinated application of effective forest-resource planning processes and forest-management practices resulting in the sustainability of the state's forests, communities, and economies.

cooperatives in which ownership remains individual, but capital is pooled and allocated by the organization. (2) Organizations of financial institutions that invest in sustainable forest management. These organizations include institutions that accumulate capital in pension funds and are seeking good long-term investment outlets. They also include institutions such as federal-land banks that provide capital to landowners. (3) Organizations' cooperatives that collect, analyze, and disseminate information relevant to investment in sustainable forest management of nonfederal forests. (4) Organizations such as the federal Empowerment Zone/Enterprise Community program, which requires communities to use collaborative planning processes in drafting funding proposals for presentation to the federal government (President's Council on Sustainable Development 1996).

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

There is substantial uncertainty as to how the federal government might better function with various nonfederal interests. Better approaches are necessary, however, to improve communication between the federal government and owners of nonfederal forests. Whatever approach is ultimately used, it should acknowledge the following interests:

- A growing interest in maintaining a sense of regional identity.
- A widespread desire to sustain the integrity of large-scale forest ecosystems.
- A citizens' interest in becoming involved in the design of policies and programs that could affect them.
- A desire for less authoritative role for the federal government in the development and implementation of programs.

The effectiveness of administrative and organizational linkages between federally administered programs focused on nonfederal forests and their public and private counterparts in various regions of the nation could be improved. Federal agencies with programs focused on nonfederal forests including the USDA, U.S. Department of Commerce, U.S. Department of the Army, U.S. Department of the Interior, U.S. Department of Labor, U.S. Department of the Treasury, and U.S. Environmental Protection Agency, should increase coordination and organization of programs. These federal programs and support should reflect a national interest in nonfederal forests.

**RECOMMENDATION:**

*Improve the ability of the federal government to focus on the national interest in nonfederal forests, especially the ability to identify national interests in nonfederal forests and to deliver programs and support that will enable accomplishment of these national interests.*

This need points to the following specific recommendations:

- *A national policy for nonfederal forests that is grounded in a comprehensive policy for the nation's forests should be established.*
- *Federal strategic-planning processes should identify national interests in nonfederal forests and subsequently set forth a strategic plan for federal action.*
- *Organization and coordination among federal agencies and programs focused on nonfederal forests should be improved and administrative and organizational links among federal programs focused on nonfederal, public, and private forests should be simplified to be more effective.*
- *Institutional partnerships that foster the coordinated use, management, and protection of large forested landscapes involving public and private forest landowners should be promoted.*

# 7

# Policy and Program Investments

## INTRODUCTION

With an understanding of the concept of sustainability and knowledge of the current status of nonfederal forests, values and benefits derived from these forests, existing policies and programs affecting forests, and forest ecological conditions, new ideas can be explored for improved policy and programs. In this chapter, opportunities are suggested to improve sustainability of nonfederal forests through policy and program options.

Investments in the nation's nonfederal forests to sustain their economic, social, and environmental contributions include investments in various types of public and private programs. These programs are a means to secure the range and magnitude of benefits potentially provided by nonfederal forests. Possible program activities include developing management responses to private market signals, forming ownerships of forest property by the public, distributing information, and providing technical assistance, access to financial resources, and the imposition of governmental regulations. The challenge for the government in policy development is to acknowledge the many kinds of landowners and goals, the effectiveness of public programs in addressing serious long-term forest-resource issues (for example, biodiversity or global climate change), and the large number of existing programs and the complex interactions between them.

## GOVERNMENTAL INITIATIVES

The history of federal involvement in nonfederal forestry has been one of providing leadership for establishment and application of progressive forestry

programs by private owners and by state and local units of government. In so doing, the federal government has been important in increasing the policy and program development of these entities (Dana and Fairfax 1980). However, many of the policies and programs, especially those for nonindustrial private forests, have been developed in response to single concerns (for example, timber, wildlife, or water quality) and assigned to different agencies for implementation: education to extension services; service forestry to state forestry agencies; tax policy to local governments; forest wildlife to state wildlife agencies; water quality to state pollution-control agencies, and so forth. There has never been a strategic, multidimensional program rooted in a comprehensive national policy focused on nonfederal forests. The result is numerous programs that often lack a common vision or direction. For example, U.S. Department of Agriculture's (USDA) Forest Service nonfederal-forests programs (see Part Two of this report) range from timber bridge initiatives to old-growth-diversification studies and from forest-products conservation and recycling to seedling, nursery, and tree improvements.

For purposes of examination, assistance programs for nonfederal forest owners can be categorized as focusing on education, technical assistance, financial incentives, tax incentives, regulatory actions, and public easements or direct ownerships (Box 7-1). The categories are usually implemented together to obtain their complementary effects. For example, technical assistance and financial incentives are usually combined. Programs (and the combination of programs) are selected on the basis of their efficiency and effectiveness and the proficiency with which they can be targeted and carried out. The frequency of use of programs is also influenced by the ease with which they can be administered, the equitable distribution of services and benefits to landowners, and the strength of public sentiment for or against their implementation.

## PRIVATE AND VOLUNTARY INITIATIVES

Private initiatives that foster management and protection of nonfederal forest are numerous. They include forest-industry efforts to enhance management of nonindustrial forests, voluntary engagement in public and private programs, conservation organizations purchasing and managing ecologically sensitive forest properties, and public-service announcements about protecting forests from wildfire. Many initiatives focused on nonindustrial private forests have expanded during the 1990s in response to growing pride in forest ownership, attempts to increase market share, and desires to avoid governmental involvement in forestry practices.

### Forest-Industry Initiatives

Industrial-forestry concerns have brought about a number of programs focused on the use and management of forests, especially nonindustrial private

**Box 7-1**
**Most to Least Commonly Used State Programs to Influence Private Forestry Practices, 1992**

| Focus of Program and Practices | Most (1) to Least (6) Used State Program to Promote Forest Practices: Educational Program | Technical Assistance | Voluntary Guidelines | Tax Incentives | Fiscal Incentives | Regulatory Program |
|---|---|---|---|---|---|---|
| Protect Water Quality | 2 | 1 | 3 | 6 | 4 | 5 |
| Promote Reforestation | 1[a] | 1[a] | 5 | 4 | 3 | 6 |
| Improve Timber Harvesting | 2 | 1 | 3 | 6 | 5 | 4 |
| Protect From Wildlife, Insects & Diseases | 1 | 2 | 4 | 6 | 5 | 3 |
| Protect Wildlife & Rare & Endangered Species | 1 | 2 | 5 | 6 | 3 | 4 |
| Enhance Recreation & Aesthetic Qualities | 2 | 1 | 4 | 5[b] | 3 | 5[b] |

[a]Educational and technical assistance programs tied (ranked 1) in frequency of use to promote reforestation.
[b]Tax incentive and regulatory programs tied (ranked 5) in frequency of use to enhance recreation and aesthetic qualities.
Source: Ellefson et al. 1995.

forests. The "tree-farm program," begun in western Washington in 1942, certifies forest property, an action that makes property owners eligible for forest-industry-sponsored technical and financial assistance. In the late 1980s, over 7 million acres of nonindustrial private forest were eligible. Tree-farm members number 70,000 (including inactive members). In the early 1990s, the program's scope was broadened to reflect other interests, especially interests in wildlife, recreation, water, and wood. The standards for tree-farm management were also upgraded to ensure that each of those four resources was addressed. From an industrial perspective, the program has been supplemented by corporate "fiber farms," which focus on fiber production. Other private initiatives to enhance the use and management of forests include the American Pulpwood Association's "pilot forests" and the joint industry-government "family-forests" programs.

The forest industry also started the "Sustainable Forest Initiative" (SFI) through the American Forest and Paper Association (AF&PA), whose member companies own 90 percent of U.S. industrial timberland. The program sets forth a set of forest principles and implementation guidelines that require companies to carry out a variety of actions, including reforesting harvested land promptly, protect water quality in streams and lakes, enhance quality of wildlife habitat, minimize visual impact of timber harvests, protect lands of special ecological significance, contribute to biodiversity by enhancing landscape diversity (American Forest and Paper Association 1995; Chapter 5, Box 5-5). Compliance with SFI is a requirement for continued membership in AF&PA. In 1996, 17 companies of more than 100 member companies were suspended from membership for failure to confirm participation in the SFI. A regional (Pacific Northwest) variation of the SFI is a cash supplement paid by mills to timber harvesters and log suppliers that engage in SFI principles and activities.

Individual companies have also initiated landowner-assistance programs (LAPs) that provide technical and financial assistance to owners of nonindustrial private forests. Historically, these programs involved agreements in which companies providing services had "first-refusal" rights to buy the mature timber or at least bid on the timber. In 1994 and 1995, nearly 11,000 landowners received assistance via LAPs (over 3,500 occurring in Louisiana and South Carolina), an increase of 47 percent over 1993 and 1994 levels. Companies also assist landowners with the preparation of forest-management plans and, in many cases, provide them with seedlings for regeneration. In 1994 and 1995, over 72 million seedlings were provided (at no cost) by the forest-products industry (Heissenbuttel 1996).

Because the industrial programs are private, governmental assistance is limited. However, these programs may seek governmental assistance in accessing and disseminating technical and program information. Government also might support initial development of various industry initiated programs, for example timber harvester certification and registration programs (MacKay et al. 1996).

### Nonprofit-Organization Initiatives

Nonprofit organizations have initiated a number of programs that directly or indirectly involve nonfederal forests. Indirectly, the educational and assistance programs of these organizations influence the way in which owners of nonfederal forest manage their property. Directly, many conservation organizations own and manage forests and related property. The Nature Conservancy, for example, operates the largest private system of nature sanctuaries in the world: 1.3 million acres in the United States is under conservancy ownership or conservation easement. Similarly, the National Audubon Society owns and manages 100 sanctuaries that encompass 150,000 acres of wide-ranging habitat. Some nonprofit organizations, such as the Nature Conservancy and the National Audubon Society,

acquire land on the basis of criteria associated primarily with protection and conservation of land; however, other nonprofit organizations, such as the American Land Conservancy, the Conservation Fund, and the Trust for Public Land, use criteria for land acquisition that largely reflect traditional federal criteria (National Research Council 1993). From 1988 to 1992, 18 nonprofit organizations acquired 249 parcels of land, much of which is forested (totaling 288,000 acres), that were either sold or transferred to a unit of government or were retained and ultimately became nonfederal ownership (GAO 1994b).

Many nonprofit organizations focus on land acquisition; others are shifting from land acquisition to cooperative partnerships for ecosystem conservation. For instance, the National Fish and Wildlife Foundation was established by Congress as a private, nonprofit foundation to support U.S. Fish and Wildlife Service activities and related activities. Private and state funds raised are matched by Congress and are spent on land acquisition, research programs education, endangered species recovery, restoration of degraded habitat, and some policy work involving political analyses to assist government agencies and nonprofit organizations in working together to achieve conservation goals. Nonprofit organizations generally seek limited government involvement in their activities; yet, they often seek partnerships with government in protecting and managing sensitive forest ecosystems.

### Forestry-Consultant Initiatives

Private-program initiatives on nonfederal forests are reflected in the actions of private-forestry consultants, especially those that focus on private nonindustrial forests. The magnitude of their impact on the latter is highlighted by the activities of the 500 members of the Association of Consulting Foresters. In 1995, association members provided technical forestry advice to nearly 29,000 clients; managed nearly 20 million acres of private forest under long-term agreements; assisted in the sale of $1 billion worth of private timber; and supervised the reforestation of almost 385,000 acres of private forestland. In context, the reforestation represents nearly 38 percent of all nonindustrial private forestland reforested with tree seedlings in 1995. Many forestry consultants favor limited involvement of government in forestry activities. If involvement is desired, it usually is in the form of referrals from governmental agencies or access to information and educational opportunities made available by governmental programs.

### Volunteer Efforts

Nonfederal forests are affected by the voluntary actions of owners or users of these forests. Undertaken with a spirit of responsible stewardship, many owners act to protect areas of exceptional value in terms of biodiversity or act to apply forest practices that foster resource sustainability (Best and Wayburn 1995). The

landowner can view voluntarily maintaining natural forest diversity (represented by forest-age classes, native biodiversity, water quality, and soil productivity) as an ecological insurance policy that will reduce the risk of supplying future markets with forestry goods and services (Best and Wayburn 1995). The motives for voluntarily protecting and managing forests in a sustainable fashion are many and complex. The role of government is frequently one of identifying opportunities for voluntary action.

Private voluntary initiatives also occur in the form of citizens volunteering to help various causes, including the application of sustainable forestry practices by private forest owners. Excellent examples are the "master woodland manager" programs that exist in at least 14 states. Engaged and trained by private (for example, the Ruffed Grouse Society) and public (for example, USDA Cooperative State Research, Education and Extension Service) organizations, volunteers seek to influence the forestry-related activities of other private landowners. To date, over 1,500 volunteers have been trained and have provided advice and counsel on forestry matters to thousands of private landowners. Again, the role of government is one of highlighting opportunities and providing educational assistance to further citizen interest in seeking those opportunities (Fletcher and Reed 1996).

## Certified Forest Practices

Market demand driven by privately initiated certification programs is considered a way to encourage sustainable production of a full range of forest products, including high-quality sawtimber, nontimber forest products, and carbon storage (Elliott and Hackman 1996, Best and Wayburn 1995). An example having implications for nonfederal forests is the various international-buyers groups that have been established by the World Wildlife Fund (WWF) and other organizations. The WWF buyers groups consist of national retailers that have agreed to purchase timber products primarily from independently certified forestry operations that comply with the Forest Stewardship Council (FSC) certification principles and standards. Some of these buyers groups have already been successful. For instance, the 1995 Plus group in the United Kingdom holds approximately one-fourth of the nation's 1995 timber market, and to date, over 168 companies are members of buyers groups in North America, United Kingdom, Germany, Belgium, Switzerland, and Sweden, and other groups are forming in Australia, Austria, and The Netherlands. A similarly structured certification program is being developed by cooperative efforts of Finland, Norway, and Sweden (Barklund 1996). Successfully implemented in North America, such certification efforts could stimulate consumer demand for forest products originating from nonfederal forests that have been independently certified as using sustainable management practices. The role of the government in fostering these programs could include providing technical advice and assisting in building the

technical and administrative capacity needed to ensure their success. The federal government could also assess impacts of certification efforts.

Private and voluntary initiatives are important means of furthering the sustainability of nonfederal forests. Private initiatives focused on the use, management, and protection of nonfederal forests often must be given priority. The government should facilitate voluntary action so that the positive self-interests that citizens and private organizations have in nonfederal forests can be fully exercised. The government can assist the private sector in developing its ability to carry out their missions for nonfederal forests—assisting private sources of technical forestry information, including forestry consultation, in carrying out their efforts to meet the technical forestry needs and facilitate actions, such as certification of forestry practices, that will enable citizens to make well-informed choices about purchasing products or services they purchase in the market place and that originate from nonfederal forests.

In addition, the federal government can cooperate with national and international organizations that develop certification standards. Federal involvement could advance the development of international standards of certification that lead forestry enterprises to seek certification of practices that are ecologically, economically, and socially sound. Federal forestland systems might also be included in programs providing independent, third-party certification, thus providing a model for state and private sectors. Participation by the federal government could facilitate effective assessment and monitoring procedures and could demonstrate high standards for sustainable forest management.

## EDUCATION AND TECHNICAL ASSISTANCE

### Education and Information

Education and information programs are prepared for groups or the general public. Forest owners, policymakers, and the general public should be informed about social, economic, and environmental impact of nonfederal forests in contributing to local, state, and national needs. The importance of good information from the landowner's perspective is highlighted by the usefulness of market information about timber prices. When available, this information enables landowners to make informed decisions regarding investments in their property and leads them to profitable markets for their products. Landowners have limited access to timely, high-quality information about market prices for forest products.

In some measure, the responsibility for forestry and environmental education exists with the USDA Cooperative State Research, Education, and Extension Service, the USDA Natural Resource Conservation Service, the USDA Forest Service State and Private Forestry, the U.S. Environmental Protection Agency (EPA), programs of state forestry agencies, and a variety of private natural-resource organizations. All of these organizations are committed in some manner

to public education. However, the potential for duplication and uncertainty over the roles of these organizations exists and is often cause for confusion and overlap (Hoban et al. 1986).

Information and education programs involving forestry often consume large amounts of financial resources and professional time and energy. For forestry and environmental education efforts to be successful, information must be timely and complete. Gaps in timeliness and completeness of information can impede the ability of persons and organizations to inform landowners and the general public, help set goals and shape policy, and facilitate the design and implementation of programs (Lewis and Ellefson 1983). Where these gaps occur, some suggest they are reflective of broader concern about the effectiveness of education and information programs especially for the general public, a concern that has received little attention (Dillman 1986, Rivera 1996). The impact of broadly based educational efforts is difficult to quantify. In part, the lack of evaluation of program effectiveness stems from the ambiguous goals and objectives of such programs. If program objectives are more clearly defined, more careful assessment of the effectiveness of information and education programs can be conducted, and the programs can be implemented more effectively.

## TECHNICAL ASSISTANCE

Technical-assistance programs provide direct field advice on technical forestry and related topics primarily to landowners, timber harvesters, and timber processors. Federal involvement in technical-assistance activities began in 1937. Over the years, states and private industry have assumed the key role in these activities. Service foresters are the primary means of delivering technical assistance; states employed nearly 3,500 service foresters in 1995 (National Association of State Foresters 1995). In general, evaluations have shown service foresters to be efficient and effective in positively influencing the forestry activities of landowners (Henly et al. 1988, Cubbage et al. 1993, Cubbage et al. 1996). The potential for providing technical assistance is highlighted by the reality that only one in five nonindustrial private forest landowners has a written management plan for their forestland (Birch 1996).

A number of issues involve technical-assistance programs. For example, concern is often expressed about the appropriate mix of providers of technical assistance, especially the mix of private consultants and state-employed service foresters. In reality, however, provision of assistance by several sectors is more likely to be complimentary than competitive (Cubbage and Hodges 1988). Concerns have also been raised about the appropriateness of providing technical assistance to virtually anyone that chooses to seek such services (Ellefson and Wheatcraft 1983, O'Leary et al. 1983, Cubbage and Hodges 1988). To improve efficiency, only those landowners with modest income, large holdings, highly productive forestland, or especially sensitive ecosystems might be targeted for

federal and state technical assistance programs. The failure of landowners to seek out technical assistance from any source is also a concern for program administrators. In some states, less than 5 percent of private nonindustrial-forest landowners (representing less than 5 percent of private nonindustrial land) seek technical forestry assistance from any source (Cubbage and Hodges 1988, Hodges and Cubbage 1990).

## FISCAL AND TAX INCENTIVES

Investment needs of well-managed forests are different from many other businesses: the investment must be held for long periods of time (up to 75-100 years) before any financial return is realized; interest costs on the invested capital must be paid for long periods of time; the capital (trees) is subject to risk because of fire, insects, disease, and disaster weather events; forests have a low degree of liquidity; and the investment is subject to a low return rate compared with alternative capital investments. For these reasons, fiscal and tax incentives become important programs for the sustainable management of private nonindustrial forests.

### Fiscal Incentives

Fiscal incentives are payments made to private nonindustrial-forest landowners to help stimulate investments by reducing or offsetting large, initial capital costs and by improving rates of return. Incentives are an encouragement and reward for investments in sustainability for long periods of time. Although several studies have shown that fiscal incentive programs have been effective in increasing timber production on private nonindustrial-forestlands (Mills 1976, Risbrudt and Ellefson 1983, Gaddis et al. 1995), there continues to be concern over their role in augmenting investments in timber production. Most concerning is whether landowners would plant trees or perform timber stand improvement without public assistance. Are public incentive monies simply substituting for private capital? Although most studies have found this not to be the case, there are lingering concerns that from a social perspective there is little in the way of a net social increase in investments (DeSteiguer 1984, Cohen 1983, Lee et al. 1992, Wallace and Silver 1983).

Implementation of fiscal incentive programs raises a number of important organizational and administrative issues. For example, federal incentive programs are administered by federal agencies, but technical assistance is provided primarily by state forestry employees or private consulting foresters, which requires coordination to be effective. Concerns have also been raised about the size of fiscal incentive programs. The question is whether they are large enough to gain the landowners' interests and to obtain investment opportunities (Hardie and Parks 1996). The federal government's use of reporting systems designed for large agricultural cost-share programs to report forestry cost-share information is

also of concern. Although appearing to be efficient, such use often contributes to the lack of data needed to evaluate the program's effectiveness and raises suspicions about the information. The appropriate targeting of federal and state fiscal-incentive programs is also an issue.

State governments might benefit from greater flexibility in administering federal fiscal-incentive programs to accommodate resource and landowner differences. States would be able to allocate cost-share grants on the broad basis of the potential social good and forest-resource sustainability. Furthermore, benefits could result from empowering local stakeholders, both public and private, to determine cost-share priorities, and giving the state governments the prerogatives to increase cost-share rates to those landowners who are willing to coordinate their plans and practices with neighboring properties. Obviously, care would have to be given to ensuring that local, state, and national interests are carefully addressed.

The focus of fiscal-incentive programs is also a concern. Fiscal incentive programs can be broadened to apply to problems involving forest health, preservation of sensitive habitats, and urban and community forestry. To some extent, the Forest Stewardship Program and related fiscal incentives address those issues but only modestly. The intent of broadening fiscal-incentive programs is to improve broader forest ecosystems, of which an individual landowner's property is only one part.

## Tax Incentives

Federal and state tax policies and their implementation reflect the complex diversity of the nation's industries, regions, and natural environments. There is some concern that these tax policies might unintentionally be lowering investments in forests and forest property. The difficulties of tax incentives often relate to questions of policy effectiveness, fairness among forest and nonforest sectors, the outlook for long-term stability in forest investments, and potentially affecting the integrity of some forest ecosystems adversely (for example, fragmenting ecosystems). At a minimum, tax policy should promote savings and long-term investments, foster equity with nonforestry investments, be easy to administer and understand, and remain stable over long periods of time so as to encourage long-term investments. From a federal perspective, concerns over taxation are rooted in policies concerning estate taxes, capital gains, and passive loss. From a state perspective, the concern often surfaces from the application of property taxes.

### Estate Taxes

When a person dies and is not survived by a spouse or when there is no current estate plan, the estate, including land, may be subject to federal estate taxes. The most recent revision of the federal tax code (1997 Taxpayer Relief Act) will make federal tax liability begin at an estate value of $1,000,000 in 2006

(maximum amount increased in steps from 1998 to 2006) or $1.3 million if the estate is part of a family-owned business. Tax rates are between 37 and 55 percent, depending upon estate value. Moreover, estate taxes usually must be paid in less than 1 year of the death of the owner. Unless heirs have other means to obtain large amounts of money, estate heirs may be forced to sell or change the use of their forestland to pay estate taxes. Estate taxes yield less than 1 percent of the national tax revenue, but they have been suggested as the cause for fragmentation of hundreds of forest properties each year (Raper 1995). As the Land Conversion Subcommittee of the Northern Forest Lands Council (1994) found, "Among individual and family landowners, estate tax concerns are a driving force behind land sales." A positive provision of the new tax law enables exclusion from the estate of up to 40 percent of the value of forestland which is placed in a qualified conservation easement. The recent revision in federal tax law may alleviate some of the problems associated with estate taxes. However, the potential consequences of the new law deserve careful and continuing analysis.

### Capital Gains Tax

Growing forests is a long-term undertaking with substantial risks. Income tax on capital gains from forest income can be a major disincentive for long-term forest stewardship and sustainability. Many developed countries (Canada, Finland, France, Germany, Japan, Norway, and the United Kingdom) recognize the long-term nature of investments in forestry and have accommodated a special capital-gains tax rate in their tax codes (Arthur Anderson and Company 1985). The Taxpayer Relief Act of 1997 made important adjustments in the tax treatment of capital gain income from investments in timber. For timber sold after May 1997, the tax rate on long-term capital gains drops from 28 to 20 percent for most owners. However, for timber sold after July 1997, the holding period required to qualify for long-term capital gains increases from 12 to 18 months. For timber held 5 years beyond December 2000, the capital gains tax rate will drop another two percent, from 20 to 18 percent for most owners.

These are important corrections in Tax Reform Act of 1986 which, among many consequences, discouraged landowners from extending timber-harvest rotations and managing older-age forests. As with recent changes in estate tax law, changes in capital gains tax law will also require continuing analysis to determine their impacts on timber investments made by private forest landowners.

### Management Cost Deductions

In order to claim a tax deduction for regeneration expenses (site preparation, planting, vegetative control costs), individuals and corporations must record these expenses and then deduct them from income earned when the timber is sold. This treatment of capitalizing regeneration costs discourages many nonindustrial-for-

est owners from managing and conserving their forests for long-term private and public benefits. Further complicating the matter is the imposition of complex passive-loss rules which attempt to eliminate the practice of deducting expenses of one activity against income earned from other sources. Changes that would help alleviate these problems include eliminating the passive-active rules; allowing private nonindustrial-forest landowners to deduct normal annual stewardship expenses against current income; and indexing to the inflation rate all expenses that must be capitalized (thereby eliminating taxation of arbitrary inflated gains). Tax credits also could be considered for landowners who invest for purposes other than timber and related forest products.

### Reforestation Investment Tax Incentive

In 1980, the Recreational Boating and Facilities Improvement Act authorized investment tax credits for reforestation. For up to $10,000 per year of reforestation expenses, investors are allowed a 10 percent investment credit plus deduction of the expenses over an 8-year period. The credit cannot exceed $1,000 annually. The U.S. General Accounting Office (1990) estimated that the credit reduced federal revenue a modest $80 million annually. The reforestation tax credit is widely used by nonindustrial private forest landowners. In nine southern states, Royer and Moulton (1987) reported 59 percent of the landowners who planted trees claimed the tax incentive. The credit also augments rates of return on investments. For landowners in the 40 percent tax bracket in 1983, rates of return on loblolly pine increased from 6.9 to 8.4 percent and for Douglas-fir from 7.3 to 8.2 percent because of the tax credit (Dennis 1983). Expanding the tax benefit to $25,000 per year would increase the deduction commensurate with inflation. Consideration should also be given to expanding the application of the credit to timber stand improvement activities and possibly other important public interests in private forests.

### State Tax Policies

Federal tax policy is not the only concern of owners and managers of private forests. Local governments rely upon property taxes to raise revenues. In the colonial agrarian society, land was a true measure of wealth. Cash crops came directly from the land. Today's nonagrarian society still bases local taxes on land values. Land value is often based on the most highly valued use of the land. That determination generally refers to the assessed value of the land if it were sold on the open market for industrial, commercial, or residential development. Demand for open land to develop for an increasing population has raised the land values substantially over the recent decades. Now, the value of land for development is far greater than the value of land for agriculture or tree growing. Thus, the land

value for a forest landowner is determined not by the owner's land-use practice but by the development of neighboring properties. The agrarian property-tax system has become outdated. Many forest landowners near developing areas have been forced to sell their land, because annual revenue from the land could not pay the annual ad valorem property taxes. Even the most productive forestlands cannot survive as forests if property taxes exceed the break-even threshold. Moreover, the ad valorem tax penalizes landowners for holding older-age trees (Northern Forest Lands Council 1994). The ad valorem property-tax policy produces many of the largest negative effects on stability and sustainability of private nonindustrial-forestlands.

Little attention has been given to the use of tax policy as an economic incentive for private investment in watershed-management activities, protection of scenic beauty, recreational opportunities for the public, and preservation of forest ecosystems for certain types of flora and fauna. Although the potential effectiveness of tax credits (or tax penalties) to influence private forestland activities has yet to be explored, they might be considered for landowners who would invest for purposes other than (or in coordination with) timber and related forest products (Hudson 1993). Level of compliance with Best Management Practices could be used to determine the amount of incentive provided.

A serious void in the design of tax policies that focus on the management of private forests when viewed as a public investment is the lack of rigorous analyses that clearly show the consequences of tax measures (Klemperer 1989). Little analytical attention has been paid to evaluations of the rates of return to the public sector from reduced tax rates for beneficial forestry activities. Analysis of returns to the public via direct cost-share payments to landowners is extensive. However, analysis of the rates of return on foregone revenue resulting from federal tax subsidies is rare.

## REGULATORY PROGRAMS

Government regulation of private-forest practices reflects growing public concern over the integrity of forest and related ecosystems. However, regulatory programs are not without problems. They are often a burden for users, managers, and owners of nonfederal forests, especially private forest landowners. Yet, when society's interest in maintaining and enhancing forest ecosystems is evident, owners and managers of forest resources are obligated to examine the range of programs available for achieving such interests. It is critical to realize that the structure and administration of federal, state, and local regulatory programs vary greatly. Many innovative, imaginative approaches emphasize adaptive management, administrative flexibility, and landscape-level resource management and protection.

## Federal Regulatory Initiatives

The federal government has a long tradition of regulating a variety of activities that involve forestry directly (for example, the Endangered Species Act) and indirectly (for example, the Rivers and Harbors Act). In recent years, however, states have assumed important regulatory responsibilities, especially for forestry practices. Various compilations of regulatory programs demonstrate the extent to which regulatory initiatives have become commonplace the forestry community (American Forest and Paper Association 1994; Ellefson et al. 1995; NCASI 1994, 1995, 1996).

Federal regulatory initiatives often have serious implications for use, management, and protection of nonfederal forests, and they often result in political conflict among those claiming a stake in the future of these forests. Although the subject of the regulatory action might be the source of the issues (for example, protecting an endangered species), the issues involve the appropriateness of the allocation of regulatory power among various units of government; the appropriateness of assigning regulatory power to a specific agency (regardless of level of government; for example, U.S. Environmental Protection Agency versus USDA); the complex and time-consuming rule-making and administrative processes that petitioners and landowners must engage in to comply with regulations; and the legalistic culture that regulatory programs (rather than collaborative solution-oriented approaches) tend to spawn among citizens.

The federal administrative landscape of regulatory programs bears little relation to a holistic approach to maintaining the integrity of forest ecosystems, which include nonfederal forests. The large number of federal regulatory programs results in questions over authority among the agencies. The appropriate distribution of regulatory authority will require resolution of political struggles, which is unlikely to be resolved easily or very soon. The federal government should continue to monitor regulatory responsibility among the various levels of government. Although the creative and responsible regulatory actions of lower levels of government should be acknowledged by monitoring, proliferation of locally initiated regulatory programs should be avoided.

Federal regulatory programs are subject to all the administrative problems associated with regulatory programs generally (Cubbage and Siegel 1985, Hickman and Hickman 1990, Hoberg 1993, Hoskisson et al. 1993, Sitkin and Bies 1993, Cheng and Ellefson 1993b, Ellefson et al. 1995, Aust et al. 1996). Administrative problems associated with federal regulatory initiatives on nonfederal forests need to be acknowledged and addressed appropriately. To ensure program efficiency and effectiveness, the following actions should be considered: implement appropriate administrative designs (for example, notification versus permit-inspection systems); foster administrative flexibility by making the standards rules rather than laws; engage the interested public in collaborative rule-making and program establishment; promote administrative structures that en-

courage adoption of new scientific findings; reduce the legalization of administrative processes; develop sensitivity to the legal and constitutional soundness of regulatory initiatives; and acquire understanding of the costs of regulation that must be borne by the government and the regulated parties.

## State and Local Initiatives

State and local governments have been especially active, although often subtly, in establishing regulatory programs for nonfederal forests, especially private forests. As described in Part One of this report, nearly every state has some form of forest-practice standard that must be complied with by private landowners or persons involved in forestry operations on private property. Similarly, local units of government involved in forest-practice regulatory standards number in the hundreds. Establishment and administration of state and local regulatory programs have caused concern over the relation between these programs and federal programs.

### Program Coordination

The nature of the problem of coordinating state and federal regulatory initiatives becomes apparent when ecosystems owned by nonfederal concerns are imposed on by multiple regulatory laws, multiple layers of government, multiple administering agencies, and conflicting client expectations of forest ecosystems. The very ecosystems that are of concern to society can become fragmented by the multiple regulatory programs developed to guide their use and management. How all the regulatory initiatives, including federal actions, relate to one another is unclear.

The narrow focus of federal regulatory programs (for example, wetlands or endangered-species habitat) and their state counterparts (for example, reforestation or road construction) is also a concern (Kilgore and Ellefson 1992). When units of state and federal government are responsible for regulations for a single good or service from a forest ecosystem, they lose their ability to address conditions on an entire forest ecosystem. At issue is how narrowly focused programs can deal with nonfederal forests in a more holistic way.

### Federal Regulatory Role

The extensive expansion of state and local regulation of forestry practices raises the issue of whether the federal government has a role in regulatory initiatives focused on nonfederal forests. The federal government has a role in communicating information to states about the administrative structure and effectiveness of regulatory programs generally. This role should enable states to make more informed choices about the programs (including regulatory programs) they select to address issues involving

nonfederal forests. However, the need for a direct federal regulatory initiative depends on the existence of a national interest in a forest resource. Even when an interest does exist, state agencies have often efficiently and effectively accomplished the national goal for a specific resource through state regulatory programs. In fact, nearly 22 percent of the nation's privately owned timberland is already subject to state regulatory programs (Ellefson et al. 1995).

### Regulatory Program Issues

Federal and state governments play a major role in developing and implementing regulatory programs on the use, management, and protection of nonfederal forests. The intensely held views of the public about the use of regulatory programs to influence forestry practices demand a special sensitivity to the design and implementation of regulation. At the very least, federal and state governments should adopt regulatory programs only when they are clearly more efficient than other types of programs that might be available for influencing private actions. If chosen, most forest-practice regulatory authority is best positioned with state governments, preferably with the state's lead forestry agency.

Regulatory programs should accommodate a community's political and resource situation. Regulatory programs should be designed and administered to accommodate specific environments. Inflexible and exacting forest-practice standards should be avoided. Users, owners, and managers of nonfederal forests should be engaged cooperatively in processes used by agencies to establish forest-practice rules and regulations, and administrative structures should be adopted to enable easy and quick incorporation of new technologies, especially information about new or modified forestry practices, into a regulatory program.

Federal and state regulatory-program administration should foster a climate in which long-range plans and investments can be made by private forest landowners without inordinate concern for major changes in regulatory standards and their administration. Regulatory programs should be attuned to changes in the legal and constitutional bases for government regulations generally and avoid imposing regulations that severely limit private investment in forests.

Careful consideration should be given to the cost of administering regulatory programs, especially to appropriate allocation of costs to public and private interests. The cost of regulatory programs should be fully acknowledged. The public should not be given the impression that the programs are largely cost free and that minimal public investments in them will lead to results consistent with their expectations for private forests.

## EASEMENTS AND RENTAL AGREEMENTS

Policy initiatives to ensure the sustainability of nonfederal forests can also include government actions to own various rights to property that continues

fundamentally in private ownership. When engaged in by private landowners, such initiatives can prove to be important.

### Conservation Easements

Easements are deed restrictions that are voluntarily designed by landowners interested in protecting forest values. Easements can prohibit subdivision, limit nonforest uses, and encourage long-term forest management to benefit both timber production and species conservation (Best and Wayburn 1995). Easements are donated to or purchased by land trusts or conservancies and provide landowners with an incentive through income and estate tax benefits. They also can aid in monetizing forest resources that have no ready market, such as habitat or water quality (Best and Wayburn 1995). Tax reductions could be used to defray costs of restoration or protection on easement lands. In addition, other voluntary conservation measures could be used, as appropriate, including acquisition and resale of development rights by the public on nonfederal lands, term easements (easements of specific duration), rolling easements (term easements whereby the easement can be renewed at specific times), and voluntary agreements (Northern Forest Lands Council 1994). These conservation measures can best be facilitated through the creation of an open public process to establish state and federal partnerships to fund public-land acquisitions and to purchase lands from willing sellers.

Additionally, the USDA Forest Service has created the Forest Legacy Program to provide funding to purchase conservation easements from willing sellers. Although this program has great potential for achieving conservation on nonfederal lands, it must be largely modified to achieve wider application. The program could be improved through increasing funding levels in key regions where biodiversity can be accomplished best through easements and land acquisitions (for example, northeastern forests that are primarily privately owned; Northern Forest Lands Council 1994). Other suggested improvements include an option for state ownership of easements, direct grants to states for easements, payments in lieu of taxes to communities for easements, amendments to include timber management as a Forest Legacy Program objective, and funds for states to monitor easement compliance.

### Conservation Rental Contracts

Conservation rental contracts can provide opportunities to protect endangered or threatened species on private forests. Using rental contracts, landowners give up a portion of land-use income in exchange for protecting listed species to earn conservation payments. Landowners earn income in exchange for habitat protection, management, and species protection in a similar way to landowner income earned by participation in the Wetland Reserve Program and

the Conservation Reserve Program (Bourland and Stroup 1996). Rental contracts could be used to encourage large industrial landowners to provide protection for listed species. For example, conservation rental payments have been proposed in red-cockaded woodpecker habitat in the long-leaf pine ecosystem of the Southeast. Biodiversity trust funds supported through public land user fees and private donations and government renting of habitat from private owners have been proposed as funding sources to support this program (Bourland and Stroup 1996).

### Safe Harbor Agreements

Forest landowners who wish to restore or manage portions of their property for endangered species are often penalized because of the costs they must incur to do so (for example, the value of the timber is foregone and special practices must be applied). In some situations, such costs can be so high that landowners have an incentive to harvest trees prematurely to ward off the species in question, for example, the red-cockaded woodpecker (Bonnie 1997). A partial solution to this dilemma is the use of a "safe harbors" program. Under this program, landowners voluntarily agree to enhance endangered species on their property and maintain the current, or baseline, population occurring at the time of signing the agreement. In return, if the population of an endangered species increases on their land, the landowners are not liable for additional land-use restrictions under current endangered species law. Some have suggested that landowners should be allowed to sell the "safe harbor" rights that they have been granted to other landowners. Such could ease the burden on those who have especially high costs associated with the designation of endangered-species habitat on their property (Environmental Defense Fund 1995).

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

Policies and programs affecting nonfederal forests include governmental initiatives, private and voluntary initiatives, education and technical assistance, fiscal and tax incentives, and regulatory programs. By far, the most cost-effective application of federal funds to state and private forestry is through education and technical assistance. These existing federal programs could become the cornerstone of the federal role in sustainable management of nonfederal forests. Fiscal and tax incentives are also an important role for the federal government to encourage sustainability of nonfederal forests.

**RECOMMENDATION**:

*Coordinate and suitably strengthen incentive, technical-assistance, and regulatory programs for nonfederal forests, and broaden their application to a wider variety of individual and societal interests.*

This recommendation points to the following specific recommendations:

- *Privately initiated programs that lead to investments in nonfederal forests should be promoted.*
- *Coordination of federal incentive, regulatory and technical assistance programs should be improved and these programs, as well as tax policies and programs, should be periodically evaluated to improve effectiveness. Technical assistance, fiscal incentive, and tax programs that target special landowner categories should be considered.*
- *A clear set of purposes for educational programs focused on nonfederal forests should be established with a well-defined statement of federal agency responsibility for attaining these goals.*
- *Tax policies and programs that discourage investments in the sustainable management of private nonfederal forests should be eliminated.*
- *Federal and state regulatory programs for nonfederal forests should be designed to honor public and private interests in nonfederal forests.*

# 8

# Investment Levels and Potential Opportunities

## INTRODUCTION

Many kinds of investments can be made to ensure that the goods and services provided by nonfederal forests are sustainable. Some investments require an outlay of money with the expectation of a monetary return. Investments, especially in nature, might not require outlays of money, nor are the expected returns necessarily monetary. For example, maintaining some level of biodiversity can have the desired result of sustaining species without monetary investments. Innovative opportunities for investment are presented in this chapter.

## FOREST INVESTMENTS

The capacity of nonfederal forests to supply goods and services to society is a function of private and public investments. These investments are made in an environment of complex interactions between forest landowners, public agencies, and various commercial and nonprofit organizations. Trends in investment in industrial and nonindustrial forestlands are of particular importance. Although industrial forests make up only 14 percent of the nation's timberland, they yield one-third of the nation's timber harvest. The importance of nonindustrial forests derives from their size (59 percent of the nation's timberland), harvest (half of the nation's timber harvest), and potential for increased harvest (Powell et al. 1993). Although the owners of industrial and nonindustrial private forests appear to invest to maximize profits, the investment and harvesting activities of nonindustrial-forest owners reflect the importance of nonmarket values (Newman and Wear 1993, Kuuluvainen et al. 1996). At present, higher prices are envisioned

for forest products, at least over the near term, as a result of decreased federal harvests (Haynes et al. 1995), which can be expected to affect investments and harvests in nonfederal forests (Adams et al. 1996) to the extent that price increases were not anticipated by landowners.

Forestland investments can be conceptualized either as establishing new forests with primary inputs of land, labor, or capital or as retaining existing forests with growing stock (Wear 1993). Some forestland investments require advance monetary outlays; others involve only opportunity costs. Some investments are made in the expectation of earning income or profit, whereas with others the expectation of return is nonmonetary. Specifically, investments in forestland can include the following:

- Keeping the forest intact, rather than allocating it to an alternative land use, such as agriculture or residential development.
- Allowing the trees with a potential market value to continue to grow and possibly increase in value.
- Protecting the forest against losses from wildfire, pests, pathogens, or vandalism.
- Developing and maintaining access, such as roads, landings, or trails.
- Management planning, such as timber harvest or estate planning.
- Pursuing management activities associated with particular objectives, such as tree planting, timber-stand improvement, or wildlife habitat enhancement.
- Subsidizing the forest in the form of cost-share programs, tax incentives, or technical-assistance programs.

## INVESTMENT ENVIRONMENTS

### Investment Climate

The magnitude of goods and services provided by nonfederal forests and the protections afforded them depends on the willingness and ability of the American public to invest in them. This willingness and ability is tempered by broad economic swings in the nation and by the attractiveness of potential investments to the public and private investors. With the national political mood favoring reduction in government at all levels, the climate for government investment is not particularly positive. In recent years, the federal government has reduced investments in real and nominal terms in natural and environmental programs generally. With the devolution of federal action, the private sector and state and local governments should pick up a major share of future investments in nonfederal forests. Whether these investments are possible is yet to be ascertained. Obviously, the federal government has a role in creating a positive national economy in which investments in nonfederal forests will occur.

## Landowner Investment Circumstances

### Nonindustrial Private Owners

Owners of nonindustrial private forestland are diverse and have a variety of objectives which must be accommodated when they make investment decisions and obtain financial support. Many owners have multiple objectives, which usually complement each other rather than compete. Less than 10 percent of landowners identify the investment potential of the land as their primary reason for ownership, although it is a secondary reason for many (Figure 8-1). Few owners (less than 3 percent) identify timber production as their primary reason for ownership, but those owners control 30 percent of all private forestland (Birch 1996). Furthermore, management objectives for private forests are transitory and change with each new owner. Industrial forest landowners want to reduce the risk of raw-material shortages and insulate the enterprise from short-term price fluctuations. On the other hand, nonindustrial forest landowners have a variety of investment strategies, each of which requires special investment attention. Some investors are custodial and make no strategic investments, and others make incidental investments; many are speculators focusing on appreciation in land values, hobbyists investors looking for supplementary income from forests, or true investors reacting to price and other market conditions. As a result, researchers on investment behavior by nonindustrial forestland owners use a number of theories

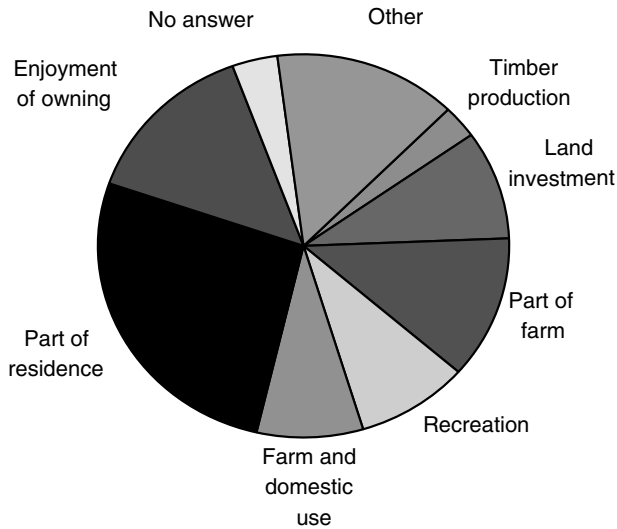


FIGURE 8-1 Landowners' reasons for owning forestland (% of landowners).
Source: U.S. Forest Service 1996.

on investment behavior (Royer 1988, Alig et al. 1990). The diversity is a challenge to public and private investment sources that package investment programs for target groups (Romm et al. 1987, Yoho 1985).

### Industrial Owners

The wood-based industry owns over 71 million acres of timberland nationwide. From an investment perspective, the industry must deal with a number of circumstances that present potential risks and uncertainties (O'Laughlin and Ellefson 1982), including the following:

*Producing timber on industrial forestlands*. In many respects, the timberland owned fee simple by the wood-based industry is the nation's only forestland devoted exclusively to the production of timber used in the manufacture of wood products. Nearly all other forestland in the nation is owned and managed by landowners who have other objectives (for example, forest recreation and wildlife habitat). Public policies, such as taxes and regulations, can have a marked effect on the way such land is used and managed.

*Relying on others for timber*. Although the industry owns over 71 million acres of forestland, a large percentage of its timber is supplied by other sources. In the West, the primary source is publicly owned timberland, whereas in the East and South, the primary source is owners of private nonindustrial forests. A de-emphasis on timber production by any of those sources can pose difficulties for the industry.

*Supplying uncertain markets*. The industry manufactures products that are sold to diverse markets. Many of these markets, however, are uncertain for the industry in terms of existence, magnitude, and stability. The markets for some manufactured products, notably lumber and related construction material, are notoriously unpredictable. Federal policies that foster a healthy economy are important in reducing those uncertainties.

*Sensitivity to production costs*. Given the reality of uncertain markets, the timber industry must be especially sensitive to the costs of securing timber and the cost of product manufacture. Moving the cost of timber production and product manufacture on to the market is not always possible, given the uncertainty of many markets and their highly competitive nature. Public policies that impose costs on industry can adversely affect its financial health.

*Responding to corporate owners*. Most wood-based firms are corporations that must be responsive to the financial interests of their stockholders, and the rates of return on stockholder investments are an important measure of corporate vigor. Costs that deter from that are not generally acceptable.

*Uncertain timber supplies*. Access to dependable supplies of raw material, namely, timber, at acceptable prices is critical to the industry's ability to function. Wood-based enterprises consider it is essential that uncertainties regarding the availability of timber be eliminated or reduced to acceptable levels. How that is accomplished varies from firm to firm, although strategies generally include fee-simple ownership of forest property, supply agreements with owners of private forestland, and contracts (short and long term) to harvest timber from public forests. In recent years, uncertainties over access to timber supplies (and over timber production and harvesting) have increased substantially, most notably in the West over federal land.

The ability of the industry to operate and meet its corporate and social responsibilities is dependent on its access to timber as a raw material. Although the industry has improved its competitive position in recent years in terms of labor productivity and expanded exports, the industry remains sensitive to the federal role in influencing access to raw-material supplies and the industries' ability to manufacture timber products demanded by a variety of markets. Federal policies, especially tax and regulatory policies, need to be sensitive to the adverse impacts they might have on the cost of growing timber on industrial timberland and on activities involving the manufacture of wood products. Federal policies should also foster cooperative actions among public and private landowners (sustained-yield units, long-term timber supply agreements) that will enable industry to address uncertainties of access to long-term supplies of timber. Industrial initiatives to improve the sustainable management of industrial timberlands (for example, the Sustainable Forestry Initiative of the American Forest and Paper Association and the Forest Stewardship Council) should also be facilitated by the actions of government.

### State and County Forests

State and county governments own nearly 64 million acres (9 percent) of the nation's forestland, most of which is in the Great Lake states (Minnesota, Wisconsin, and Michigan), Alaska, New York, Oregon, Pennsylvania, and Washington. Some 24 million acres are located in five states, namely, Minnesota, Wisconsin, Michigan, Pennsylvania, and New York, with 14 million in the three Great Lake states alone. The largest single state ownership (22 million acres) is in Alaska.

State and county forest-resource programs have been strengthened markedly over the past 25 to 30 years. Federal technical and financial assistance has been used in the process, although the assistance resulted from the state's initiative to obtain it. Important efforts to strengthen management of state and county forestland are illustrated in Box 8-1. Over a period of 25 to 30 years, Minnesota, for example, markedly raised the professional level of resource

managers of state-owned forests. Wisconsin provided assistance to counties, and Michigan undertook two interrelated initiatives to improve management of its state-forest system. The first initiative involved separating forest uses to reduce unnecessary conflict. The second initiative created a more adequate, investment-oriented funding arrangement for forest management in that part of the state system where intensive vegetation management was the primary purpose.

State and county forests often have an economic-development focus and thus have proved to be especially important to local and regional communities. Commodity outputs tend to be emphasized more strongly the closer management is to the local level. This is perhaps most clearly the case in the Great Lake states. For example, in Michigan during the past 14 to 16 years, the governor's Target Industry Program fostered expansion of forest-products industries as part of a comprehensive initiative to diversify a vulnerable, recession-prone economy. To accomplish economic development, government programs that foster stability in community income and employment have proven to be especially important, as have programs that enable county and state governments to improve the capacity of management to develop sustainable forests.

### Tribal Forests

Tribal forests occupy nearly 16 million acres of land and are managed by more than 200 tribal or related governing units in 23 states. These forests provide a wide variety of goods and services to tribal members and the general public. Significant concern about the status of and level of investment in Native American forests led to the National Indian Forest Resources Act, which directed the Secretary of the Interior to obtain an independent assessment of conditions affecting investments in Native American forests and their management (Indian Forest Management Assessment Team 1993). Among the assessment's four most important findings are (1) the existence of a substantial gap between the ideas that Native Americans envision for their forests and the actual management their forests; (2) a major lag in funding for Native American forests relative to funding for federal and private forests; (3) a lack of coordinated forest-resource planning and management; and (4) ineffective methods for setting and overseeing trust standards for Native American forestry. In response to these findings potential federal actions that would improve conditions for investment were identified, including encouraging the development of tribally defined trust standards that clarify trust oversight; increasing funding and staffing to levels comparable to other forest ownerships; protecting Native American forests via ecosystem management; strengthening application of forest-management practices and forest-enterprise performance; and reinforcing coordinated forest-resource planning and natural-resources inventorying.

**Box 8-1**
**Innovative Programs Involving the Use and Management of State- or County-Owned Forestlands**

*California*

- Organized partnerships among diverse owners for mutually agreeable, reasonably compatible management of large blocks of land.

*Massachusetts*

- Developed cutting-practice regulations that have allowed timber harvests to occur in an intensively suburbanized state, with reasonable harmony among harvesters and residents.

*Michigan*

- Managed planning for large state-forest system that focuses directly on separating uses and users to prevent unnecessary conflicts.
- Created a new investment-oriented financing mechanism to finance improved management for timber on carefully selected parts of state forests.
- Established Governor's target industry program for forest resources and industries, which helped to lead to a 25-percent decrease in the state's dependence on the recession-prone automobile industry.

*Minnesota*

- Impending expansion of carefully planned timber harvests on state forests.
- Impending strengthening of technical assistance to nonindustrial private forest owners.
- Considerable success in fostering agreement among stakeholders via roundtables.
- Forest-products industry currently state's fastest growing industrial sector (twice the rate of the overall healthy state economy).

*Missouri*

- Improved resource-management programs for forests, wildlife, and fisheries by dedicating a fixed percentage of the general sales tax to such management.

*Montana*

- Developed effective method for assessing compliance with best management practices on all types of forest ownership.

*North Carolina*

- Created strong and well-financed forestry extension program providing effective technical assistance to both forest owners and modest-size forest-products firms.

*South Dakota*

- Successfully manages Custer State Park in the Black Hills for a wide range of purposes/uses, including many kinds of recreation activities, wildlife, and timber. Partial geographic separation and skilled application of relatively light-handed timber management/harvest have made this range of uses compatible.

*Innovative Programs…continues*

*Innovative Programs…continued*

*Virginia*

- Created what is acknowledged best-coordinated package of technical assistance and financial incentives for nonindustrial private forest owners (common delivery system for both in essence).
- Encouraged landowners to follow best management practices for water quality. Effectively uses low-cost incentives first. High-cost regulatory arrangements are limited to the relatively few situations where incentives fail to prevent serious difficulties. (Amounts to pattern-setting cost-effective approach to aspects of environmental protection.)

*Washington*

- Intensively managed timber resources of state public lands for helping to finance the public school system adequately.
- Fostered agreement among resource stakeholders via the Washington timber, fish, and wildlife agreement.

*Wisconsin*

- Effectively managed county-owned forests. State provides direct help in terms of both technical guidance and part of funding.

**Urban and Community Forests**

Owners of urban and community forests range from owners of residential city lots to large publicly owned regional parks that urban residents use for recreation. Twenty million acres of land is estimated here to be urban and community forest land. By some estimates, over 60 million acres of urban land in the United States are forested; 75 percent of the nation's population live in such environs (Dwyer et al. 1992). Urban-forest management within the structure of local governments often receives low investment priority. Disinvestment in urban forests occurs; management budgets are reduced and eliminated, and tree care and maintenance activities are done only when reactionary. In California, where municipal-urban forest management has been eliminated in many cities, a number of volunteer organizations are filling the need. Nationally, volunteer organizations dedicated to tree planting and education are forming consortiums to identify how they can continue to participate in urban-forest activities. Although these organizations raise the awareness of thousands of individuals about trees and urban forests and assist urban-forest managers in their educational initiatives, their numbers are still very few.

The National Urban and Community Forest Advisory Council was charged, in part, with determining why investment in urban and community forestry is far less than the benefits often ascribed to these forests. The resulting analysis confirmed a number of disturbing trends (National Urban and Community For-

estry Advisory Council 1993). For example, only one tree is planted for every four removed; 500 to 700 million tree-planting spaces remain vacant; because of improper planting and care, trees in urban areas live only an average of 7 years; compacted and paved-over soils increase temperatures and increase storm-water runoff, which prevents water from reaching tree roots; thousands of acres of forestland are cleared for development with little regard to replacement, further increasing fragmentation of forest lands.

The Council identified two major causes of these disturbing trends: the lack of a comprehensive national program on urban and community forestry, and the marked decline in the health and vigor of most urban and community forests (National Urban and Community Forestry Advisory Council 1993). Six strategies were recommended as means of improving the level of investment in these forests, namely expand public outreach to improve understanding of and appreciation for urban and community forests; foster self-sustaining municipal and community volunteer programs; develop multi-discipline educational opportunities for urban- and community-forestry professionals; stimulate additional funding from public and private sources; support substantial expansion of research on urban and community forests (including distribution of research findings); and promote partnerships with private-sector urban- and community-forestry interests. Also identified was the lack of timely and relevant information about urban and community forests (International Society of Arboriculture 1991).

## INVESTMENT ISSUE AREAS

### Forestland Area

One measure of investments by private concerns is their willingness to own forestland. In fact, most investments in nonfederal forests are made by owners in the form of holding land. The area of nonfederal forests increased from 1987 through 1992 by approximately 3 million acres (Table A-1). However, that increase masks some important regional shifts, most notably declines in the Rocky Mountain region and a large (nearly 7 million acres) increase in the South Central region (Table A-2). Net losses of timberland to agricultural uses in the Southern region are no longer being observed (Powell et al. 1993), indicating that a balance has been achieved in profitability of forestry and agriculture. In the Pacific Northwest region, research has indicated that the proportion of land in forest use should be relatively unresponsive to markets or public-policy instruments, such as cost-share programs (Parks and Murray 1994). As for future ownership, the area of nonfederal forestland is forecast to decline five percent by 2020 and seven percent by 2040. Those declines amount to a disinvestment in nonfederal forest use in favor of other uses. In the federal government's Conservation Reserve Program, trees were planted in a substantial area of highly erodible cropland. That project amounted to an investment in forest and a disinvestment in cropland.

However, the federal program is unlikely to result in a substantial increase in forest area in the near future (Moulton et al. 1996).

## Timber Inventory

Another overall measure of investment in nonfederal forests is the volume of growing stock. The overall stock of trees grown on industrial and nonindustrial private forestland has been increasing and is expected to increase (2.5 percent by 2040) (Table A-21). For those ownership categories, softwood inventories are expected to rise by 21 billion cubic feet (in 2040) or about a 10 percent increase relative to 1991 levels (Haynes et al. 1995). Although the overall trend in the average number of trees per acre is up, that average masks some important changes, including changes in species composition and in the resulting character and quality of the forests. Nevertheless, a significant overall increase appears to have occurred in the wood volume of forest trees in recent decades and, thus, in the amount of capital invested in nonfederal forests.

### Nonindustrial Private Forests

Nonindustrial private forestlands account for 32 percent of the nation's softwood inventory and 72 percent of the hardwood inventory (Table A-21). Currently, growth exceeds removal of trees for these forests, indicating an increased investment in timber inventories. The overall ratio of growth to removals is 1.5, but the ratio of growth to removals is much lower for softwoods (1.1) than for hardwoods (2.0). As a result, the quantity of the hardwood resource on nonfederal forests has been improving steadily (Powell et al. 1993), but the adequacy of investments in softwoods has been questioned (Cubbage et al. 1995). Projections on nonindustrial forestlands show a sustained increase in softwood inventories over the next 40 years. The current high ratio of growth to removals of hardwoods on nonindustrial forestlands is not expected to be sustained.

### Industrial Timberlands

Industrially owned forests are an important part of the nonfederal forest landscape. Investments in these forests vary from firm to firm, depending on the strategic position of timberland in the companies' operations. Industrial firms account for approximately 16 percent of the nation's softwood inventory and 10 percent of the hardwood inventory (Table A-21). The ratio of growth to removals (0.8) on these forestlands indicates an ongoing disinvestment in both hardwood and softwood growing stock. From 1952 through 1987, a 33 percent decline in

softwood growing stock occurred on industrial timberland in the Pacific Northwest (USDA Forest Service 1989). Softwood sawtimber inventories on industrial lands in the Pacific Northwest show a larger and more sustained decline, having dropped by 52 percent between 1952 and 1992 (namely, 236 billion board feet to 114 billion board feet) (Powell 1993). Softwood inventories on industrial forestlands in the South increased from 1952 to 1987, but 1992 statistics showed a reversal of this trend.

Long-term projections of inventories on industrial forestlands show softwood inventories declining in the current decade and then rising through the first four decades of the next century. Long-term hardwood inventories on industrial and nonindustrial forestlands are expected to be close to current levels (Haynes et al. 1995).

### Nonfederal Public Forests

Public forestland other than the national forests accounts for 11 percent of the nation's softwood inventory and 10 percent of the hardwood inventory. The trend for several decades has reflected an increase in hardwood inventories and decrease in softwood inventories on these lands (Powell et al. 1993).

## Timber Management

Management practices that increase the productivity of nonfederal forests for timber purposes are numerous. Tree planting, for example, is a highly visible, fundamental investment in forestland. In 1995, private landowners planted approximately 1 million acres of trees, which amounted to 85 percent of all planting activity in the nation (Table A-6). Planting by industrial wood-based firms accounted for half of all private planting (1,037,356 acres; 43 percent of total planting in the United States) (Table A-6). On the basis of the 1990-94 annual average of 1,098,000 acres, the trend in industrial tree planting can be characterized as stable to modestly declining, (peak years were 1990 and 1991) (Moulton et al. 1996). Perhaps the timing of industrial plantings was largely determined by the need to replace harvested stands. Industrial owners other than forest-products companies planted 54,654 acres of trees in fiscal year 1995, a significant increase over 1994 (9,356 acres). Those plantings resulted from investments by insurance companies and investment trusts (Moulton et al. 1996).

Another indicator of direct investments in industrial timberland is net annual growth of growing stock per acre, which in 1992 was 61 cubic feet per acre of industrial timberland. Such high growth reflects the physical potential of land to grow timber, but also reflects investments in the modern timber-management practices of controlled spacing, genetically improved trees, and application of

fertilizers. Additional economic opportunities exist for investing (yielding at least a four percent rate of return) in reforestation and controlled-spacing activities on industrial land (Ellefson and Stone 1984).

Information about private investments (exclusive of public subsidies) of owners of nonindustrial forests is scarce. In 1995, private owners planted 956,953 acres of trees, a decrease of about nine percent from fiscal year 1994 (Table A-6). If the tree planting of 419,448 acres with federal-assistance programs is deducted, net tree planting on nonindustrial private forest acres in 1995 was 537,505 acres (Moulton et al. 1996). As with industrial forests, growth per acre is also an indication of nonindustrial private owner investments in forest-management practices. In 1991, the growth per acre was 42, which was close to the national average of 44. On nonindustrial forests, the USDA cost-share programs have contributed to tree planting on one-third to one-half of the acres planted annually over the last four decades. Tree planting on private forestland by the USDA Conservation Reserve Program peaked in the 1980s at over 3 million acres (Moulton et al. 1996).

Investments in planting are often characterized as risky because of the long period between reforestation and harvest. It is not surprising, therefore, that some studies attest to the economic superiority of high-cost planting regimens that involve intensive site preparation (for example, Brodie et al. 1987, Guldin and Guldin 1990), and other studies indicate that low-cost regeneration methods are economically attractive especially for nonindustrial forest landowners for whom a multispecies forest has nonmarket benefits (Haight 1993).

The findings conflict regarding the effect of timber prices on tree-planting activity on private forestlands. Most studies indicate that tree-planting activity in the short run is relatively unresponsive to timber prices but is responsive to costs (Alig et al. 1990); in the long run, responsiveness to timber prices might be much greater (Wear and Newman 1991).

Studies have also concluded that cost-share programs encourage tree planting on nonindustrial forest-lands, although the degree of cost sharing needed to elicit a response from different categories of landowners has not been extensively investigated (Alig et al. 1990).

Investments in timber-management activities other than reforestation are made on nonfederal forests. For example, in 1995, 70 percent of timber stand improvement (TSI) was done on industrial forestland and 18 percent was done on nonindustrial forest-land. The West and South dominate TSI activities, accounting for 69 and 26 percent respectively. Of the more than 3 million acres treated, federal cost-share programs contributed to TSI on only 100,000 acres (Moulton et al. 1996). Research results on the propensity of nonindustrial forest landowners to invest in intermediate stand treatments point to landowner characteristics being more important than expected returns (Alig et al. 1990).

## Private Investments

### Scale of Private Investments

Trees constitute the bulk of nonindustrial landowners' investments in forestry. Most of their investments are made without government assistance. Investments made to improve the condition of their forestlands are small by comparison, but those investments are important in pursuing particular management objectives. Among industrial landowners, forestlands clearly constitute the bulk of their investments in forestry. The importance of forestlands to individual firms varies according to their function in the firm's operations. In the early 1980s, the value of standing timber owned by 40 companies was estimated to be $47 billion; the top five companies accounted for 46 percent of the timber owned (Ellefson and Stone 1984).

Research on investment and productivity found positive net investment in acreage and management activity on industrial forestlands in the South between 1962 and 1985 but net disinvestment on nonindustrial forestlands (Wear 1994). Long-run forecasts of the timber supply foresee greater management activity on industrial forestlands, but only small increases in management activity on nonindustrial forestlands (Haynes et al. 1995).

### Capital and Rates of Return

Acquiring financial resources to manage and protect nonfederal forests adequately is often adversely affected by features specific to forests and forestry. Although low timber prices may be the fundamental cause, two especially widely cited barriers to private investment are lack of sufficient advance capital and low expected rates of return (Haines 1995). In addition, biological risks are often associated with forests (for example, insects, disease, and wildfire), investment returns are not realized for long periods of time, markets are uncertain for some forest-based goods and services, access to capital needed for incremental investments in management is small, small-scale landholdings suffer from large-scale poor economies, and costs for certain positive investments, such as prevention of water pollutants, cannot be recovered. All of these conditions can be encapsulated in the owners' beliefs that forestry investment generally represents slow, modest yield and low liquidity (USDA Forest Service 1989a). For example, in timber-production, financing is required to prepare management plans and establish timber stands, management costs must be covered until first income is received, and reforestation cost must be paid. These special features of forests and forestry can make investments in them unattractive to private investors and call for ways to reduce risk, increase efficiency, and reduce cash-flow problems (McGaughey and Gregersen 1988). Limitations on nonindustrial private forest landowners' access to capital markets are also a concern. Evidence from studies

in Finland suggests that the perception of credit rationing affects landowner management behavior (Kuuluvainen and Salo 1991).

### Regulatory Effects

A variety of local, state, and federal programs require forest landowners to limit disturbances of wildlife in critical habitat areas, reserve riparian areas to enhance water quality and fish habitat, submit professionally prepared management plans for regulatory approval, and reforest harvested stands to ensure future timber supplies. The investments mandated under these programs are unpopular with many landowners and have been criticized for diverting funds from other investment opportunities.

In general, however, the effect of public regulatory programs on nonfederal forests has been to increase tree planting, improve water quality, and protect wildlife habitats. Whether these results would have been greater under a different type of public program (for example, cost-share or technical assistance) is not known. Analyses showed that in Oregon, Washington, and California, for example, 30 to 40 percent, 10 percent, and 25 percent more area, respectively, was reforested since the inception of each state's forest practice regulatory law. In California, regulations resulted in $2 to $3 million of reforestation that would not have occurred otherwise (Ellefson et al. 1995). Other assessments have shown that current and expected state regulatory programs would often substantially increase private timber inventories over base (or expected) inventories, with harvest volumes remaining the same or slightly different from base levels (Haynes et al. 1995). Regulatory effects appear to have been greater on softwood resources than on hardwood resources, based mostly on western public timberland withdrawals. However, in the East, regulatory actions are more likely to decrease hardwood timber availability (Greene and Siegel 1994). In addition to the unpopularity of regulatory programs, diversion of funds from other investment opportunities (for example, plant modernization) is also a real concern. Regardless of effects, controversy remains over the long-term effects on forestry investments and whether cost-sharing programs should be considered replacement or expansionary investments (Alig et al. 1990, Lee and Kaiser 1992, Wear 1993, Haynes et al. 1995, Haines 1995).

## Public Investments

Although many landowners do not consider government assistance necessary for them to make appropriate investments on their land, others argue strongly for the necessity of publicly funded cost-sharing programs to overcome the deterrents to private investment. This lack of consensus is understandable given the

diversity of nonindustrial private forest landowners, and the difficulty of defining what constitutes optimal, appropriate, or adequate investment. However, public investments in protection as well as education, technical, and financial assistance programs are effective at the margin in increasing the willingness of landowners to invest further in their forest properties.

### Federal Investments

Considerable research and public debate has focused on the question of whether the cost of public investments in nonfederal forests are commensurate with the benefits contributed by such forests nationwide. The data for making such judgments are sketchy, although information is available on federal expenditures by program category for assistance to nonfederal-forest owners (see Tables A-23, A-24, A-25, and A-26). Whether these investments are sufficient is subject to conjecture. Focused investment opportunities for public monies do exist. In the late 1980s nationwide, nearly 70 million acres of private forestland (excluding industrial timberland) could be regenerated or subjected to stocking-control practices for at least a four percent return rate on the investment. The total cost of carrying out these treatments is approximately $7.2 billion, the largest share of which would be invested in the South Central and Southeast regions (USDA Forest Service 1989a). Another study suggested that investment opportunities of at least four percent (again, mostly in the South) existed in the late 1980s on 50 million acres of nonindustrial private forestland (USDA Forest Service 1988b,c). Although the information available to make these investment decisions is sketchy, economically attractive investments could be made that are not being made in the current investment climate.

Concern for the adequacy of federal involvement in the future is especially apparent in the concern for tree planting after the decline of the federal Conservation Reserve Program (CRP). Tree planting in the United States was expected to decline after the CRP, and that decline has occurred. Most CRP tree planting, 2.2 million acres, was done in 1986-1989; an additional 396,000 acres were planted from 1990 to 1997. When CRP plantings are deducted, tree planting for all ownership categories has remained essentially constant (2.4 to 2.5 million acres) since 1983 (for 12 years). Because the bulk of CRP planting have been done in the South (more than 90 percent) and on nonindustrial private forests, the implications of reduced CRP planting are especially critical for that region and for those nonindustrial forest owners. Concern over future timber supplies is increasing because of the scarcity of timber resources in the South and the reluctance of nonindustrial private landowners to plant trees in response to higher stumpage prices (Alig et al. 1990, Cubbage et al. 1995). The decline in CRP planting of pine plantations (especially loblolly pine) also has serious negative implications for various species of wildlife, especially birds and small mammals (Moulton et al. 1991)

### State and Municipal Investments

States invest in private forest-lands by providing protection from wildfire, insects, and disease and also by providing technical and financial assistance to private owners. In addition, states and municipalities are themselves forest landowners, with objectives and investment behaviors that vary as widely as those of industrial or nonindustrial forest landowners (Souder and Fairfax 1995). Little information is available on trends in investments on these lands. For the period for which data are available (1978-1987), state funding of forestry programs increased substantially in nominal-dollar terms, although in real terms state revenue decreased somewhat or, at best, remained stable (Table A-25).

States with the most rapid increases in forestry budgets were in the South, Midwest, and Mountain regions; those with the most rapid decreases were in the Northeast and the West Coast. The differences largely reflect the general economic climate of the region. Although real-dollar state forestry budgets (excluding federal funds) were stable or slightly reduced, they increasingly accounted for less of the states' natural-resource budget (which increased 20 percent from 1978 to 1987 real dollars) and less of the state budgets generally (Lickwar et al. 1988). Evidence also suggests that state forestry agencies that are part of a larger environmental regulatory administration have had substantially reduced budget allocations (Hacker and Ellefson 1996).

### Scale of Public Investments

Public investments in cost-share programs and technical assistance are important, yet they are quite modest to many. Whether the amount of public investment in such programs is sufficient to be effective is questionable. For example, the federal Forestry Incentive Program enabled reforestation of 2,789,000 acres from 1975 to 1993 (at a federal cost share of nearly $156 million) or 155,00 acres per year (Agricultural Stabilization and Conservation Service 1993). However, in 1987, an economic opportunity developed (treatment yielding four percent or more) to have 47 million acres of nonindustrial private forest regenerated (USDA Forest Service 1989). Similarly, the Stewardship Incentives Program in 1992 assisted 579 persons in developing stewardship incentive plans covering 89,541 acres at a federal cost share of $293,000 (Agricultural Stabilization and Conservation Service 1993). The number of persons involved in these programs is small in comparison to the 9.9 million nonindustrial forest owners who own 353 million acres of forest in the United States. At a rate of new plans covering 89,000 acres of forest each year, it will take many decades to have plans covering even a small portion of the nation's nonindustrial private forestland. The programs used as examples here are not the only federal cost-share programs devoted to private forestry. The size of the federal effort is larger than that but

certainly is not excessive. The concerns over federal assistance are not about program efficiency but about appropriate scale and whether existing programs are large enough to make a difference. Also enlightening is the rate of federal investment per acre in nonindustrial private timberland via USDA Forest Service state and private programs versus the agency investment in national forest timberland. The latter is approximately $30 per acre while the former is about $0.50 per acre.

### Infrastructure Investments

To produce goods and services, the nation's nonfederal forests require substantial investments in the infrastructure, including bridges, buildings, trails, campgrounds, communication systems, and flood-control structures. From 1970 through 1990, national nonmilitary capital stock declined over 8 percent as a proportion of gross national product, and new public capital investments nearly stopped in the mid-1980s. The implications of those declines can have serious consequences for nonfederal forests: (1) a less useful and less modern infrastructure will be available for the management of nonfederal forests and the delivery of goods and services from such forests; and (2) communications will be less socially and economically healthy within or near nonfederal forests because of the low rates of investment in schools, transportation systems, and hospitals (Lewis and Ellefson 1993). Infrastructure investments are frequently large, leading many to call for the federal government to share their costs or at least to create an economic environment in which other units of government and the private sector can make the infrastructure investments needed for effective management of the nation's nonfederal forests.

### Incidence of Investments

Opportunities for furthering the magnitude and kinds of benefits generated by nonfederal forested lands certainly exist and possibly are facilitated by public investments. Some observers argue that investments in private forest properties are the sole responsibility of private owners and that the government has no role to play. Others suggest that private investments result in a variety of public benefits; therefore, the public should bear a portion of the costs of producing these benefits. For example, better water quality or more pleasing landscapes are enjoyed by a wide segment of the public. Some inequality geographically or temporally between those who pay for and those who benefit from investments in nonfederal forests is, perhaps, inevitable. However, investment responsibilities should be allocated to the extent possible to minimize unfair distribution.

## POTENTIAL STRATEGIES

### Remedies for Investment Disadvantages

Attracting investments in nonfederal forests can be facilitated by making the climate for private and public investments more attractive economically, and by improving access to adequate sources of financing. Steps can be taken to generate greater interest in investing in nonfederal forests by focusing on remedies for the apparent investment disadvantages that forests generally exhibit. Among the potential remedies are cost-share programs, access to credit, special tax treatments or exemptions, and efficient timber-producing operations. A clearer link between the forestland investors and the beneficiaries of such investments has also been suggested as a way to enhance investment opportunities. Payments from hydroelectric power concerns, users of irrigation water, and users of domestic and industrial water for upstream forest-management activities could clarify the link (McGaughey and Gregersen 1988).

Reducing risk and uncertainty can also improve the investment climate for nonfederal forests. Among the options to do so are expanded protection programs; guaranteed prices for timber products, insurance programs to protect against catastrophic losses; and greater access to marketing information, price reporting, and technical assistance (Boyd and Hyde 1989). The public role in providing technical assistance, however, might be reduced in the future because of the development of efficient markets for technical assistance (Munn and Rucker 1994, McColly 1996). Public technical assistance has been found to be less effective than cost-share programs in promoting reforestation investments (Skinner et al. 1990). On the other hand, only one in five nonindustrial private forest landowners has a written management plan for their forestland, and only 11 percent of those plans were prepared by consultants (Birch 1996). Other studies of technical-assistance programs have concluded that public and private assistance are effective and efficient (Cubbage et al. 1996).

Options to overcome the problem of insufficient cash flow during the life of forestry investments include access to loans and easily accessible credit sources (Rhinehart 1992), lease arrangements for timber productions, and formation of cooperatives that pay annual fees to landowners in anticipation of access to timber. Improvements in the investment climate for nonfederal forests also implies changes in allowable tax deductions for reforestation and management costs, changes in the effective tax rate for capital gains, providing tax credits for industrial assistance to nonindustrial forest landowners, and providing favorable property tax laws for forestland. Unfortunately, the basis for judging the desirability of such changes in the tax laws is often inadequate, except with respect to the obvious desirability of a stable environment in which investment decisions can be made (Boyd and Hyde 1989, Chang 1996).

### Sources of Capital for Investments

Public-sector funds for investments in nonfederal forests have traditionally come from public borrowing or from a wide variety of tax levies on incomes (income tax and value added tax), wealth (property, death, and gift), and consumption (sales tax and excise tax). In the current political climate, interest in looking beyond traditional investment sources has grown. Half of the states with rising state forestry budgets from 1978 to 1988 reported increases in funding from nontraditional sources (Lickwar et al. 1988). In some cases, the sources provided revenues specifically dedicated to forest and natural-resource activities. For example, Wisconsin's mill tax dedicates a portion of state property taxes to support the Wisconsin Bureau of Forestry, and an Oregon severance tax on harvested timber supports programs in the Oregon Department of Forestry. Natural-resource programs in Missouri and North Carolina are partially supported by a dedicated portion of general state sales taxes. To dedicate funds for activities on nonfederal forests requires a good match between revenue sources and revenue needs; a simple administrative mechanism for gathering and managing the funds; protection of general fund monies, especially if dedicated funds perform well; and prevention of diverting dedicated funds to nontargeted programs (Hacker and Baughman 1995). Especially innovative funding mechanisms using general obligation bonding have been used in Florida and Michigan to secure funding for activities that will later provide revenue to pay off the bonds (Box 8-2).

Financing for industrial forestland investments comes from retained earnings, borrowed money, and sale of equity. On nonindustrial forestlands, financing of forestry activities comes from savings, grants, and borrowing. Especially innovative funding mechanisms for private financing of activities on private forestlands include Norway's Forest Trust Fund (Oistad et al. 1992) and Oregon's Forest Resource Trust Fund (Box 8-3, Box 8-4). Both programs involve a portion of receipts from the sale of products to be deposited in a fund that can then be invested in forest-management and protection activities.

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

Investments in forestland and the trees account for the bulk of the nation's investments in nonfederal forests, which serve many purposes. These purposes range from timber production, to provisions for recreation and aesthetic values, to providing habitat for endangered species. Holding land and trees may not serve all purposes equally well; however, investments are being made in both forestland and trees by individuals to meet most objectives of sustainable management of nonfederal forests. Critical to these investments in nonfederal forests are healthy national and regional economies in which the federal government has a major role.

Most investments in nonfederal forests are made by private forest owners. The size of the investments made by the owners (or the public) to improve the

**Box 8-2**
**Michigan's Long-Term Bonding Program: A Creative Approach to Investing in Public Nonfederal Forests**

*Program Intent*: Motivated by the Governor's 1983 Target Industry Program, Michigan's revenue bonding program focuses on state-owned forests (3.8 million acres). Legislatively established in 1990, the intent of the bonding program is to:

- diversify the state's economic base and promote the development of economically healthy local communities that are dependent on state-owned forests.
- break from the low development investment trap involving timber sale receipts as the sole source of revenue for investing in state forests. Link current investments in forests (viewed as a capital asset) to larger returns anticipated in the future.
- grow the state forest system's proportionate share of total state timber supply on fewer acres than would occur with low intensity management.

*Financing-Planning Linkages:* Link forest planning and plans for the state forest system with the funding necessary for carrying out the plans. Planning activities separate uses and user of state-owned forests into primary uses (or key values), namely areas for intense vegetative management for timber and wildlife; areas for developed forms of recreation and related leisure activities; and areas important for a variety of naturalistic values. Complementing planning activities, finances are made available (via a long-term forest development fund) to carry-out intensified timber management on areas determined to be appropriate for intense vegetative management, and on which practices can be applied that will be sufficiently productive to earn a minimum acceptable rate of return (four to 25 percent real rate of return). Planning has determined that of the state's 3.8 million acres of state forests, 775,000 are considered good timber investment opportunities and without apparent conflicts with other uses.

*Bond Sales:* State revenue bonds are the source of funding for the program. They were chosen because they are an investment-oriented source suitable to an enterprise with strong earning potential, and because the prospect of general fund appropriations on an adequate scale was highly unlikely given the state's financial condition and history. Bond sales occur every 3 years, specific timing being determined by prevailing interest rates, strength of bond markets, and interests of special investment categories such as pension funds. Repayment of the bonds is to be made with future receipts from more valuable and greater amounts of timber.

*Administrating Unit:* The Michigan Finance Authority, the program's administrative unit, is managed by an executive director (state forester) and an assistant executive director (primary forestry analyst). The arrangement establishes a permanent link between financing matters and resource management considerations. The administering unit for the bond sales is the State Treasury Department.

Source: "Michigan's Investment-Oriented Financing System: A Focus on the State Forest System" by H. H. Webster. Unpublished Report. Department of Forest Resources. University of Minnesota. St. Paul, MN 1996.

**Box 8-3**
**Norway's Forest Trust Fund: A Creative Approach to Investing in Nonindustrial Private Forests**

*Authority and Purpose*: Norway's Forest Trust Fund was authorized by the Norwegian Forestry and Forest Protection Act of 1965 (Fund established by law in 1932). The purpose of the Fund is to promote timber production, reforestation, and protection of forests while encouraging their use and management for recreation, wildlife, quality water, and scenic beauty. These intents are to be accomplished by balancing private landowner freedom and responsibility.

*Requirements:* All private forest landowners selling timber from their land must place 5 to 25 percent of the gross value of timber sold into trust account. Exact amount depends on the landowner's tax and financial status and on past history of caring for forest (current average rate is 12 percent). Buyer of timber deducts correct percentage from sales receipt and deposits said amount in the seller's (landowners) account at a local bank providing the most favorable interest rate.

Landowners may withdraw funds from their trust account for purposes of carrying out forestry practices on properties from which the money originated. Acceptable practices are determined by landowner associations and the Norwegian Department of Forestry.

Because landowners do not receive the interest earned by their trust fund accounts, they have a strong incentive to quickly withdraw the funds and invest them in forestry practices that will provide a financial return.

*Tax implications:* Landowners may deduct from federal income taxes the full amount of their deposit into a trust account. When the funds are withdrawn and applied to a forestry practice, a significant portion of such investments can also be deducted from annual income taxes. Depending on the owners marginal tax rate, these incentives amount to public subsidies of 50 to 60 percent of the cost of the practice.

*Public Purposes*: Interest from landowners' trust accounts is used for the common benefit of forestry at local, regional, and national levels in Norway. With its portion of the funds, Norway's Department of Forestry supports forest nurseries, seed orchards, professional continuing education, and publicly-oriented organizations such as a forestry museum, professional forestry society, and an extension service institute. Local governments support demonstration projects, study tours for public, planning activities, and equipment rental.

*Magnitude of Program:* In 1988, landowners withdrew $48 million from the Trust Fund. In 1989, the Fund contained approximately $84 million, of which $54 million was deposited by landowners in same year.

Source: Oistad et al. 1992.

**Box 8-4**
**Oregon's Forest Resource Trust: A Creative Approach to Investing in Nonindustrial Private Forests**

*Authority and Intent*: The Forest Resource Trust was established in the Oregon Department of Forestry by state law in 1993. Its purpose is to provide funds for financial, technical, and related assistance to nonindustrial private forestland owners for stand establishment and management for timber, wildlife, water quality, and other purposes. Priority given to reforestation of lands zoned for forest uses and other lands with high probability of successful reforestation. Goal is to reforest 250,000 acres by 2010.

*Administration*: The Trust Fund is created in the State Treasury, separate and distinct from the General Fund. Earnings on money in Trust are retained in fund. Overall responsibility for the Trust rests with the State Board of Forestry, although a 15 person advisory committee assists the Board in setting policy for the program. The State Forester is responsible for implementation of the program, including identification of suitable lands, providing technical assistance, and monitoring landowner compliance with agreements involving the Trust. A biannual report on program status must be submitted to legislature, as well as an independent evaluation of program goals, administration, problems, and outcomes.

*Eligibility*: Eligible persons are nonindustrial private forest landowners having land that is: deemed capable of supporting a healthy stand of trees; at least 10 acres, but not over 5,000 acres in size; zoned for forest or farm use; free from reforestation requirements of the Oregon Forest Practices Act; free from any covenants or encumbrances prohibiting tree cutting; and not under petition for conversion to non-forest property.

*Application:* Qualified landowners must develop a project plan, often with the assistance of a consulting forester, extension forester, or Department service forester. Plan must include maps, aerial photos, recommended forest practices, and implementation time schedule. Approved plans receive up to 100 percent of cost of implementation. Maximum of $100,000 every two years per landowner.

*Obligations:* The landowner is obligated to repay the loan (return to the Trust) from proceeds of the sale at the time of harvest (a lien imposed on timber to be harvested). The obligation runs with the property, unless terminated when the forest is destroyed through no fault of the landowner (e.g., insects, disease, fires, flood), or repayment of the loan (including interest) by an owner during the 200 year life of the contract. The landowner chooses when and whether to harvest, but must notify the Oregon Department of Forestry of intent to harvest. The landowner must agree to allow access to the land by the state forester.

*Magnitude of Program*: In 1995, landowners borrowed $500,000 from the Trust, namely the total amount contained in the Trust in that year.

Source: Oregon Department of Forestry 1996

condition of nonfederal forests is minimal in comparison with the simple costs of holding the land and trees. Economic opportunities for larger public and private investments in nonfederal lands do exist. State governments make substantial investments in nonfederal forests, although their investments are declining in proportion to state natural-resource budgets and state budgets generally. Regulatory programs in some states require private investments in forest management, an approach that has serious political and investment ramifications. Relative to the opportunities for investment in nonfederal forests, federal investments in cost-share and technical-assistance programs are modest.

Nonfederal forests and the communities associated with them suffer from a lack of investment in various types of infrastructure. In addition, forests and forestry often exhibit special conditions that can discourage investment in nonfederal forests. Some private owners of nonfederal forest-land in certain regions of the nation are no longer investing in certain types of timber growing stock, especially softwoods in the Pacific Northwest. Among the disadvantages to owning forestland are high risk, long time periods before returns are realized, and uncertain markets.

Investments made in nonfederal forests by various segments of the public should be commensurate with expected returns to the public. In many cases, that means that funding of public programs for nonfederal forests should be increased. Infrastructure conditions needed to provide a wide range of benefits from nonfederal-forest development should be assessed, and additional public investments in infrastructure should be made as needed.

For purposes of attracting additional capital, public actions should be taken to reduce the risk and uncertainty that often deters long-term investments in nonfederal forests. Federal and state governments should ensure especially that tax policies do not deter investment of private capital in nonfederal forests. The tax policies should be neutral in application, equitable among sectors, and efficient in cost of collection. The federal government could provide more information on private and public financing of nonfederal-forestry programs and assist financing states in implementing especially effective financing programs that are used in other states or other countries.

**RECOMMENDATION:**

*Promote public and private investments in nonfederal forests by establishing innovative investment policies and fostering healthy national and regional economies. Investment should be broadly construed to include financial, intellectual, human and ecological resources.*

This points to the following specific recommendations:

- *Major deterrents to private investments in forestry that affect investment by nonindustrial private landowners, especially lack of sufficient advance capital and low expected rates of return, should be eliminated.*

- *Federal fiscal and technical assistance programs leading to investments in private nonfederal forests should be sufficiently large to affect the use and management of nonfederal forests.*
- *Innovative public and private revenue sources for investments in nonfederal forests, including general obligation bonds and various forms of private trusts, should be established.*

# 9

# Investing in Research and Technology Transfer

## INTRODUCTION

Sustainable management of nonfederal forests is dependent on timely and accurate information that flows from reliable and easily accessible scientific sources. Research on nonfederal forests, technology transfer, and dissemination of information is important to address unique and diverse ownership and management needs, growing demands for wood, and forest health and ecological concerns. This chapter provides an overview of research and technology transfer programs that are focused on nonfederal forests.

## RESEARCH AND DEVELOPMENT

Important social and environmental benefits provided by sustainable nonfederal forests are challenged by the complexity of the ecosystems, ownerships, and institutions. The landowners are concerned about risk and capital requirements, and the public is concerned about appropriate combinations of educational, technical, and regulatory programs. These concerns detract from development of nonfederal forests to provide even greater benefits. These issues deserve more attention and research.

Information needed for the management and protection of nonfederal forests is often dissimilar from that required by other major landowner categories. Certainly, the variety of objectives associated with management of the nation's 9 million nonindustrial private forests requires information that often is different from that needed for the management of federal public lands. Similarly, tribal

forests, industrial forests, and state-owned forests often have markedly dissimilar goals that can drive informational needs in different directions.

There are three fundamental issues concerning research on nonfederal forests. The issues are (1) the magnitude of research activities, (2) the organization and management of research, and (3) future research directions. In some respects, these issues parallel the research concerns expressed in *Forestry Research: A Mandate for Change* (National Research Council 1990).

## Quantity and Quality of Research

Although research on forests in general provides information that is often applicable to nonfederal forests, there is no major national focus on the informational needs unique to nonfederal-forests-management per se. This is especially troublesome given the information void and inconsistencies that often plague analyses of major issues involving nonfederal forests. The information available to describe the latter is often out-of-date, gathered by agencies with conflicting interests, inconsistent in form and presentation, and incapable of being summed across regions. However, the 1978 and 1994 nationwide reviews of private forest owners have been helpful in this respect (Birch 1966, Birch, et al. 1982). More frequent compilations of this sort could prove especially useful in anticipating issues involving nonfederal forests and in designing suitable program responses by public and private organizations.

The lack of information about nonfederal forests is especially alarming when considered in the context of growing public perceptions of the importance of forests generally and with the meager and often declining research investments being made in most forestry sectors generally. Since the late 1970s, real dollar federal investments in forestry research have remained the same or declined slightly. Private wood-based investments in forestry research continue to be substantially below the national average (4.7 percent) for company research expenditures as a proportion of domestic sales (paper and allied products: 0.8 percent; lumber, wood products and furniture: 0.7 percent) (National Research Council 1990; Ellefson and Ek 1996). The magnitude of needed research investments is put into perspective by the 70 million acres of nonindustrial private forests that are worthy of management practices yielding at least a 4 percent real rate of return. An investment of over $7.2 billion would be needed to produce that return, an amount reflective of the minimum value of the goods and services produced by these forests (USDA Forest Service 1989a,b). An annual research investment of $1 million devoted to this landowner category would be less than 0.02 percent of this value. In addition to concern over funding of research, there is concern over the availability of researchers (since the late 1970s, the number of students earning doctoral degrees in forestry has increased very little) (National Research Council 1990; United Nations 1992).

## Organization and Management of Research

Research on nonfederal forests is fragmented by disciplines and organizations. Although such a structure has the advantage of being able to respond to various disparate research issues, it also can fractionate research responsibilities to the point that major problems requiring research are sometimes bypassed. Within such a structure, seldom does any one organization have as its dominant mission the development of information required by owners, managers, and users of nonfederal forests. The exception might be wood-based-industry research and development programs, which, when focused primarily on forestry research, are in the range of $60 to $70 million per year (Ellefson and Ek 1996). As is coordination and integration among forestry research scientists generally, coordination of scientific effort devoted to nonfederal forests is limited (National Research Council 1990). Given the importance of nonfederal forests to the nation and the diversity of clients that depend on them, the forestry research community needs to be aggregated and integrated.

## Planning and Focus of Research

Providing for the informational needs of owners, users, and managers of nonfederal forests requires research focused on resource use, management, and protection. Often, only research on nonfederal forests receives attention within the context of larger forestry research planning. For example, gaining an understanding of the composition, function, and distribution of genetic variation of wildlife might have broad application among many owners, but more specific information might be needed by specific tribes and industrial timberland owners. A process does not exist for periodic review and establishment of a national research agenda for nonfederal forests. Research results useable to the community with interests in nonfederal forests depends on planning and focus. Such has yet to occur.

National assessments could be used to guide the direction of research on nonfederal forests; however assessments are limited. One effort to do so was carried-out by the American Forest and Paper Association (1995a) which ranked research needs in the following order: forest management research, research on environmental-social-biological interactions, silvicultural research, and research on energy utilization and markets. The report also calls for a national research coordinating council. A more narrowly focused national assessment addressed the nonindustrial private-forest sector (Ellefson et al. 1990). Many assessments leading to a national research agenda are very broad in scope. For example, a report prepared by the National Science and Technology Council (1995) suggests that research focus on understanding the state of natural systems and their susceptibility to change, socioeconomic dimensions of environmental changes, human health consequences of environmental change, and vulnerability of socioeco-

nomic and ecological systems to environmental changes. Greater emphasis on economic and sociology research is also suggested (National Research Council 1990). Especially useful information is found in recent national reviews of the number, characteristics, and intentions of persons owning nonindustrial private forests. Also of special relevance have been the few comparative assessments of policies and programs that are being implemented by other countries.

## INFORMATION AND TECHNOLOGY TRANSFER

Demand continues to increase for scientific information required to make informed decisions on the use, management, and protection of nonfederal forests. A challenge facing the nation, however, is how to transfer such information effectively to the users, managers, and owners of the nation's nonfederal forests, and the variety of current and potential partnerships that involve these users and managers (National Research Council 1990). The potential for transferring information exists among a number of public and private organizations and within the research community itself. A variety of issues prevent full access to this potential.

The forestry community is increasingly viewing science as an important basis for informed decisions. Unfortunately, researchers are not always well organized to transfer scientific findings to users, managers, and owners of forest land, including findings on nonfederal forest (National Research Council 1990). For example, many public and private organizations have responsibility for extending information, often doing so with little coordination and conflicting missions. Similarly, the modest funding often available to these organizations seldom enables them to achieve meaningful results. The client groups and the scope of programs (for example, professional continuing education, services to landowners, and informing the general public) in the technology-transfer area are exceptionally broad, a circumstance that tends to diffuse and blur organizational direction. Unknowns about the appropriate combination of methods used to deliver scientific information to important client groups (for example, electronic mediums, traditional classroom settings, and demonstration projects) are also distressing. Limited focus on emerging clients for new science also is of concern (for example, tribal forestry, urban and community forestry, and private interest groups). Although communication is increasingly suggested as an important role for researchers, they are often hesitant to communicate the results of their research to important client groups.

Building a more effective systemwide structure and associated commitment to transferring scientific information to interested users can be accomplished in a number of ways. For example, clarify the scientific informational needs of persons and organizations interested in or responsible for nonfederal forests; fostering mechanisms for transferring information, especially public and private partnership arrangements that can provide mutual synergy and potentially eliminate duplication; merge public organizations that have similar information-trans-

fer functions; build on private-sector strengths in information transfer, especially private consultants and industrial forestry information programs; encourage development of continuing-education opportunities for professional managers of natural resources and provide incentives for participation in programs offered by such centers (for example, the U.S. Fish and Wildlife Service National Training and Education Center); substantially increase the funding of information-transfer programs; and aggressively incorporate technology-transfer components into research projects focused on nonfederal forests. In addition, partnerships and incentives that encourage cooperative efforts, outreach, and expansion of technology-transfer programs to a broader clientele—including newly emerging clientele groups such as Native American and urban forestry—should be cultivated.

## MONITORING AND INFORMATION MANAGEMENT

Management of the nation's nonfederal forests requires relevant and readily available information. Two invaluable methods to provide information are assessment and monitoring systems that gather information about the status of resources and the programs devoted to them, and information-management systems that enable information to be easily shared across regions, ownerships, and administrative units. The forestry community has a rich history of assessment and inventory activities that guide policy and program activities. These activities have served the nation well; however, they are in continual need of refinement because of the demand for different types of information, demand for timely information, and demand for accurate information. Refinement is needed as the nation becomes more sensitive to the importance of diversity in the structure of forest ecosystems and to the cumulative effects of management activities in large ecosystems that involve many different types of nonfederal-forest owners.

### Assessment and Monitoring

Federal and state governments and some nonprofit organizations (for example, the Nature Conservancy) have engaged in developing complex assessment and monitoring systems that evaluate the status of forest resources and the progress in implementing programs on them. One of the most widely acknowledged assessment programs is the Forest Inventory and Analysis program authorized by the Forest and Rangeland Renewable Resources Planning Act of 1974. Other examples are the U.S. Geological Survey's National Water Quality Assessment Program; the National Biological Survey Gap Analysis Program; U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program; and the National Forest Health Monitoring Program which was begun in 1990 and involves a variety of public and private cooperators. In addition, various monitoring programs provide resource users and managers with information needed to focus, discard, or expand programs. An

example is state-level programs that monitor the application of best-management practices in forestry.

Nonfederal forests are typically included as an integral part of broader assessment and monitoring efforts and therefore are subject to their shortcomings. For example, protocols for inventory (assessment) methods and resource descriptions might lack standardization (for example, the variation in the definition of forestland by USDA Forest Service and USDA Natural Resources Conservation Service); information sampling methods might be incompatible; certain landowner categories or forestland classifications might be excluded from survey samples; research designs providing information about resource conditions might be inconsistent; information on the human dimension might be lacking (for example, political, legal, and economic information); and the information reported might be out-of-date or poorly timed for important decisions. Those shortcomings in assessment and monitoring systems can have serious implications for guiding the use, management, and protection of nonfederal forests. Problems might occur in comparing assessment information both temporarily and spatially (for example, between states and between regions), in coordinating analysis of resource information between disciplines, and in comparing the results of research on important forestry use and management problems (Council on Environmental Quality 1995; Sample and LeMaster 1995).

## Information Management

Informed decisions about nonfederal forests require a shared interest in collecting and disseminating information. In reality, however, there are obstacles to doing so. For example, the general public reports a lack of fundamental resource information that describes the character of nonfederal forests (for example, area, type, and condition) and their potential for providing various benefits to different client groups (for example, wildlife habitat condition and scenic beauty condition). In contrast, there is an enormous amount of information that is gathered by Forest Inventory and Analysis (FIA) activities. The implication is that FIA processes are apparently gathering a wide variety of information that is not being provided in a manner that can be easily accessed by interested persons and organizations.

Additional conditions that detract from easy access to information about nonfederal forests include information-management systems that might use incompatible technologies; GIS technologies that might not be available to a wide range of interested users (including the general public); systems that suffer from lack of use because they are not "user friendly"; information-gathering activities that are duplicated among organizations; a lack of technical advice that is needed to enhance clients' understanding and use of information; and possible lack of administrative or organizational leadership and resources that are needed to focus the collection, management, and dissemination of information. The inability of

public and private organizations to share information can detract markedly from their ability to carryout their mission. Similarly, the general public's inability to secure information easily can foster inaccuracies and mistrust.

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

Accomplishing needed forestry research that is focused on nonfederal forests will require continued engagement of public organizations and an even greater role for the private sector. Funding research on forests and related resources is generally of concern because of the conservative fiscal climate being experienced by the nation. Although greater public funding of research might be difficult, funding decisions should take into account the ever growing importance of the nation's nonfederal forests. Public funding should be continued and where possible augmented to be commensurate with current or potential benefits provided by nonfederal forests. In addition, research administrators should consider creative funding mechanisms, including dedicated public funding, special fees on commodities obtained from forests, a greater role for the private sector via the issuance of bonds and reinvestment of revenues, and fees for conducting research activities. As for the number and quality of forestry scientists, innovative recruitment and enhanced educational climate should be explored (National Research Council 1990).

Organization and management of research on nonfederal forests will continue to be a problem as long as funding deteriorates and research units must operate large-scale, efficient research enterprises. Consideration should be given to structures to coordinate national and regional research, partnerships and cooperative arrangements among research enterprises, fiscal and tax incentives for collaboration between organizations and scientists, merging of some federal-research projects with similar projects at universities, and development of greater clarity between public and private research responsibilities.

Existing research establishments need greater clarity of mission, reliance on broader environmental and natural-resource research agendas, and a national research coordinating structure devoted to the nation's nonfederal forests. With regard to the latter, serious consideration should be given to the National Research Council's recommendation for a National Forestry Research Council (National Research Council 1990).

Information-management and monitoring and assessment functions are growing in importance as reliable information bases become increasingly critical to decisions about the use, management, and protection of nonfederal forests. Among the many potential actions that would enhance availability of information for these decisions are the development of guidelines that foster commonality in data and information bases, especially since it would promote integrated resource management. Developing technical information systems (GIS) that support easy access to information by the interested public and owners and managers of

nonfederal forests is important as well as promoting access to and distribution of information that is currently being gathered by programs such as Forest Inventory and Analysis. Information-gathering approaches that improve the accuracy, reliability, and statistical soundness of information should be promoted. Developing linkages with and integration of various information systems; carrying out planning activities that focus information gathering and improve the quality of information systems; establishing information partnerships and cooperatives between public and private concerns, especially at state and regional levels; and focusing administrative leadership for the management of information about the nation's nonfederal forests is fundamental (National Science and Technology Council 1994).

**RECOMMENDATION**:

*Improve the quantity, quality, and timeliness of information about nonfederal forests and enhance access to this information.*

This recommendation points to the following specific recommendations:

- *Research focused on nonfederal forests should be strengthened by expanding public and private investments in research, improving the organization and management of research, and guiding research with a strategic research plan for nonfederal forests.*
- *Programs for transferring information about nonfederal forests to landowners, managers, and citizens should be strengthened. Cooperative partnerships should be used to assist in this effort.*
- *Programs for monitoring the condition and use of nonfederal forests and systems for managing this information should be strengthened, with emphasis on establishing consistent information gathering protocols for monitoring activities.*

# 10

# Resource-Owner Rights and Responsibilities to Invest

## INTRODUCTION

The ability of nonfederal forests to provide social, economic, and environmental benefits often rests on society's respect for the rights that many view to be associated with private forestland ownership. Conversely, society expects owners of forestland to responsibly use and manage their property in manners consistent with accepted principles of sound forest stewardship. Without such a mutual understanding, landowners and society in general have difficulty in determining if and when investments in nonfederal forests are appropriate. The dilemma is especially troublesome for owners of private forest property. Taking these aspects into consideration, an overview of stewardship and landowner rights and responsibilities is presented in this chapter.

## HISTORIC DIMENSION

The growing debate over how to deal with actual or potential adverse impacts of forest practices is in many respects a continuation of early concerns over the use and management of the nation's nonfederal forests (see especially Cubbage et al. 1993). For example, rudimentary statutes in colonial America protected game from exploitation and timber from wanton destruction. Although early 1900s efforts to federally regulate timber harvesting practices failed, the concerns lead to enactment in the 1930s of a variety of far-reaching federal laws that reflected the nation's growing interest in fostering a community of forest landowners that were committed to land stewardship (e.g., Clarke-McNary Act

of 1924). The adverse impact of forestry practices was considered manageable and primarily an issue of providing education and financial assistance in amounts sufficient to change landowner attitudes and actions. However, beginning in the early 1970s additional state and federal laws were established to deal with growing concerns over the status of natural environments, including forest environments. Federal examples are the Clean Water Act, Clean Air Act and the Federal Insecticide, Fungicide and Rodenticide Act, while state examples are the many state laws that regulate forest harvesting and management practices on private land. This most recent period places greater emphasis on government imposition of forest stewardship principles on owners of forest property. Doing so has lead to important debates over forest landowner rights and responsibilities.

## RESPONSIBLE STEWARDSHIP

Sustainability of forest and related natural resources is achieved in a number of ways, including through the responsible actions of private owners of forestland and through responsible implementation of public policies toward such property by the government. When properly exercised, these responsibilities become, in essence, investments. However, in recent years the distinction between public and private rights and responsibilities has become a major policy issue. In large measure, the issue arises because of such factors as increased government restrictions on the use of private land, increased U.S. Supreme Court protections of private property, increased public and community expectations for access to private forest property, and the appeal of property rights as a means of easing regulatory controls (Meltz 1995). Private forest management is engulfed in the issue of public and private rights and responsibilities and in the various remedies, including "right to practice forestry laws," suggested to resolve it (Flick et al. 1995, Argow 1996).

As society acts to ensure the sustainability of natural resources in the context of different landowner circumstances, a fundamental issue that must be addressed is whether private landowners have legal or societal responsibilities to protect the land and water they use? The question is often addressed in terms of stewardship, although in recent years the discussion of stewardship has been subsumed in some ways into the larger discussion of sustainable management. Efforts to promote sustainable forestry provide an opportunity to consider the basis for a responsibility of stewardship and the mechanisms available for implementing it. The issue of stewardship over land and natural resources is at the heart of the Jeffersonian model upon which American democracy was founded and finds its roots in religious, political, and ethical principles upon which our society developed.

The responsibility of stewardship is not a new issue in American land-use policy. Henry A. Wallace, secretary of agriculture, in the forward to the U.S. Department of Agriculture's (USDA) 1938 Yearbook of Agriculture (USDA

1938) said, "The social lesson of soil waste is that no man has the right to destroy soil even if he does own it in fee simple. The soil requires a duty of man which we have been slow to recognize." In upholding a law in 1943 requiring advance notice for terminating farm tenancies, the Iowa Supreme Court stated the following about the role of landowners in protecting soil (Benschoter v. Hakes, 232 Iowa 1354, 1363-64; Iowa 1943):

> It is quite apparent that during recent years the old concept of duties and responsibilities of the owners and operators of farm land has undergone a change. Such persons, by controlling the food source of the nation, bear a certain responsibility to the general public. They possess a vital part of the national wealth, and legislation designed to stop waste and exploitation in the interest of the general public is within the sphere of the state's police power.

Although focused on farmland, the above two statements provide a context for the discussion of owners' rights and responsibilities toward forest property. Two of the most commonly held beliefs today are that the present generation of landowners in effect is borrowing the land from future generations and that landowners are obligated to improve the land.

Coupling multiple-use methods, which provide the basis for much of America's forest-management education and policy, with long-term planning in forest-resource management makes forestry an important area for consideration of rights, responsibility, and stewardship issues. Any discussion dealing with sustainable management of nonfederal forestlands must address the issue of stewardship and individual rights and of landowners responsibilities (Box 10-1).

## Private Property Rights and Societal Action

The U.S. system of laws and jurisprudence are based on the Magna Carta and English Common Law. In colonial times, colonists generally regarded forests as a liability and cleared them for higher valued farms and towns. In fact, many colonial laws promoted clearing forestland. This action of disposition, development, and private use prompted the first protective and regulatory statutes in the early seventeenth century. Forestland owners had been using forests as an unlimited resource and conservation of these lands was generally ignored. Protection laws existed in the 1800s, but these laws were not enforced until 1891. These initial acts set the precedent that government had the power to regulate activities on public and private lands. Colonial courts also enforced the English Common Law concept of nuisance—an unreasonable interference in the use and enjoyment of an interest in land—a concept still enforced today.

Ownership and use of private property are essential components of America's society and economy. Use of natural resources, such as forests and water, have helped fuel the growth of our society, provided employment for millions of people, and brought wealth to many landowners. Enjoyment of these resources,

**Box 10-1**
**Landowner Rights and Responsibilities: A Range of Elements**

One aspect of the discussion about stewardship and the relation to private property concerns the rights and responsibilities of the owners of private property. The following elements are commonly accepted "rights and responsibilities" of property owners:

Rights:

- To control access to the property and exclude or accept public use.
- To make economic use of the property, including harvesting of trees and other natural resources.
- To choose the primary management goals or objectives, including the right to not use resources.
- To use, sell, transfer, or otherwise dispose of the property freely.
- To seek quiet use and enjoyment of property, free from unreasonable interference by others.

Responsibilities:

- To pay applicable taxes on the land and income generated from the use of resources.
- To comply with applicable laws concerning the use and management of resources.
- To comply with applicable environmental laws to protect resources such as soil and water.
- To consider the impact on neighboring landowners, communities, and the public when making significant land-management decisions.

through outdoor recreation and appreciation of wildlife, and scenic beauty, supports important cultural values that help define life in our nation. As America has developed, recognition of the multi-faceted value of natural resources—from economic, cultural, and psychological perspectives—has contributed to efforts to manage and use the resources in ways that protect them. That recognition can be considered the foundation of sustainability, and the goal of sustainable development has been integrated into many aspects of resource policy.

An important dimension of national efforts to promote sustainable use of natural resources is the need to reconcile the personal desires and objectives of private landowners with the interests of the public. Landowners, who own much of the property that constitutes America's natural-resource base, have various objectives for their property. The public also has objective relating to how natural resources are managed, most notably the objective of protecting the public from adverse affects. The expression of the public's objectives is most commonly seen in environmental laws and other property-related regulations that might restrict how land and resources are used. The potential tension between

landowners who use the natural resources that they own and the public who want to preserve other resources on that property is inherent in our society. From a legal standpoint, the relation between the actions of private landowners and those of the public in regulating how that property may be used is controlled by the Fifth Amendment of the U.S. Constitution. In more general terms, this relation is the subject of current discussion about property rights in the United States.

Another approach to rights and responsibilities is found in the native societies of North America, which had two institutional concepts underlying their land tenure systems: usufruct tenure (legal right to enjoy the fruits or profits of land belonging to another) and required sharing of land rent among the community.

Those emphasizing the responsibilities of landowners would appear to side more with the Native American view, although two distinctions need to be made. First, the principle that the Fifth Amendment does not allow landowners to harm the interests of the public still rests on the public's desires as a basis for limiting the rights of landowners to do as they wish with their property. The responsibility of a landowner to pay taxes represents some recognition of legitimate community interests in the land, but taxation does not limit on the definition of private property rights.

The second distinction is the presence of modern government. The definition of responsibilities in America often involves the actions of government. The Native American idea of community ownership of land involved local units, such as clans, *numaym*, villages, or bands. Confederacies, such as that of the Iroquois, might have been closer to the concept of modern government; however, they had rules that limited the power of the confederacy to interfere with local units.

Examination of Native-land institutions, therefore, raises the issue of the proper definition of "community" for the purpose of defining "responsibilities." During the series of public forums held by the committee for this report, many participants argued that current government policies to protect the environment are illegal and go too far in regulating forest harvesting practices or restricting landowner actions. Other participants argued that the government should be doing more to promote sustainable management of forest resources. Most agreed, however, that forest landowners recognize the need to manage their properties responsibly. Part of the challenge for public officials is to identify how best to work with forest landowners to help promote sustainable practices that reflect a commitment to long-term stewardship. A commonly accepted definition of stewardship and sustainable forestry must also be developed. Part of that task will involve identifying opportunities for forest landowners to manage their property in ways that are economically profitable and protect public interests.

The danger in discussion about sustainable management of private forests is that it can become embroiled in a debates over rights and responsibilities associated with private property, which obscures progress on efforts involving interested landowners. A recently developed program designed to promote sustainable forestry involves a number of forest-landowner associations. That program

shows the strong interest of private landowners in the topic and demonstrates an example of landowners taking part in the opportunity to work with interested groups (Box 10-2).

### Native American Perspectives on Property and Sovereignty

Native American communities have world views that differ from the world view that governed the exploration and development of North America. Consistently, many native peoples objected to policies that did not show respect for the land. As environmental problems have become more important in recent years and as the widespread consequences of extreme environmental policies, such as the exclusion of fire, have become evident, American society has shown some interest in the concepts and principles of "property" as employed by native peoples.

**Box 10-2**
**Private Property Responsibility Initiative of the National Woodland Owners Association**

In 1994 the National Woodland Owners Association linked private property rights directly with responsible land stewardship through the "Private Property Responsibility Initiative." The heart of the campaign is a 12-point "Woodland Responsibility Code" as follows:

As Woodland Owners We Agree to:

- Follow Best Management Practices when harvesting trees.
- Show, by action, a practical concern for other resources, including water, wildlife, soil, and natural beauty.
- Share our knowledge of good forestry with others and exercise our property rights in a responsible manner.
- Use only "certified loggers" when available.
- When practical, and at our discretion, we will consider opening our land to hunting and other uses by the public, either at a fee or at no cost.
- Manage our woodlands to promote economic and biological benefits.

In Return, We (Woodland Owners) Expect:

- Respect for private property rights.
- Fair timber taxes, at the federal, state, and local levels.
- Self-policing among mill owners so as not to provide a market for stolen or improperly harvested wood.
- Loggers and foresters to perform to the highest standards.
- Multiple sources of professional forestry advice and educational opportunities.
- A fair chance to compete.

Source: National Woodland Owners Association 1995

Much of the interest in the world view of native peoples has focused upon issues of land ethics (Callicott 1989) and spirituality (Hughes 1983). Of equal importance, but largely ignored, are issues of land tenure and systems of property rights. One consistent policy among tribal leadership has been resistance to the concept of private property in land. Tribal leadership opposed two aspects of private-property principles. First, they did not want to allow members of their tribe to sell land without permission from the tribal government—whether it was a chief or a council of leaders. Second, even if a tribe was successful in opposing the sale by individuals of the land they claimed, many tribal spokesmen still insisted that their internal property rights not be private-property rights. Because of the diversity of native cultures in North America, most generalizations about indigenous property systems have to be made with care. The largest generalization is that most native cultures used a version of usufruct tenure: rights to the use of parcels of land depended upon use of the land. Categories used to describe land, however, were extensive. In New England, historian William Cronon described the situation as follows: "Property rights . . . . shifted with ecological use. . . . Hunting grounds are the most interesting case of this shifting, nonagricultural land tenure. The ecological habits of different animals were so various that their hunting required a wide range of techniques, and rights to land use had to differ accordingly (Cronon 1983)." What the Native Americans owned—or, more precisely, what their villages gave them claim to—was not the land but the things that were on the land during the various seasons of the year (Cronon 1983). However, Native Americans recognized that individual members of the tribe could have extensive control over particular parcels of land. The right of control, however, was contingent upon use of the land.

*The Native American Reality: A Land Ethic.* Native American cultures share an attitude of respect toward the world around us (Brown 1989; Callicott 1989; Nelson 1983, 1993). To summarize distinct world-view assumptions, Trosper (1995) offered the following four components to characterize the Native American definition of respect: community, connectedness, seventh generation, and humility.

*Community*: Men and women are members of a community that includes all beings. Each has its proper role and each has obligations to others. All beings have spirit. Human-to-human relationships are similar to human-to-animal and human-to-plant relationships. Human obligations in actions toward nature should mirror human actions toward one another (Fiske 1991).

*Connectedness:* One should expect that an action that affects one part of the environment will have impacts on other parts. Further, the connections are many and complicated. As a consequence of the assumption of connectedness, native peoples rarely classify other species as "good" or "bad." They assume that every being has a reason to exist, even if humans do not understand the reason.

*Seventh Generation*: Among humanity, past generations left a legacy, and humans have a duty not only to their children but to seven generations. This assumption of duty to the seventh generation leads to a belief that the land should be sustained.

*Humility:* In taking action, humans should be humble. The natural world is powerful and complicated. Connections are not obvious, but they are important when considered over the time scale of seven generations. Some tribes object to the concept of "management" and prefer the term "care-giving" to describe their philosophy of interaction with the land.

On reservations, tribes generally have rights of self-government that exclude land regulation by states. (The legal doctrines are complicated, however; see Getches et al. 1993.) Not only do tribes control timber harvest, they control other land uses as well. Federal statutes, however, usually apply either to Native American lands (if Congress was explicit) or to the Bureau of Indian Affairs (BIA) as a federal agency. Tribes must comply with the Endangered Species Act, the National Historic Preservation Act, and many others. Tribes are able to qualify for enforcement of matters under the jurisdiction of the U.S. Environmental Protection Agency. Application of some statutes, such as the National Environmental Policy Act and the Endangered Species Act, are controversial. These acts require action by the BIA, but if it is recognized that tribal land is private land, then application of these acts should be limited to tribes.

In the Pacific Northwest, tribes reserved the right to fish in common with others at accustomed fishing areas. Those rights have been upheld in recent court decisions (Cohen 1986). Treaties in the Great Lakes area, Wisconsin in particular, protect tribal hunting and gathering rights.

Alaska is governed by two major federal laws, the Alaska Native Claims Settlement Act (1971) and its amendments (43 U.S.C.A. § 1601-1628) and the Alaska National Interest Lands Conservation Act (16 U.S.C.A. § 3101-3133), which became law in 1980. Along with state law, these federal statutes define subsistence hunting and fishing rights. The federal law protects Alaskan native rights on federal lands, whether or not the state laws protect native rights (Getches et al. 1993).

Native Americans do not regard their lands as belonging to the federal government. However, federal policy has not adequately distinguished between tribal and federal lands. A representative of the Quinault tribe summarized the resulting conflict as follows:

> "Indian forests are often managed with the objective of preserving natural and cultural values so harvest activity has not been as intensive as on nearby federal, state, and private lands. This situation has resulted in a growing tendency to rely upon Indian lands as wildlife sanctuaries or habitat or to restrict the exer-

> cise of federally-protected rights. Under the ESA [Endangered Species Act], efforts have been made to shift the conservation responsibility onto Indian tribes to compensate for problems caused by non-Indian development and management practices. . . ." (Gary Morishima 1996)

Standards have been prescribed by tribal governments to guide the application of conservation measures whenever Native American rights or resources are involved. More fundamentally, however, the species-by-species approach to prevent extinction embodied in the ESA is at odds with the Quinault's broader perspective of consideration of the consequences upon the whole environment and future generations. Other tribes have expressed similar concerns.

For many decades, Native Americans applied higher environmental standards to their land than the federal government applied; for example, "sustained yield" for Native American land is defined only in terms of wood-fiber production. After preserving diverse habitats on their land with their own policies, tribes wish to maintain control of their land.

## BALANCING RIGHTS AND RESPONSIBILITIES

The debate over property rights is not as simple as favoring private-property rights or favoring more government regulation. All citizens enjoy the freedom and economic potential of private property and the benefits of government programs. The issue is how to balance the property rights of individuals and protect the health, safety, and welfare of the public.

Use of private property is a fundamental component of American life and a major factor in our economic and political freedom. At the same time, the quality of life and success of the economy is greatly shaped by government action, whether environmental protection, land-use planning, or protection of public safety. The balance between private-property rights and state imposition of responsibilities on use of private property is one of the most fundamental issues in society. It has a constitutional dimension because of the Fifth Amendment prohibition against taking private property for public use without compensation. The debate over more protection of individual property rights or more protection for societal interests and creation of more private responsibilities has ethical and political dimensions in society.

The forest-resource community has a fundamental stake in the debate. Discussion of sustainable forest-resource management, individual stewardship, or environmental protection illustrates the range of issues involved in public regulation of forests. Whether it is protecting wildlife habitat or wetlands, controlling soil erosion, reducing potential fire danger, promoting sustainable management and harvesting practices, or preventing water pollution, important public goals for the nation's forest resources often cannot be achieved without affecting the actions of private forest owners and placing responsibilities on how they manage and use their property.

The effects of government actions can be as indirect as those that result from educational programs for landowners or can be as direct as enforcement of environmental or forest-practice laws. Most commonly, restrictions occur in the form of regulatory standards that establish responsibilities, such as requiring permits before certain actions or prohibiting some types of conduct (Ellefson et al. 1995). The effect of such regulations might increase costs or reduce the value of the property or income due to limitations on its use. Although some landowners might find such effects objectionable, courts have historically upheld the ability of the public to impose reasonable responsibilities for use on the owners of private. It is uncommon for regulations to result in loss of private land or removal of any form of economic use. When that has occurred, courts have recognized such results as violations of the Fifth Amendment. Consequently, judicial rulings on taking property in such cases greatly shape future environmental laws by defining the range of regulatory actions possible that do not require compensation.

Courts have traditionally been the sole source of authority for interpreting the Fifth Amendment, but in recent years, state legislatures and the U.S. Congress have entertained proposals to modify interpretation of the Constitution and alter the balance between the public and individual property owners. This trend has occurred as a result of increasing concern about the ability of government to regulate use of private property. The most common suggestion for legislative action is to limit the percentage by which a regulation can reduce the value of property before compensation is mandated. Although some states have adopted such legislation, others have not, leaving the current legislative debate over property rights inconclusive (Box 10-3).

Laws restricting use of private property or imposing responsibilities for its use might not be accepted favorably by landowners who believe their property is being taken. However, taking property from landowners should not imply that the laws in question are unconstitutional. Property rights have always been subject to the power of courts to limit uses to protect the interests of other landowners, which is the basis of nuisance law. More directly, property rights have always been subject to the power of government to enact reasonable restrictions designed to protect the public health, safety, and welfare, known as "police power." This is the basis for laws to protect water supplies from pollution and natural resources, such as soil, waste, and exploitation. In many ways, establishment of these responsibilities for private resource management has been the way society has defined stewardship.

Environmental restrictions on use of forestland, such as setback requirements for harvesting near waterways to prevent water pollution, limitations on clear cutting, requirements to obtain harvest permits, or acts to comply with forest-management practice are examples of laws that are controversial to some landowners. Enforcing requirements for management practices or regulations for property use do not necessarily result in taking property. The courts are inclined

**Box 10-3**
**State Property-Rights Laws**

| State | Law and Year Enacted/Amended | Type of Law[a] |
|---|---|---|
| Arizona | Ombudsmen for Private Property Rights. Ariz. Rev. Stat. Ann. Secs. 9, 11, 41 (1995) | Assessment |
| Delaware | Del. Code Ann. Title 29 (1992) | Assessment |
| Florida | Florida Stat. Secs. 70 and 163 (1995) | N/A |
| Idaho | Idaho Code Sec. 67 (1994, 1995) | Assessment |
| Indiana | Ind. Code Sec. 4 (1993) | Assessment |
| Kansas | Property Rights Protection Act. Stat. Sec. 77 (1995) | Assessment |
| Louisiana | Right to Farm and Forest. La. Rev. Stat. Sec. 3 (1995) | Assessment/ Compensation (20 percent) |
| Mississippi | Miss. Code. Ann. Sec. 49 (1994, 1995) | Compensation (40 percent) |
| Missouri | Mo. R. S. Sec. 536 (1994) | Assessment |
| Montana | Mont. Code Ann. Secs. 2 and 75 (1995) | Assessment |
| North Dakota | N. D. Cent. Code Chap 28 (1995) | Assessment/ Compensation (50 percent) |
| Tennessee | Tenn. Code. Ann. Sec. 12 (1994) | Assessment |
| Texas | Private Real Property Rights Preservation Act. Tex. Gov. Code Sec 2007 | Assessment/ Compensation (25 percent) |
| Utah | Private Property Rights Protection Act Utah Code Ann. Secs. 78 and 63 (1993, 1994) | Assessment |
| Virginia | Va Code Ann. Sec. 9 (1995) | Assessment |
| Washington | Wash. Rev. Code Sec. 36 (1991) | Assessment |
| West Virginia | W. Va. Code 22 (1994) | Assessment |
| Wyoming | Wyoming Regulatory Taking Act Wyo. Code Sec 9 (1995) | Assessment |

[a]Assessment law requires state or local agencies to assess taking of private property rights before government action can be initiated. Compensation law requires state or local agencies to compensate property owners once property is reduced by a certain percentage or when use of the property is inordinately burdened.

Source: Zhang 1996

to enforce the law if the property remains in private ownership, an economically viable use for the property is allowed, and a legitimate public-health interest is being promoted (Stedfast 1997).

Some restrictions do result in loss of property which might occur when the government chooses to regulate land use. Regulatory action might be taken especially in times of declining public budgets. Laws that work by making extensive restrictions on use of land, for example, habitat protections under the Endangered Species Act, might be more likely to result in property being taken than more traditional environmental protections that have a historic basis in public nuisance law. Even with the Endangered Species Act, courts have held that limiting the use of private land to provide habitat is not necessarily a taking of private property. However, a recent Supreme Court decision enables landowners to take legal action against the government if loss of property values is caused by regulation under the Endangered Species Act.

The purpose of the "taking" clause of the Fifth Amendment is to prevent confiscation of private land for public use. Courts have held that governments can go too far in obtaining public benefits by restricting use of private property without compensation. However, defining the limits on the reach of "police power" and defining how far public regulations can go in restricting use of private property before taking property have been difficult questions for our courts. The U.S. Supreme Court has noted its own inability to develop a set formula for determining when economic injuries from public actions must be compensated.

When property is physically occupied by the public, the owner clearly must be compensated, as is generally the case when all economically viable use of the property has been restricted to render it valueless (Stedfast 1997). That is the case unless the use of the property was considered a nuisance historically or a threat to the public. The issue is more complicated in situations where land is not physically taken but the use is restricted or the value is reduced, as is possible with many environmental or land-use laws. Could a law prohibiting clear cutting or a zoning law preventing converting forestland to houses be the same as taking property? Each case is likely to depend on the facts and the nature of the restrictions. Courts consider many factors when deciding a property claim, including the following: the nature of the restrictions and whether they promote a legitimate state interest; the impact on the property value and the owner's reasonable expectations to use the property; and the nature of the public benefit that is being protected or the harm that is being prevented by imposing responsibilities on the private landowner. As a general rule, courts will find restrictions valid if they are reasonably related to promoting a public interest and the landowner is left with some economically viable use of the property. Courts find for property claims only in extreme situations.

Limits on the "police power" are hard to define for other reasons. First, the nature of private property, or what society will respect as distinctly private, is

influenced by legislative action and can change over time. Second, activities seen as having an adverse impact on public health also change over time. The environmental movement and related regulations developed in the last 20 years demonstrate the changes over time. As society develops, recognition of what is private property and what activities are potentially injurious to the public might change. Efforts to promote sustainable management of forest resources are clearly part of this societal trend.

Changing views about private and public responsibilities do not portend that the government can decide that what is now considered private property may be taken in the future through regulation without compensation. Government regulations and changes in society's attitudes expressed in laws are evaluated by courts applying the Fifth Amendment (see Cubbage et al. 1993, Cubbage and Siegel 1995, Flick et al. 1995, Sanderson and Mesmer 1993, Sax 1983, Strong et al. 1996). The nature of public discourse over issues has a direct effect on how courts respond. With the emergence of property-rights movement (comprising groups and individuals who argue for stricter interpretation of the clause allowing the taking of property), the nature of public debate over environmental regulation has changed in the United States. Laws such as the Endangered Species Act and wetland protections have been a focus of these interested groups, but their actions have affected enforcement of laws relating to the use of private lands.

Today, any discussion about governmental approaches to implementing a resource-related goal, whether soil conservation, water-quality protection, or sustainable forest management, invokes a discussion about the implications of the proposed approaches on property rights. That is a positive development in one regard, because it requires regulatory officials to be sensitive to the impact of their choices on private landowners. For example, property-rights discussions have led to the following suggestions for designing regulatory programs on private forest management practices (Cheng and Ellefson 1993b):

- Advance well-defined and legitimate state interests in private forest property.
- Complement well-defined and long histories of public policy favoring environmental protection and land-use control.
- Promote the distribution of program benefits among many, widely dispersed segments of society.
- Avoid the promotion of severe reductions in the value of private forest property.
- Avoid denial of all economically viable uses of private forest property, if denial would result from standards requiring permanent physical occupation of private property.
- Apply rationally based and reasonably constructed forest-practice standards.
- Firmly link regulatory standards (required forest practices) to state interests in private forest property.

- Avoid burdensome and overly complicated procedures that deny use and management of private-forest property.
- Avoid arbitrary and capricious application of forest-practice standards.

Discussion of property rights in a forestry context has been valuable because it provides the opportunity for officials and policymakers to consider alternative methods that might be available to achieve the same goals. Conversely, increased attention to property rights concerns can also have negative consequences if it results in the refusal of public officials to act. When that happens the controversy over property rights might result in the delay of important societal objectives because of potential litigation or adverse legislative action.

New forestry laws illustrate the important impacts of the second stage of policy development. First, the forestry sector has been given the evidence of adverse environmental impacts and is defining mechanisms to correct the adverse impacts with ownership commitment to stewardship. Second, the forest industry is recognizing its impact on the environment. It is increasingly clear that society will not accept environmental problems as the cost of having reasonably priced lumber and paper. Third, laws and legal institutions are being used to deal with the impact on the environment and to implement a "new relation" between forest owners and the environment. As a result of the shift in society's attitude toward use of forestlands, government programs are being reexamined.

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

Achieving the levels of forest stewardship that will ensure the sustainability of privately owned nonfederal forests implies a sensitivity to the public interest in private property as well as to the private owners interest in exercising certain rights in property. Private landowners most certainly have a responsibility to be good stewards of the land, while society has a responsibility to encourage them to fully exercise these responsibilities. In both situations, the nexus of the issue often involves agreement on acceptable standards of forest stewardship. The special perspective of Native American toward property can be instructive in this respect. The rights-responsibility dilemma can become especially acute when government implements regulatory programs. The latter should be designed to both foster stewardship among private owners while at the same time respecting deep-seated desires to exercise rights inherent in private ownership of forest property.

**RECOMMENDATION:**

*Acknowledge public and private rights and responsibilities associated with nonfederal private forests and the multitude of ways that these rights and responsibilities are exercised by various landowners.*

This acknowledgment points to the following specific recommendations:

- *Federal program goals and objectives should build on the variety of interests and objectives of nonfederal forest landowners.*
- *Federal regulatory programs should be designed to reflect public and private rights, responsibilities, and interests in sustained management of nonfederal forests, especially private forests.*

# 11

# Investing in Global and International Settings

## INTRODUCTION

Nonfederal forests of the United States are part of larger biological, economic, and political systems throughout the world. Because they account for two-thirds of the nation's forested area, nonfederal forests will be called upon to play a larger role than other ownership categories in meeting the nation's expected contributions to healthy global economies and environments. Hence, U.S. public and private investments in nation's nonfederal forests will be important contributors to the sustainability of these larger systems. The U.S. government has a responsibility to exercise its leadership, counsel, and, as appropriate, resources to sustain positive contributions from nonfederal forests to the world.

## GLOBAL CONSIDERATIONS

Over the past two decades, the public has increasingly focused its attention on a variety of global issues, including climate change, ozone conditions, and biological diversity. Nearly all of the global issues involve forests. Furthermore, domestic policy debates over the use and management of forests in the national arena are greatly influenced by debates in the global arena, and domestic and global issues involving forests have often merged. The June 1992 United Nation's Conference on Environment and Development (Rio De Janeiro, Brazil), which was a major event in the emergence of international debate on forestry issues, was notable in this respect. These debates and how the issues are addressed have implications for nonfederal forests.

Forests of the United States account for 7 percent of the world's forested area. Moreover, the United States has about 13 percent of the world's temperate forests, and nearly half of the world's coastal temperate rain forest (World Resources Institute 1996). More than half of U.S. forests are privately owned, an amount that accounts for about 40 percent of the world's private forests. In comparison to the rest of the world, the United States has a higher proportion of its forests in a managed condition (one-half versus one-third worldwide). "Managed" implies some degree of control over forests. The majority of those forests are under nonfederal ownership (Brooks 1993). Another important factor globally is the 13 million hectares (10 percent of world plantations) of U.S. forests in plantations, the majority of which are in nonfederal-ownership categories.

Nonfederal forests are important in providing environmental services worldwide. Certainly, they are reservoirs of plant and animal genetic material that is of worldwide importance. Examples are the extensive temperate rainforests of the West Coast, rare plant communities in oak savannas of the Midwest, high concentrations of mixed broadleaf species in Southern Appalachia, and rare hardwood-forest ecosystems in the bottomlands of the Southeast. In addition, nonfederal forests provide critical habitat for birds migrating across international boarders; they absorb and buffer pollution discharges originating in various regions of the world; they serve as storage places (or possibly sources of) for carbon, which might otherwise affect global climate adversely; and they contribute to the favorable regulation of climatic changes (United Nations 1992a). Nonfederal forests support international tourism and recreation. Because half of the world's tourism involves nature, even a small portion attributed to nonfederal forests is still significant.

Nonfederal forests are important sources of timber products for export. U.S. forest exports reached $17.1 billion in 1992, and the U.S. was the world's second largest exporter of forest products (second only to Canada). The export level has increased by nearly 8 percent annually since 1950 (adjusted for inflation); the increase is largely due to devaluation of the U.S. dollar in 1985, export promotion efforts by government and industry, and elimination or curtailment of trade barriers. The trade deficit in forest products in the United States is modest. In terms of net trade in roundwood equivalents in 1989, the United States imported 55 million cubic meters more than it exported (Brooks 1993).

Management experience of nonfederal forests in the United States is useful to other countries as they make decisions about the use and management of their forests. Because of the diversity of the nation's nonfederal forests (spread over half a continent) and the many products and services they provide, combined with the important role of private ownership and the governments' use of a variety of policies, nonfederal-forest management in the United States is a source of knowledge and experience for other nations.

Many global forestry issues are relevant to nonfederal forests. Actions taken on nonfederal forests affect forests outside the United States, and actions taken

elsewhere in the world affect nonfederal forests in the United States. The implications of these actions are biological (for example, ensuring global biological diversity) and social (for example, international trade) in nature (U.S. Congress 1991, Schmidheiny 1992, Brooks 1993, World Resources Institute 1996).

## INTERNATIONAL ACCORDS

### Environmental Agreements

The United States has recognized a number of international agreements that have implications for the use and management of nonfederal forests. Especially notable in that respect are the global consensus on forest principles adopted at the United Nation's Conference on Environment and Development and, subsequently, the criteria for conservation and sustainable management of temperate and boreal forests. The objective of the principles is to contribute to the sustainable development of forests generally and to provide for their multiple uses and functions (see Box 11-1). The consensus agreement is that the ". . . principles should apply to all types of forests . . . . in all geographic regions and climatic zones," and that ". . . . each state in accord with its constitution and or national legislation should pursue the principles at the appropriate level of government" (United Nations 1992b).

To implement the forest principles, countries containing a substantial portion of the world's temperate and boreal forests developed criteria for, and indicators of, successful conservation and sustainable management of these forests. The United States is part of the agreement. The majority of U.S. forests are temperate or boreal forests and, therefore, are subject to the criteria and indicators, which address the following: conservation of biological diversity; maintenance of productive capacity of forest ecosystems; maintenance of forest ecosystem health and vitality; conservation and maintenance of soil and water resources; maintenance of forest contribution to global carbon cycles; maintenance and enhancement of long-term multiple socioeconomic benefits to meet societal needs; and the legal, institutional, and economic framework for forest conservation and sustainable management (United Nations 1995).

### Trade Agreements

The General Agreement on Tariffs and Trade (GATT) is a multilateral agreement designed to promote international commerce through the elimination of barriers to trade. GATT supersedes all other trade-related agreements, including the International Tropical Timber Agreement (ITTA) and the North American Free Trade Agreement (NAFTA). Completion of the Uruguay round of GATT negotiations has created the largest, most comprehensive set of trade agreements in history. In many respects, those agreements have implications, although often

**Box 11-1**
**Selected Principles for the Management, Conservation and Sustainable Development of the World's Forests**

- Forest resources should be sustainably managed to meet the social, economic, ecological, cultural, and spiritual needs of present and future generations.
- Timely, reliable and accurate information on forests and forest ecosystems is essential for public understanding and informed decision-making.
- Forest management should be integrated with management of adjacent areas so as to maintain ecological balance and sustainable productivity.
- Forest policies should recognize and duly support the identity, culture and rights of indigenous people and their communities.
- Decisions [about] forest resources should benefit, to the extent practical, from a comprehensive assessment of economic and noneconomic forest values and the environmental costs and benefits.
- Scientific research, forest inventories and assessment carried out by national institutions . . . should be strengthened.
- Planted forests as . . . sources of renewable energy and industrial raw material should be recognized, enhanced and promoted.
- Appropriate measures should be undertaken to protect against harmful effects of pollution, including airborne pollution, fires, pests and diseases.
- Natural forests constitute a source of goods and services, and their conservation, sustainable management and use should be promoted.

Source: Agenda 21: Programme of Action for Sustainable Development. Rio Declaration on Environment and Development. Statement of Forest Principles. United Nations Conference on Environment and Development, New York, NY.

only indirectly, for nonfederal forests (U.S. Department of Agriculture's [USDA] Forest Service 1994).

From a timber-production perspective, GATT is expected to increase, for example, U.S. paper and paperboard net exports by $3.5 billion (the equivalent of 9,300 jobs) over a 10-year phase-in period. A large portion of the expansion is expected to come from nonfederal forests. Concern has arisen that if owners of U.S. nonfederal forests sustain their forests and charge prices reflecting their costs, they might be at a disadvantage in international markets. In addition, subsidies used to compensate landowners for meeting higher management and environmental standards might be challenged as a violation of free trade. Trade agreements generally discourage subsidies and in some cases provide for countervailing duties for their continued use (USDA Forest Service 1994). The Uruguay negotiations of GATT also call for tightening of regulations in which export of unprocessed logs can be banned only in conjunction with restricting exports of processed forestry products.

GATT also has implications for the environmental goals for nonfederal forests. These implications are indirect however, because other countries are not

prohibited from distinguishing between unsustainable and sustainable forests, including nonfederal forests. Those countries choosing to do so could impose tariffs, quotas, or bans on timber harvested from nonfederal forests that are considered unsustainable. The lack of those options could interfere with the achievement of the International Tropical Timber Organization's Target 2000 program, which plans to have international tropical-timber trade based entirely on sustainable-forest management by 2000.

## INTERNATIONAL ISSUES AFFECTING NONFEDERAL FORESTS

### Timber Export

World demand for wood and wood products is expected to increase substantially over the next 40 years. U.S. exports of nearly all major forest-product groups are expected to increase through 2040. Lumber is expected to increase by 21 percent; structural and nonstructural panel products, by 36 percent; paper and board exports, by 164 percent; and wood pulp, by 97 percent. However, in size, U.S. increases in exports are a very modest portion of the nation's total production in any one forest-product category. For example, in 2040, exports of lumber are expected to be only 7 percent of U.S. lumber production; panel products, only 4 percent; and paper and board, only 12 percent (Haynes 1995). Previous analyses have suggested that "the United States has many unique opportunities to increase its exports, particularly in paper products [and] . . . has both the manufacturing capacity and forest resources needed to expand wood production." Furthermore, ". . . world markets offer the United States an opportunity to sustain a positive balance of trade in forest products" (U.S. Congress 1983). Even though well-positioned to meet a respectable portion of rising world demand for wood and wood products, the United States is hampered by a number of factors. The most severe and least controllable factors are worldwide recessions and the strength of the dollar relative to foreign currencies. Factors that can be more positively influenced are industry behavior, trade barriers (for example, tariffs, quotas, and nontariff impediments), and government domestic policies adopted by choice (for example, prohibition of unprocessed log exports). If the United States is to consider exploiting its comparative advantages in world markets, it must address those factors. Furthermore, efforts to expand the export of forest products will require the engagement of several categories of forest landowners. Given current trends in national-forest polices, expansion efforts will be undertaken essentially by nonfederal-forest owners.

### Global Climate Change

The updated assessment of the Intergovernmental Panel on Climate Change (IPCC 1995) found evidence sufficient to conclude that human activities are

affecting the current global climate and will continue to do so for many decades. The conclusions of the report were endorsed by the U.S. government in July 1996 at the Second Conference of Parties to the Framework Convention on Climate Change in Geneva. These climatic effects, resulting primarily from increased atmospheric carbon dioxide, are expected to generally alter forest composition, location, and productivity and the available supply of timber. Although the extent and nature of these alterations have not been assessed specifically for nonfederal forests, inferences can be made from more general assessments (Joyce 1995, Haynes et al. 1995). For timber supply, expected temperature and precipitation increases will generally increase forest growth (over a 75-year period) by 5 percent to 24 percent. Softwood inventories are expected to increase, thus lowering softwood timber prices if demand remains the same. For trade, lower softwood lumber prices will reduce the advantage of Canadian producers; domestic U.S. harvest (much of which occurs on nonfederal forestland) will replace Canadian harvest of softwood (Haynes et al. 1995). Regional shifts in softwood and hardwood timber production will also occur and have implications for prices received (and investments made in forests) by nonfederal-forest landowners.

Climate change also has implications for carbon sequestration. Warmer temperatures could enhance net accumulation of carbon in cooler climates and increase respiratory losses disproportionately in already warm climates. Potential changes in water availability resulting from changing temperature patterns could easily alter the carbon balances of many ecosystems to a greater degree than temperature changes themselves. Trees are generally long-lived organisms; therefore, the potential effects of changing climate, and related implications for carbon sequestration, should be considered as policies and programs are directed toward the use, management and protection of forests, including nonfederal forests.

## Environmental Concerns

The global impact of environmental polices and programs for nonfederal forests has been suggested as a basis for more careful crafting of U.S. forest policies. U.S. forest policies that limit adverse environmental consequences domestically should also consider the consequences on forests in other countries (Bowyer 1992). Concern has been focused specifically on the global consequences of reductions in federal timber harvesting and of regulations on the forestry practices of private owners of nonindustrial forests (Bowyer 1992, Schallau and Goetzl 1992). Issues of this nature might or might not be cause for concern. Full assessments have to be made on the linkage between U.S. forest policies and international environmental impacts; whether international environmental impacts of timber harvesting are significant; whether the international impacts are greater than the domestic environmental impacts; whether other countries are capable of making environmentally acceptable choices in the management and use of their forest resources (Brooks 1993).

## Forests as Emission Absorbers

Managing worldwide emissions that contribute to global climate problems can have implications for U.S. forests, including nonfederal forests. One approach to emission management is "emission trading," whereby one country agrees to limit emissions below their specified portion of worldwide levels and allow other countries to increase their emission outputs. However, instead of limiting emission levels, countries may choose to provide additional absorption capacity by enlarging their forest areas, which could be nonfederal forests in the United States (Moltke 1990). That approach is acknowledged to be potentially difficult to implement, especially with regard to distribution of emissions among countries. The European community suggests that it is possible to implement and that forests should be used as an element in the emission-absorption equation (Marland 1988, Moltke 1990). If the approach were considered worldwide, including the U.S., nonfederal-forest owners could be expected to play a part in absorption-emission plans, even to the point of being active in programs designed to expand their area for such purposes.

## Migratory Wildlife Habitat

Migratory wildlife do not recognize international boundaries and domestic political boundaries (Flather et al. 1994). Nonfederal forests are important in providing the necessary habitat for the survival of wildlife. Large intact forests serve as migration corridors for the north-south movement, particularly across the United States, Canada, and Mexico borders, of neotropical migrants and large carnivorous mammals and their prey. For example, 250 of the 750 bird species found in the United States and Canada spend their summers in North American forests and winters in Central American forests. Large intact temperate coniferous forests of the United States and Canadian Rockies provide important connections for woodland caribou and large carnivores from source areas in Canada to population sink areas in the United States. Intact forests in the northeastern and southeastern United States provide important nesting habitat for neotropical migrants that winter in Mexico and Central America. Coastal Pacific forests located within the Pacific flyway are important for bird migrations and for maintaining connections between grizzly-bear populations in British Columbia and those in the Northern Cascades of Washington. Similar examples exist in the mid-Atlantic states flyway used by neotropical migratory songbirds and waterfowl. The role of nonfederal forests in providing key habitat linkages is important. Whether existing policies and programs are appropriate, well focused, and adequately financed is open to conjecture. The type of incentives that might be used to encourage owners of nonfederal forests to undertake actions to further the habitat of the internationally migrating species of wildlife are of special concern (Schmidheiny 1992).

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

Policies and programs that are consistent with and further U.S.- adopted international treaties and agreements concerning the use and management of forests are important to the U.S. position in international activities. To the extent that they are germane, these policies and programs should focus on nonfederal forests. In addition, engaging in international treaties and agreements that enable owners and managers of nonfederal forests to manage sustainable forests for international markets (for example, timber) will alleviate fear of being at a competitive disadvantage because of lower-priced products produced in other countries with unsustainable-forest practices. Public and private policies and programs involving the export of timber and processed wood products should be evaluated, and polices should be encouraged that will enable the United States to build on its comparative advantages and be a strong competitor in world markets for forest products.

Forests are an important factor in relation to global climate change; they act as storehouses of carbon, which could have an important impact on future management issues. Scientific understanding of the role of forests, and nonfederal forests in particular, in mitigating the effects of regional and global pollutants is critical for overall assessment of ecosystems throughout the world. Monitoring the effects of global climate change on the composition, location, and productivity of nonfederal forests also should be continued.

Finally, migratory wildlife rely on forests for habitat and migration corridors. The U.S. government should participate in international agreements that protect the habits of internationally migrating wildlife and provide owners and managers of nonfederal forests with the incentives necessary for sustainably managing their forests in ways that advance such habitats.

**RECOMMENDATION**:

*Exercise federal leadership, counsel and, as appropriate, resources to sustain positive contributions from U.S. nonfederal forests to the world.*

This recommendation points to the following specific recommendations:

- *Federal policies and programs for nonfederal forests should be consistent with international environmental and trade agreements to which the United States is a party.*
- *The United States should advance scientific understanding of the role of forests, and nonfederal forests in particular, in mitigating global pollutants and climate change. The effects of global climate change on nonfederal forests should continue to be monitored.*

# APPENDIXES

APPENDIX

# A

# Table of Contents

TABLE A-1 Forestland cover in the United States, by ownership, 1982, 1987, and 1992 (thousand acres)

| | | | Nonfederal Public | | | Private | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | All Owners | Nonfederal Owners | Total Nonfederal Public[1] | State | County and Municipal | Total Private | Forest Industry | Other Private | Indian |
| 1982 | 731,304 | 492,212 | n/a | n/a | n/a | n/a | n/a | n/a | 13,302 |
| 1987 | 734,559 | 484,763 | 66,886 | n/a | n/a | 417,877 | 71,368 | 330,598 | 15,911 |
| 1992 | 736,684 | 487,553 | 63,798 | 53,315 | 10,483 | 423,755 | 71,209 | 336,647 | 15,899 |

[1]1987 data is a rough estimate.

[2]Managed in trust by the Bureau of Indian Affairs.

[3]USDA Forest Service reports currently overstate the nation's nonfederal forest land in 1987 by slightly more than 39 million acres (personal communication, J. Faulkner 1996).

Note: n/a means not available.

Source: USDA Forest Service (unpublished data; personal communication, J. Faulkner 1996), USDI - Bureau of Indian Affairs (undated and 1983), and Intertribal Timber Council 1993.

TABLE A-2 Nonfederal forestland area in the United States by region, 1987 and 1992 (thousand acres)

| Region | 1987 | 1992 |
|---|---|---|
| North Central | 70,525 | 73,158 |
| Northeast | 81,739 | 82,262 |
| Pacific Northwest | 76,337 | 76,022 |
| Pacific Southwest | 19,907 | 19,729 |
| Rocky Mountain | 46,772 | 43,587 |
| South Central | 107,145 | 113,893 |
| Southeast | 82,338 | 78,897 |
| Total | 484,763 | 487,548 |

Source: USDA Forest Service unpublished data and personal communication, J. Faulkner 1996.
Note: 1992 forestland totals differ slightly between Table A-1 and Table A-6, due to the use of different reports. 1987 data includes Native American lands managed in trust by the Bureau of Indian Affairs.

TABLE A-3 Timberland area in the United States, by ownership and region, 1952-1992 (thousand acres)

| | | | | Nonfederal, Public | | | Private | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Region | Year | All Owner-ships | Total Non-federal | Total Non-federal, Public | State | County/ Municipal | Total Private | Forest Industry | Total, Farmer and Other Private | Farmer | Other Private |
| North Central | 1952 | 81,240 | 72,820 | 13,455 | 7,054 | 6,401 | 59,365 | 3,577 | 55,788 | 32,828 | 22,960 |
| | 1962 | 78,731 | 70,552 | 12,726 | 7,410 | 5,316 | 57,826 | 3,583 | 54,243 | 30,420 | 23,824 |
| | 1977 | 74,885 | 67,096 | 12,544 | 7,613 | 4,931 | 54,552 | 4,664 | 49,887 | 26,451 | 23,436 |
| | 1987 | 74,584 | 66,594 | 12,385 | 7,503 | 4,882 | 54,209 | 4,361 | 49,848 | 23,255 | 26,593 |
| | 1992 | 78,350 | 70,038 | 13,318 | 8,165 | 5,153 | 56,720 | 4,340 | 52,380 | 21,615 | 30,765 |
| Northeast | 1952 | 73,035 | 70,590 | 4,810 | 4,225 | 585 | 65,780 | 10,144 | 55,636 | 22,956 | 32,680 |
| | 1962 | 77,875 | 75,431 | 5,075 | 4,514 | 561 | 70,356 | 10,105 | 60,251 | 17,707 | 42,544 |
| | 1977 | 78,561 | 76,249 | 5,921 | 5,171 | 750 | 70,328 | 12,789 | 57,539 | 13,063 | 44,476 |
| | 1987 | 79,834 | 76,909 | 6,665 | 5,665 | 1,000 | 70,244 | 12,575 | 57,669 | 12,868 | 44,801 |
| | 1992 | 79,449 | 76,937 | 6,165 | 5,167 | 998 | 70,772 | 11,858 | 58,914 | 9,390 | 49,525 |
| Pacific Northwest | 1952 | 65,218 | 25,676 | 3,440 | 2,967 | 473 | 22,236 | 9,046 | 13,190 | 5,527 | 7,663 |
| | 1962 | 64,602 | 25,033 | 3,511 | 3,177 | 334 | 21,522 | 9,426 | 12,096 | 5,366 | 6,730 |
| | 1977 | 61,855 | 26,905 | 6,605 | 6,300 | 305 | 20,300 | 9,841 | 10,459 | 4,285 | 6,174 |
| | 1987 | 54,697 | 32,273 | 7,821 | 7,474 | 347 | 24,452 | 9,702 | 14,750 | 2,579 | 12,171 |
| | 1992 | 52,919 | 31,519 | 7,773 | 7,445 | 328 | 23,746 | 9,034 | 14,712 | 2,459 | 12,253 |
| Pacific Southwest | 1952 | 18,216 | 9,477 | 688 | 680 | 8 | 8,789 | 2,167 | 6,622 | 2,030 | 4,592 |
| | 1962 | 18,287 | 9,034 | 559 | 554 | 5 | 8,475 | 2,445 | 6,030 | 1,883 | 4,147 |
| | 1977 | 17,251 | 8,805 | 548 | 521 | 27 | 8,257 | 2,687 | 5,570 | 1,646 | 3,924 |
| | 1987 | 17,412 | 8,361 | 445 | 431 | 14 | 7,916 | 2,757 | 5,159 | 1,523 | 3,636 |
| | 1992 | 16,900 | 8,221 | 445 | 431 | 14 | 7,776 | 3,280 | 4,497 | 1,313 | 3,183 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rocky Mountains | 1952 | 66,599 | 22,458 | 2,313 | 2,240 | 73 | 20,145 | 2,250 | 17,895 | 10,181 | 7,713 |
| | 1962 | 66,920 | 22,195 | 2,310 | 2,236 | 74 | 19,885 | 2,240 | 17,645 | 10,008 | 7,638 |
| | 1977 | 60,173 | 21,866 | 2,310 | 2,234 | 76 | 19,556 | 2,095 | 17,460 | 9,837 | 7,622 |
| | 1987 | 61,140 | 22,438 | 2,693 | 2,566 | 127 | 19,745 | 2,964 | 16,781 | 8,008 | 8,773 |
| | 1992 | 62,628 | 22,887 | 2,647 | 2,546 | 101 | 20,240 | 2,918 | 17,322 | 8,223 | 9,098 |
| South Central | 1952 | 115,479 | 107,456 | 1,533 | 1,067 | 466 | 105,923 | 17,851 | 88,072 | 44,187 | 43,885 |
| | 1962 | 117,663 | 109,773 | 1,670 | 1,187 | 483 | 108,103 | 18,841 | 89,262 | 36,873 | 52,389 |
| | 1977 | 111,812 | 103,644 | 1,805 | 1,305 | 500 | 101,839 | 21,548 | 80,291 | 29,573 | 50,718 |
| | 1987 | 112,128 | 103,211 | 1,937 | 1,485 | 452 | 101,274 | 21,438 | 79,836 | 28,157 | 51,679 |
| | 1992 | 114,515 | 105,536 | 2,368 | 1,814 | 554 | 103,168 | 22,774 | 80,395 | 21,041 | 59,354 |
| Southeast | 1952 | 89,067 | 82,323 | 1,143 | 951 | 192 | 81,180 | 13,944 | 67,236 | 55,072 | 12,165 |
| | 1962 | 91,040 | 84,198 | 1,404 | 1,199 | 205 | 82,794 | 14,794 | 68,000 | 41,390 | 26,610 |
| | 1977 | 87,818 | 80,905 | 1,549 | 1,303 | 246 | 79,356 | 15,312 | 64,044 | 29,629 | 34,415 |
| | 1987 | 85,141 | 78,099 | 2,028 | 1,713 | 315 | 76,071 | 16,550 | 59,521 | 19,401 | 40,120 |
| | 1992 | 84,794 | 77,763 | 2,124 | 1,789 | 335 | 75,639 | 16,252 | 59,387 | 18,444 | 40,943 |
| United States | 1952 | 508,854 | 390,799 | 27,380 | 19,183 | 8,197 | 363,419 | 58,979 | 304,440 | 172,781 | 131,660 |
| | 1962 | 515,118 | 396,216 | 27,254 | 20,277 | 6,977 | 368,962 | 61,434 | 307,528 | 143,645 | 163,883 |
| | 1977 | 492,355 | 385,468 | 31,282 | 24,447 | 6,835 | 354,186 | 68,937 | 285,249 | 114,485 | 170,765 |
| | 1987 | 484,936 | 387,885 | 33,974 | 26,837 | 7,137 | 353,911 | 70,347 | 283,564 | 95,791 | 187,773 |
| | 1992 | 489,555 | 392,901 | 34,840 | 27,356 | 7,484 | 358,061 | 70,455 | 287,606 | 82,484 | 205,121 |

Source: USDA-Forest Service 1994a.

TABLE A-4 Changes in land use and cover in the United States, 1982 and 1992 (thousand acres)

| | Land use or cover in 1992 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land Cover/Use in 1982 | Nonfederal Cropland | Nonfederal Pastureland | Nonfederal Rangeland | Nonfederal Forestland | Other Nonfederal Rural Land cover/uses[1] | Nonfederal Developed land | Water Areas and Federal land | 1982 Total |
| Nonfederal Cropland | 361,233 | 14,813 | 2,096 | 3,136 | 34,087 | 4,161 | 1,434 | 420,961 |
| Nonfederal Pastureland | 11,816 | 104,647 | 1,475 | 8,222 | 2,636 | 2,468 | 623 | 131,887 |
| Nonfederal Rangeland | 5,686 | 2,416 | 391,654 | 1,524 | 1,852 | 2,120 | 3,650 | 408,901 |
| Nonfederal Forestland | 1,457 | 2,864 | 1,136 | 379,594 | 1,296 | 5,584 | 2,434 | 394,364 |
| Minor land cover/uses | 1,178 | 808 | 271 | 1,426 | 48,480 | 291 | 372 | 52,825 |
| Nonfederal Developed land | 251 | 85 | 91 | 217 | 22 | 77,705 | 3 | 78,373 |
| Water Areas and Federal land | 697 | 293 | 2,226 | 840 | 251 | 24 | 448,370 | 452,702 |
| 1992 Total | 382,317 | 125,927 | 398,949 | 394,958 | 88,624 | 92,352 | 456,885 | 1,940,011 |

Note: Read this table horizontally to determine how a particular 1982 land use (row heading) was distributed in 1992 (column headings). Read this table vertically to determine where a particular 1992 land use (column heading) came from, in terms of 1982 land uses (row headings). Columns may not sum due to rounding.

[1]Includes land under Conservation Reserve Program contracts, farmsteads and other farm structures, field windbreaks, barren land such as salt flats or exposed rock, and marshland.

Source: USDA NRCS 1995.

TABLE A-5 Forested and nonforested urban land area in the United States, by region, 1992 (thousand acres)

| Region | Urban Forest Land | Nonforested Urban Land | Total[1] |
|---|---|---|---|
| North Central | 4,421 | 10,137 | 14,558 |
| Northeast | 4,247 | 7,332 | 11,579 |
| Pacific Northwest | 601 | 1,501 | 2,102 |
| Pacific Southwest | 817 | 3,599 | 4,415 |
| Rocky Mountain | 624 | 5,431 | 6,054 |
| South Central | 4,518 | 9,346 | 13,864 |
| Southeast | 4,935 | 7,478 | 12,413 |
| Other[2] | 52 | 311 | 363 |
| Total | 20,214 | 45,135 | 65,349 |

1 Does not include Alaska or federal lands.

2 Includes Puerto Rico and the Virgin Islands.

Source: USDA-NRCS 1996.

TABLE A-6 Area of tree planting in the United States, including seeding, by ownership and region, 1991-1995 (acres)

| Region | Year | Federal | State Forest | Other State | Local Government | NIPF[2] | Forest Industry | Other Industry | Total |
|---|---|---|---|---|---|---|---|---|---|
| North Central | 1991 | 8,030 | 15,242 | 691 | 5,423 | 73,757 | 12,120 | 2,470 | 117,733 |
| North Central | 1992 | 6,979 | 12,946 | 529 | 7,842 | 78,157 | 10,084 | 2,825 | 119,362 |
| North Central | 1993 | 11,195 | 13,362 | 341 | 9,036 | 69,201 | 11,789 | 2,271 | 117,195 |
| North Central | 1994 | 8,539 | 17,166 | 1,519 | 4,126 | 55,912 | 11,460 | 1,785 | 100,507 |
| North Central | 1995 | 10,455 | 15,312 | 1,053 | 8,887 | 48,183 | 17,124 | 2,968 | 103,982 |
| Northeast | 1991 | 1,707 | 595 | 104 | 256 | 15,881 | 8,537 | 169 | 27,249 |
| Northeast | 1992 | 628 | 486 | 140 | 205 | 21,398 | 11,155 | 182 | 34,194 |
| Northeast | 1993 | 644 | 124 | 140 | 176 | 14,837 | 11,174 | 0 | 27,095 |
| Northeast | 1994 | 1,243 | 224 | 153 | 259 | 13,291 | 9,975 | 327 | 25,472 |
| Northeast | 1995 | 849 | 164 | 444 | 247 | 13,853 | 10,374 | 181 | 26,112 |
| Pacific Northwest | 1991 | 162,646 | 22,127 | 221 | 2,800 | 87,716 | 157,592 | 0 | 433,102 |
| Pacific Northwest | 1992 | 130,756 | 19,210 | 157 | 3,901 | 80,602 | 155,024 | 0 | 389,650 |
| Pacific Northwest | 1993 | 125,433 | 16,905 | 55 | 1,446 | 80,468 | 136,094 | 0 | 360,401 |
| Pacific Northwest | 1994 | 112,480 | 20,635 | 60 | 1,426 | 87,065 | 134,171 | 0 | 355,837 |
| Pacific Northwest[1] | 1995 | 130,865 | 17,918 | 1,739 | 1,591 | 89,396 | 170,331 | 0 | 411,840 |
| Pacific Southwest | 1991 | 52,443 | 514 | 160 | 20 | 24,535 | 21,800 | 450 | 99,922 |
| Pacific Southwest | 1992 | 49,462 | 271 | 128 | 16 | 12,105 | 17,440 | 360 | 79,782 |
| Pacific Southwest | 1993 | 44,710 | 235 | 120 | 12 | 9,731 | 16,550 | 385 | 71,743 |
| Pacific Southwest | 1994 | 39,115 | 315 | 65 | 47 | 10,441 | 19,210 | 490 | 69,683 |
| Pacific Southwest | 1995 | 36,959 | 270 | 80 | 30 | 10,898 | 19,000 | 400 | 67,637 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rocky Mountain | 1991 | 65,734 | 4,290 | 807 | 193 | 32,267 | 16,900 | 161 | 120,352 |
| Rocky Mountain | 1992 | 74,662 | 4,091 | 1,007 | 118 | 25,367 | 25,275 | 167 | 130,687 |
| Rocky Mountain | 1993 | 75,811 | 3,177 | 587 | 501 | 26,166 | 17,598 | 38 | 123,878 |
| Rocky Mountain | 1994 | 71,923 | 4,875 | 596 | 269 | 23,703 | 19,830 | 47 | 121,243 |
| Rocky Mountain | 1995 | 67,292 | 3,412 | 824 | 530 | 33,262 | 16,634 | 90 | 122,044 |
| South Central | 1991 | 52,022 | 235 | 15,523 | 80 | 328,458 | 529,077 | 0 | 925,395 |
| South Central | 1992 | 43,199 | 184 | 21,582 | 80 | 396,271 | 492,545 | 2,291 | 956,152 |
| South Central | 1993 | 31,859 | 259 | 9,272 | 1,442 | 385,599 | 467,859 | 2,062 | 898,352 |
| South Central | 1994 | 32,448 | 248 | 12,788 | 60 | 364,469 | 473,336 | 4,443 | 887,792 |
| South Central | 1995 | 22,032 | 63 | 27,620 | 60 | 369,168 | 453,810 | 5,282 | 878,035 |
| Southeast | 1991 | 33,632 | 2,775 | 3,352 | 878 | 423,997 | 365,603 | 3,859 | 834,096 |
| Southeast | 1992 | 25,308 | 2,602 | 736 | 802 | 414,364 | 387,363 | 3,178 | 834,353 |
| Southeast | 1993 | 26,396 | 2,733 | 2,331 | 49 | 411,602 | 374,313 | 3,085 | 820,509 |
| Southeast | 1994 | 23,515 | 2,833 | 3,226 | 551 | 493,828 | 390,040 | 2,264 | 916,257 |
| Southeast | 1995 | 15,571 | 3,117 | 4,616 | 679 | 391,707 | 350,083 | 45,733 | 811,506 |
| Other | 1991 | 0 | 5 | 10 | 67 | 94 | 0 | 0 | 176 |
| Other | 1992 | 0 | 56 | 74 | 88 | 464 | 0 | 0 | 682 |
| Other | 1993 | 0 | 33 | 1 | 91 | 393 | 0 | 0 | 518 |
| Other | 1994 | 7 | 87 | 40 | 120 | 434 | 0 | 0 | 688 |
| Other | 1995 | 0 | 34 | 75 | 110 | 486 | 0 | 0 | 705 |
| United States | 1991 | 376,214 | 45,783 | 20,868 | 9,717 | 986,705 | 1,111,629 | 7,109 | 2,558,025 |
| United States | 1992 | 330,994 | 39,846 | 24,353 | 13,052 | 1,028,728 | 1,098,886 | 9,003 | 2,544,862 |
| United States | 1993 | 316,048 | 36,828 | 12,847 | 12,753 | 997,997 | 1,035,377 | 7,841 | 2,419,691 |
| United States | 1994 | 289,270 | 46,383 | 18,447 | 6,858 | 1,049,143 | 1,058,022 | 9,356 | 2,477,479 |
| United States | 1995 | 284,023 | 40,290 | 36,451 | 12,134 | 956,953 | 1,037,356 | 54,654 | 2,421,861 |

[1]The 1995 data for the Pacific Northwest includes 55,371 acres planted by the Department of Interior in Oregon.
[2]Nonindustrial Private Forest
Sources: USDA-Forest Service 1992b, 1993c, 1994f, 1995b, and 1996c.

TABLE A-7 Artificial versus natural origin of forest stands on nonfederal timberland in the Southeast region (thousand acres)

| Most Recent Inventory | | Stand Origin from Previous Inventory | | |
|---|---|---|---|---|
| Stand Origin | All | Natural | Planted | Unknown |
| Natural stand | 60,979 | 58,925 | 985 | 1,069 |
| Artificial stand | 16,588 | 3,730 | 11,663 | 1,196 |
| All stands | 77,567 | 62,655 | 12,648 | 2,264 |

Note: Rows and columns may not sum due to rounding
Source: Based on analysis of most recent forest inventory and analysis information and on Rosson, 1995.

TABLE A-8 Projected area of pine plantation in Southeast and South Central regions, 2000-2040 (million acres)

| Year | Projection |
|---|---|
| 2000 | 36.192 |
| 2010 | 40.925 |
| 2020 | 44.005 |
| 2030 | 45.326 |
| 2040 | 45.237 |

Note: Assumes that current policies affecting forests and their management remain unchanged.
Source: USDA Forest Service 1995a.

TABLE A-9 Projected area of plantations on private timberland in the South Central, Southeast, and Pacific Northwest regions, 1990-2040 (million acres)

| | South Central and Southeast | | | Pacific Northwest (Westside)[1] | | |
|---|---|---|---|---|---|---|
| Year | Forest Industry | Nonindustrial Private | Total | Forest Industry | Nonindustrial Private | Total |
| 1990 | 13.01 | 10.01 | 23.02 | 3.63 | 2.94 | 0.68 |
| 2000 | 16.79 | 35.31 | 52.10 | 6.80 | 4.51 | 2.29 |
| 2010 | 26.74 | 54.65 | 81.38 | 8.01 | 5.17 | 2.84 |
| 2020 | 28.05 | 57.77 | 85.82 | 8.73 | 5.64 | 3.09 |
| 2030 | 27.93 | 58.52 | 86.45 | 9.41 | 6.04 | 3.37 |
| 2040 | 27.95 | 58.44 | 86.39 | 9.91 | 6.37 | 3.54 |

[1]This consists of the areas of Oregon and Washington that are west of the crests of the Cascade Mountains.
Source: Alig et al. 1996.

TABLE A-10 Forestland area in the United States, by region and ownership, 1992 (thousand acres)

| State | All Owners | Nonfederal Owners | Public | | | Private | | |
|---|---|---|---|---|---|---|---|---|
| | | | Nonfederal Public | State | County/ Municipal | Total private | Forest industry | Other |
| North Central | 83,109 | 73,160 | 15,576 | 9,807 | 5,769 | 57,584 | 4,392 | 53,192 |
| Northeast | 85,381 | 82,264 | 10,418 | 9,330 | 1,088 | 71,846 | 11,997 | 59,849 |
| Pacific Northwest | 177,611 | 76,020 | 25,564 | 23,708 | 1,856 | 50,456 | 9,512 | 40,944 |
| Pacific Southwest | 39,011 | 19,729 | 1,540 | 1,093 | 447 | 18,189 | 3,280 | 14,909 |
| Rocky Mountains | 139,733 | 43,589 | 5,477 | 5,307 | 170 | 38,112 | 2,975 | 35,137 |
| South Central | 123,760 | 113,891 | 2,557 | 1,931 | 626 | 111,334 | 22,775 | 88,559 |
| Southeast | 88,079 | 78,900 | 2,666 | 2,139 | 527 | 76,234 | 16,278 | 59,956 |
| Total U.S. | 736,684 | 487,553 | 63,798 | 53,315 | 10,483 | 423,755 | 71,209 | 352,546 |

Source: USDA Forest Service unpublished data.

TABLE A-11 Private forestland area and number of private ownership units in the United States, by region, 1978 and 1994

| | Acres (in millions) | | Owners (in thousands) | |
|---|---|---|---|---|
| Region | 1978 | 1994 | 1978 | 1994 |
| North Central | 51 | 57 | 895 | 1,684 |
| Northeast | 63 | 71 | 2,395 | 2,256 |
| Pacific Northwest | 19 | 30 | 345 | 274 |
| Pacific Southwest | 11 | 16 | 141 | 370 |
| Rocky Mountain | 16 | 30 | 132 | 386 |
| South Central | 99 | 111 | 1,961 | 2,499 |
| Southeast | 74 | 76 | 1,889 | 2,441 |
| Total | 333 | 392 | 7,758 | 9,902 |

Source: USDA Forest Service 1996a.

TABLE A-12 Number of private owners of forestland in the United States, by size class of ownership, 1978 and 1994

| | 1978 | | 1994 | |
|---|---|---|---|---|
| Tract Acreage | Thousands | Percent | Thousands | Percent |
| 1-9 | 5,528 | 71.3 | 5,795 | 58.6 |
| 10-49 | 1,164 | 15.0 | 2,762 | 27.9 |
| 50-99 | 464 | 5.9 | 717 | 7.2 |
| 100-499 | 538 | 7.0 | 559 | 5.6 |
| 500-999 | 40 | 0.5 | 41 | 0.4 |
| 1000+ | 23 | 0.3 | 27 | 0.3 |
| Total | 7,757 | 100.0 | 9,902 | 100.0 |

Source: USDA Forest Service 1996a.

TABLE A-13 Area of forestland owned by private owners in the United States, by size class of ownership, 1978 and 1994

| | 1978 | | 1994 | |
|---|---|---|---|---|
| Tract Acreage | millions | percent | millions | percent |
| 1-9 | 11 | 3.3 | 17 | 4.3 |
| 10-49 | 28 | 8.4 | 60 | 15.5 |
| 50-99 | 33 | 9.9 | 47 | 11.9 |
| 100-499 | 103 | 30.8 | 92 | 23.3 |
| 500-999 | 27 | 8.1 | 25 | 6.3 |
| 1000+ | 132 | 39.5 | 153 | 38.8 |
| Total | 333 | 100.0 | 393 | 100.0 |

Note: Totals may not sum due to rounding.
Source: USDA Forest Service 1996a.

TABLE A-14 Area of forestland owned by private owners in the United States, by date of acquisition, 1978 and 1994

| | 1978 | | 1994 | |
|---|---|---|---|---|
| Date of acquisition | millions | percent | millions | percent |
| 1978-1993 | 0 | 0.0 | 93 | 23.6 |
| 1970-1977 | 72 | 21.7 | 57 | 14.5 |
| 1960-1969 | 66 | 19.8 | 60 | 15.1 |
| 1950-1959 | 52 | 15.5 | 44 | 11.3 |
| Prior to 1950 | 88 | 26.3 | 117 | 29.8 |
| No answer | 56 | 16.7 | 23 | 5.7 |
| Total | 333 | 100.0 | 393 | 100.0 |

Note: Totals may not sum due to rounding.
Source: USDA Forest Service 1996a.

TABLE A-15 Number of private forestland owners in the United States, by date of acquisition, 1978 and 1994

| | 1978 | | 1994 | |
|---|---|---|---|---|
| Date of acquisition | thousands | percent | thousands | percent |
| 1978-1993 | 0 | 0.0 | 3,991 | 40.3 |
| 1970-1977 | 2,696 | 34.8 | 1,802 | 18.2 |
| 1960-1969 | 2,130 | 27.5 | 1,527 | 15.4 |
| 1950-1959 | 1,009 | 13.0 | 757 | 7.6 |
| Prior to 1950 | 1,409 | 18.1 | 922 | 9.3 |
| No answer | 513 | 6.6 | 903 | 9.1 |
| Total | 7,757 | 100.0 | 9,902 | 100.0 |

Note: Totals may not sum due to rounding.
Source: USDA Forest Service 1996a.

TABLE A-16 Private forestland area and number of forestland ownership units in the United States, by whether a written management plan had been prepared, 1994

| | Acres | | Owners | |
|---|---|---|---|---|
| Management Plan Preparation | millions | percent | thousands | percent |
| Private owners with written plans | | | | |
| Nonindustrial | 88 | 22.4 | 529 | 5.3 |
| Forest industry | 66 | 16.6 | 2 | 0.0 |
| Subtotal | 154 | 39.0 | 531 | 5.4 |
| Private owners with no written plan | 226 | 57.5 | 8,594 | 86.8 |
| No answer | 14 | 3.5 | 785 | 7.9 |
| Total | 393 | 100.0 | 9,902 | 100.0 |

Note: Totals may not sum due to rounding.
Source: USDA Forest Service 1996a.

TABLE A-17 Area of forestland and number of private ownership units in the United States, by primary reason for owning forest land, 1994

| | Acres | | Owners | |
|---|---|---|---|---|
| Reason for Owning | millions | percent | thousands | percent |
| Timber production | 113 | 28.9 | 272 | 2.7 |
| Land investment | 39 | 10.0 | 920 | 9.3 |
| Part of farm | 39 | 9.8 | 1,190 | 12.0 |
| Recreation | 38 | 9.5 | 875 | 8.8 |
| Farm and domestic use | 36 | 9.1 | 816 | 8.3 |
| Part of residence | 33 | 8.2 | 2,642 | 26.7 |
| Enjoyment of owning | 29 | 7.3 | 1,392 | 14.1 |
| Other | 61 | 15.3 | 1,441 | 14.5 |
| No answer | 6 | 1.5 | 354 | 3.6 |
| Total | 393 | 100.0 | 9,902 | 100.0 |

Note: Totals may not sum due to rounding.
Source: USDA Forest Service 1996a.

TABLE A-18 Economic characteristics of wood-based industries in the United States, by number of employees, payroll, and value of shipments, 1992

| Industry | Number of Employees (in thousands) | Payroll (million dollars) | Value of shipments (billion dollars) |
|---|---|---|---|
| Logging and sawmills | 221.7 | 4,739 | 31.3 |
| Millwork and veneer[1] | 224.6 | 5,027 | 24.9 |
| Wood containers | 40.0 | 639 | 2.9 |
| Wood buildings, mobile homes | 56.2 | 1,230 | 6.6 |
| Misc. wood products | 84.9 | 1,740 | 10.3 |
| Pulp mills | 15.9 | 688 | 5.5 |
| Paper mills | 130.7 | 5,425 | 32.8 |
| Paperboard mills | 51.5 | 2,135 | 16.1 |
| Paperboard containers and boxes | 199.0 | 5,710 | 32.6 |
| Converted paper and paperboard products | 229.2 | 6,521 | 46.0 |
| Total | 1,253.7 | 33,854 | 209.0 |

[1]Includes plywood and structural members.
Source: U.S. Bureau of the Census 1995.

TABLE A-19 Softwood and hardwood timber harvest in the United States, by ownership, 1952-1991, with projections to 2040 (million cubic feet)

| | | Estimates (trend level of harvest) | | | | | | Projections[1] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ownership | Type | 1952 | 1962 | 1970 | 1976 | 1986 | 1991 | 2000 | 2010 | 2020 | 2030 | 2040 |
| National Forest | Softwood | 1,028 | 1,728 | 2,082 | 1,986 | 2,061 | 1,681 | 934 | 957 | 986 | 1,015 | 1,041 |
| | Hardwood | 117 | 126 | 146 | 129 | 161 | 186 | 184 | 192 | 200 | 205 | 211 |
| Other Public | Softwood | 429 | 568 | 750 | 851 | 858 | 616 | 705 | 729 | 741 | 752 | 755 |
| | Hardwood | 141 | 150 | 199 | 225 | 222 | 326 | 234 | 235 | 236 | 233 | 231 |
| Forest Industry | Softwood | 2,666 | 2,171 | 2,898 | 3,439 | 4,055 | 3,942 | 3,621 | 3,809 | 4,715 | 5,501 | 5,550 |
| | Hardwood | 522 | 657 | 567 | 597 | 807 | 1,211 | 976 | 817 | 783 | 809 | 860 |
| Farm and Other | Softwood | 3,640 | 3,137 | 3,457 | 3,721 | 4,392 | 4,678 | 5,477 | 5,474 | 5,538 | 5,749 | 6,537 |
| Private | Hardwood | 3,308 | 3,398 | 3,926 | 3,240 | 3,892 | 3,595 | 5,420 | 6,322 | 6,719 | 8,671 | 6,805 |
| United States | Softwood | 7,763 | 7,604 | 9,187 | 9,996 | 11,366 | 10,917 | 10,738 | 10,969 | 11,979 | 13,017 | 13,883 |
| | Hardwood | 4,087 | 4,330 | 4,208 | 4,192 | 5,082 | 5,318 | 6,814 | 7,566 | 7,938 | 7,918 | 8,107 |
| Total | | 11,850 | 11,934 | 13,395 | 14,188 | 16,448 | 16,235 | 17,552 | 18,535 | 19,917 | 20,935 | 21,990 |

[1]Projections assume current public and private policies directed at forest use and management remain unchanged.
Source: USDA Forest Service 1995a.

TABLE A-20 Timber harvest in the United States, by region, 1952-1991, with projections to 2040

| | Region (percent) | | | |
|---|---|---|---|---|
| Year | North Central[2] and Northeast | South Central and Southeast | Rocky Mountains[3] | Pacific Northwest[4] & Pacific Southwest[5] |
| 1952 | 21 | 47 | 5 | 28 |
| 1962 | 19 | 41 | 6 | 34 |
| 1970 | 16 | 44 | 7 | 33 |
| 1976 | 16 | 44 | 7 | 32 |
| 1986 | 24 | 45 | 6 | 26 |
| 1991 | 26 | 46 | 7 | 21 |
| Projections[1] | | | | |
| 2000 | 28 | 51 | 6 | 15 |
| 2010 | 29 | 52 | 5 | 14 |
| 2020 | 28 | 52 | 5 | 14 |
| 2030 | 28 | 52 | 5 | 14 |
| 2040 | 28 | 52 | 4 | 15 |

Source: USDA Forest Service 1995a.

Note: Rows may not add to 100 due to rounding

[1]Projections assume current public and private policies directed at forest use and management remain unchanged.

[2]Includes Kansas, Nebraska, North Dakota, and South Dakota.

[3]Excludes Kansas, Nebraska, North Dakota, and South Dakota.

[4]Excludes Alaska.

[5]Excludes Hawaii.

TABLE A-21 Timber growing stock inventory in the United States, by ownership, 1952-1991, with projections to 2040 (million cubic feet)

| | | Estimate | | | | | | Projections[1] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ownership | Resource | 1952 | 1962 | 1970 | 1976 | 1986 | 1991 | 2000 | 2010 | 2020 | 2030 | 2040 |
| National Forest | Softwoods | 204,437 | 213,696 | 211,927 | 208,099 | 186,313 | 185,574 | 191,645 | 210,300 | 230,036 | 250,718 | 271,911 |
| | Hardwoods | 13,556 | 17,207 | 19,721 | 21,567 | 25,107 | 25,641 | 28,860 | 32,129 | 35,352 | 38,636 | 42,001 |
| Other Public | Softwoods | 55,184 | 55,720 | 57,521 | 59,039 | 57,255 | 50,002 | 54,088 | 58,069 | 62,450 | 67,800 | 73,683 |
| | Hardwoods | 16,417 | 20,621 | 23,894 | 26,365 | 31,256 | 32,857 | 37,623 | 43,047 | 48,292 | 53,549 | 58,874 |
| Forest Industry | Softwoods | 70,672 | 69,647 | 69,494 | 69,370 | 67,410 | 66,142 | 61,500 | 72,240 | 82,957 | 88,211 | 90,276 |
| | Hardwoods | 20,270 | 25,324 | 29,281 | 32,249 | 35,278 | 34,773 | 34,117 | 33,017 | 33,226 | 33,592 | 33,670 |
| Farm & Other | Softwoods | 101,497 | 110,693 | 121,345 | 130,448 | 141,933 | 148,175 | 145,486 | 146,364 | 148,692 | 149,151 | 145,300 |
| Private | Hardwoods | 133,627 | 152,469 | 168,474 | 185,717 | 220,707 | 242,177 | 251,073 | 257,160 | 251,614 | 243,026 | 234,183 |
| United States | Softwoods | 431,790 | 449,756 | 460,287 | 466,956 | 452,911 | 449,893 | 452,719 | 486,973 | 524,135 | 555,880 | 581,170 |
| | Hardwoods | 183,870 | 215,621 | 241,370 | 265,898 | 312,348 | 335,448 | 351,673 | 365,353 | 368,484 | 368,803 | 368,728 |
| Total | | 615,660 | 665,377 | 701,657 | 732,854 | 765,259 | 785,341 | 804,342 | 852,326 | 892,619 | 924,683 | 949,898 |

[1] Projections assume current public and private policies directed at forest use and management remain unchanged.
Source: USDA Forest Service 1995a.

TABLE A-22 Net annual growth of softwoods and hardwoods in the United States, by ownership, 1952-1991, with projections to 2040 (million cubic feet)

| | | Estimate | | | | | | Projections[1] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ownership | Resource | 1952 | 1962 | 1970 | 1976 | 1986 | 1991 | 2000 | 2010 | 2020 | 2030 | 2040 |
| National Forest | Softwoods | 1,664 | 1,999 | 2,367 | 2,468 | 2,783 | 2,747 | 2,779 | 2,924 | 3,061 | 3,185 | 3,225 |
| | Hardwoods | 396 | 508 | 573 | 658 | 617 | 544 | 532 | 497 | 491 | 499 | 507 |
| Other Public | Softwoods | 730 | 961 | 1,113 | 1,191 | 1,371 | 1,130 | 1,099 | 1,132 | 1,214 | 1,348 | 1,335 |
| | Hardwoods | 492 | 634 | 749 | 840 | 978 | 834 | 788 | 769 | 754 | 769 | 763 |
| Forest Industry | Softwoods | 1,793 | 2,234 | 2,523 | 2,844 | 3,027 | 3,063 | 3,867 | 5,026 | 5,400 | 5,673 | 5,764 |
| | Hardwoods | 688 | 828 | 1,068 | 1,220 | 1,129 | 1,098 | 1,086 | 938 | 921 | 920 | 922 |
| Farm & Other | Softwoods | 3,548 | 4,419 | 5,337 | 5,998 | 5,339 | 5,033 | 5,335 | 5,741 | 5,743 | 5,741 | 5,782 |
| Private | Hardwoods | 4,599 | 5,124 | 6,088 | 6,706 | 6,837 | 7,174 | 7,043 | 6,642 | 6,331 | 6,109 | 6,019 |
| United States | Softwoods | 7,735 | 9,613 | 11,340 | 12,501 | 12,520 | 11,973 | 13,080 | 14,823 | 15,418 | 15,947 | 16,106 |
| | Hardwoods | 6,175 | 7,094 | 8,478 | 9,424 | 9,561 | 9,650 | 9,449 | 8,846 | 8,497 | 8,297 | 8,211 |

[1]Projections assume current public and private policies directed at forest use and management remain unchanged.
Source: USDA Forest Service 1995a.

TABLE A-23 Budget history of State and Private Forestry, USDA Forest Service, 1992-1996 (millions of dollars)

| Program | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| Forest Health Management | | | | | |
| Cooperative & Federal Forest Health Management | 57.2 | 55.3 | 50.8 | 49.3 | 32.9 |
| Cooperative Lands Fire Management | 16.6 | 16.9 | 17.1 | 13.7 | 17.0 |
| Total | 73.8 | 72.2 | 67.9 | 63.0 | 49.9 |
| Cooperative Forestry Programs | | | | | |
| Economic Action | 0.0 | 0.0 | 5.2 | 5.2 | 4.7 |
| Forestry Assistance[1] | 10.7 | 2.7 | 0.0 | 0.0 | 0.0 |
| Forest Legacy | 4.9 | 9.9 | 6.9 | 0.0 | 3.0 |
| Forest Stewardship | 23.9 | 23.3 | 25.8 | 25.9 | 23.4 |
| Pacific Northwest Assistance | 0.0 | 0.0 | 16.4 | 17.1 | 16.0 |
| Rural Forestry Assistance | 9.4 | 9.5 | 10.3 | 10.8 | 9.8 |
| Special Projects[1] | 15.4 | 10.7 | 0.0 | 0.0 | 0.0 |
| Stewardship Incentives | 0.8 | 17.8 | 17.9 | 18.3 | 4.5 |
| Urban Forestry | 23.8 | 24.7 | 27.0 | 28.3 | 25.5 |
| Total | 88.9 | 98.6 | 109.5 | 105.6 | 86.9 |
| Total S&PF Budget | 162.8 | 170.9 | 177.6 | 168.6 | 136.8 |

[1] These two programs provided for a wide range of forestry assistance not available through other programs.
Source: Unpublished USDA Forest Service data. Columns may not sum to totals due to rounding.

TABLE A-24 Federal programs designed to provide financial assistance for forest-related activities, by region, federal FY 1993 (dollars)

| Region | Agricultural Conservation Program[1] | Forestry Incentives Program | Stewardship Incentives Program | Tree Assistance Program | Total Assistance |
|---|---|---|---|---|---|
| North Central | 1,720,596 | 714,311 | 1,200,712 | 59,352 | 3,694,971 |
| Northeast | 620,470 | 517,903 | 1,710,048 | 58,852 | 2,907,273 |
| Pacific Northwest | 1,759,198 | 804,911 | 733,320 | 49,659 | 3,347,088 |
| Pacific Southwest | 54,069 | 114,323 | 210,749 | 619,339 | 998,480 |
| Rocky Mountain | 36,242 | 152,484 | 856,724 | 84,096 | 1,129,546 |
| South Central | 2,503,360 | 4,563,877 | 1,898,726 | 1,243,587 | 10,209,550 |
| Southeast | 3,476,674 | 5,062,103 | 1,223,743 | 90,834 | 9,853,354 |
| Other | 9,408 | 18,240 | 0 | 0 | 27,648 |
| Total | 10,170,609 | 11,929,912 | 7,834,022 | 2,205,719 | 32,140,262 |

[1]Cost share funds for forest tree plantations, forest tree stand improvement, and site preparation for natural regeneration.
Sources: USDA Agricultural Stabilization and Conservation Service 1994a, 1994b, and 1994c; USDA Forest Service 1994d.

TABLE A-25 Forestry program expenditures by state governments, by region, 1994 (thousands of dollars)

| Region | Fire Management | State Forests | Cooperative Forestry | Utilization and Marketing | Insects and Disease | Urban and Community | RC&D and PL-556[1] | ASCS Programs[2] | Nursery | Forest Recreation[3] | Other Expenditures | Total Expenditures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North Central | 24,834 | 26,927 | 12,208 | 1,902 | 2,612 | 7,995 | 143 | 1,605 | 9,121 | 3,225 | 22,227 | 112,799 |
| Northeast | 22,688 | 6,397 | 7,902 | 1,594 | 2,038 | 5,203 | 330 | 520 | 1,698 | 3,455 | 8,738 | 60,563 |
| Other | 394 | 96 | 303 | 0 | 21 | 639 | 0 | 0 | 170 | 543 | 2,972 | 5,138 |
| Pacific Northwest | 62,735 | 46,731 | 3,854 | 242 | 290 | 1,603 | 22 | 188 | 3,749 | 1,650 | 37,214 | 158,277 |
| Pacific Southwest | 340,602 | 3,568 | 225 | 35 | 1,291 | 2,373 | 34 | 108 | 1,206 | 257 | 26,757 | 376,455 |
| Rocky Mountain | 35,293 | 9,577 | 5,612 | 135 | 1,458 | 4,622 | 584 | 88 | 4,431 | 12 | 12,501 | 74,312 |
| South Central | 71,926 | 5,793 | 20,140 | 798 | 3,928 | 5,115 | 358 | 4,939 | 6,984 | 240 | 6,507 | 126,727 |
| Southeast | 85,585 | 2,731 | 26,540 | 528 | 2,519 | 2,880 | 339 | 2,290 | 9,336 | 1,329 | 31,960 | 166,035 |
| Total | 644,056 | 101,819 | 76,783 | 5,235 | 14,157 | 30,429 | 1,810 | 9,736 | 36,694 | 10,710 | 148,875 | 1,080,304 |

Note: Columns and rows may not sum due to rounding.

[1]Resources conservation and development and watershed programs.

[2]Agricultural Stabilization and Conservation Service programs.

[3]In some states expenditures for recreation may be included in the total for state forests.

Source: National Association of State Foresters 1995.

TABLE A-26 Finances of state forestry agencies, by region and source of support, 1994 (thousands of dollars)

| Region | Federal Government | State Government | Other Government | Revenue | Private | Other | Total |
|---|---|---|---|---|---|---|---|
| North Central | 10,899 | 83,206 | 5,201 | 32,743 | 86 | 3,277 | 135,412 |
| Northeast | 10,294 | 44,456 | 541 | 5,640 | 272 | 648 | 61,851 |
| Pacific Northwest | 8,482 | 38,410 | 11,717 | 64,742 | 300 | 60,595 | 184,246 |
| Pacific Southwest | 11,022 | 257,862 | 12,022 | 14,122 | 0 | 87,230 | 382,258 |
| Rocky Mountain | 9,284 | 34,783 | 11,098 | 10,195 | 4,428 | 6,668 | 76,456 |
| South Central | 15,964 | 76,762 | 11,303 | 19,978 | 300 | 2,187 | 126,494 |
| Southeast | 15,865 | 125,802 | 5,965 | 7,405 | 1,135 | 716 | 156,888 |
| Other | 1,170 | 8,128 | 75 | 412 | 19 | 0 | 9,804 |
| Total | 81,810 | 661,281 | 57,847 | 154,825 | 6,521 | 161,321 | 1,123,605 |

Source: National Association of State Foresters 1995.

TABLE A-27 State government programs focused on major private forestry activities by activity, region, and type of program, 1992

| Major Forestry Activity and Type of Program | Number of States in Region Having Program Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Northeast | Lake States | Mid-Atlantic | Mid-Continent | Southeast | South Central | Great Plains | Rocky Mountain | West | Total |
| **Protect Water Quality** | | | | | | | | | | |
| Educational Programs | 6 | 3 | 6 | 5 | 5 | 5 | 5 | 5 | 6 | 46 |
| Technical Assistance | 6 | 3 | 7 | 5 | 5 | 5 | 5 | 6 | 5 | 47 |
| Voluntary Guideline | 5 | 3 | 6 | 4 | 5 | 5 | 1 | 4 | 1 | 34 |
| Tax Incentives | 1 | 1 | 4 | 3 | 0 | 1 | 3 | 1 | 0 | 14 |
| Fiscal Incentives | 2 | 3 | 5 | 3 | 1 | 4 | 5 | 4 | 2 | 29 |
| Regulatory Programs | 6 | 1 | 5 | 1 | 4 | 1 | 0 | 2 | 6 | 26 |
| **Promote Reforestation** | | | | | | | | | | |
| Educational Programs | 6 | 3 | 6 | 5 | 6 | 5 | 4 | 5 | 6 | 46 |
| Technical Assistance | 6 | 3 | 6 | 5 | 6 | 5 | 5 | 6 | 4 | 46 |
| Voluntary Guidelines | 1 | 1 | 3 | 2 | 1 | 1 | 1 | 4 | 1 | 15 |
| Tax Incentives | 2 | 3 | 3 | 3 | 1 | 1 | 0 | 1 | 2 | 16 |
| Fiscal Incentives | 5 | 2 | 5 | 3 | 4 | 5 | 5 | 5 | 3 | 39 |
| Regulatory Programs | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 6 | 14 |
| **Improve Timber Harvesting Methods** | | | | | | | | | | |
| Educational Programs | 6 | 3 | 6 | 5 | 5 | 4 | 5 | 5 | 6 | 45 |
| Technical Assistance | 6 | 3 | 7 | 5 | 6 | 5 | 5 | 6 | 4 | 47 |
| Voluntary Guidelines | 4 | 2 | 6 | 1 | 3 | 3 | 2 | 4 | 2 | 27 |
| Tax Incentives | 2 | 2 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 9 |
| Fiscal Incentives | 3 | 0 | 4 | 0 | 0 | 1 | 2 | 2 | 1 | 13 |
| Regulatory Programs | 4 | 0 | 4 | 0 | 1 | 1 | 0 | 1 | 6 | 16 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Protect from Wildfire, Insects and Diseases** | | | | | | | | | | |
| Educational Programs | 6 | 3 | 6 | 5 | 5 | 5 | 5 | 6 | 6 | 47 |
| Technical Assistance | 6 | 3 | 7 | 4 | 6 | 5 | 4 | 6 | 6 | 48 |
| Voluntary Guidelines | 3 | 0 | 3 | 1 | 2 | 3 | 2 | 4 | 2 | 20 |
| Tax Incentives | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 6 |
| Fiscal Incentives | 1 | 1 | 4 | 2 | 1 | 0 | 2 | 4 | 2 | 17 |
| Regulatory Programs | 5 | 2 | 3 | 1 | 3 | 2 | 1 | 4 | 6 | 27 |
| **Protect Wildlife and Rare and Endangered Species** | | | | | | | | | | |
| Educational Programs | 6 | 3 | 7 | 5 | 6 | 5 | 4 | 5 | 5 | 46 |
| Technical Assistance | 5 | 3 | 6 | 5 | 6 | 5 | 5 | 5 | 4 | 45 |
| Voluntary Guidelines | 4 | 1 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 18 |
| Tax Incentives | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| Fiscal Incentives | 3 | 2 | 5 | 3 | 2 | 4 | 5 | 2 | 2 | 28 |
| Regulatory Programs | 4 | 2 | 2 | 0 | 3 | 1 | 1 | 2 | 5 | 20 |
| **Enhance Recreation and Aesthetic Qualities** | | | | | | | | | | |
| Educational Programs | 6 | 3 | 6 | 4 | 5 | 5 | 4 | 5 | 3 | 42 |
| Technical Assistance | 6 | 3 | 7 | 5 | 5 | 5 | 5 | 6 | 3 | 45 |
| Voluntary Guidelines | 3 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 16 |
| Tax Incentives | 1 | 1 | 1 | 2 | 0 | 1 | 0 | 1 | 1 | 8 |
| Fiscal Incentives | 4 | 1 | 6 | 2 | 2 | 4 | 2 | 3 | 1 | 25 |
| Regulatory Programs | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 8 |

*Note*: Northeast — Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; Lake States — Michigan, Minnesota, Wisconsin; Mid-Atlantic — Delaware, Maryland, New Jersey, New York, Pennsylvania, Virginia, West Virginia; Mid-Continent — Illinois, Indiana, Kentucky, Missouri, Ohio; Southeast — Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina; South Central — Arkansas, Louisiana, Oklahoma, Tennessee, Texas; Great Plains — Iowa, Kansas, Nebraska, North Dakota, South Dakota; Rocky Mountain — Arizona, Colorado, Montana, New Mexico, Utah, Wyoming; West — Alaska, California, Hawaii, Idaho, Nevada, Oregon, Washington.
Source: Ellefson, Cheng and Moulton 1995.

TABLE A-28 Summary of research on variables affecting the decisions by private, nonindustrial forest landowners to plant trees in the United States

| | Price | | | | | | Interest rate | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Researcher | Sawtimber | Pulpwood | Reforest costs | Cost share | Tax incentives | Technical assistance | Short | Long | Income | Farm occupation | Size |
| Alig (1986) | 0 | | | + | | | | | + | | |
| Brooks (1985) | 0 | | - | + | | | | | | | |
| Cohen(1983) | + | | 0 | + | | | | 0 | | | |
| de Steiguer (1984) | 0 | | | | | | 0 | | + | | |
| Hyberg & Holthausen (1989) | + | | - | + | | 0 | | | 0 | 0 | 0 |
| Romm and others (1987) | | | | | | | | | + | | |
| Royer (1987) | 0 | 0 | - | + | | + | | | + | 0 | 0 |
| Royer & Moulton (1987) | 0 | 0 | 0 | + | + | + | | | + | 0 | |
| Royer & Vasievich (1987) | 0 | 0 | - | + | | | | | + | 0 | |

Note: Variables tested and significant are represented by (+) and (-); those tested and insignificant are represented by (0).
Source: Alig et. al. 1990.

TABLE A-29 Effectiveness of state forestry programs focused on private forestry activities as judged by program managers, by activity and program type, 1992

| Forestry Activity or Objective | Rating of Program Effectiveness[a] | | | | | |
|---|---|---|---|---|---|---|
| | Educational Programs | Technical Assistance | Voluntary Guidelines | Tax Incentives | Fiscal Incentives | Regulatory Programs |
| Protect Water Quality | 3.70 | 4.68 | 3.14 | 2.98 | 3.85 | 3.08 |
| Promote Reforestation | 3.59 | 4.54 | 2.29 | 3.64 | 4.53 | 2.60 |
| Improve Timber Harvesting Methods | 3.96 | 4.58 | 2.82 | 3.58 | 3.64 | 2.74 |
| Protect from Wildfire, Insects and Diseases | 4.25 | 4.74 | 2.87 | 2.78 | 3.08 | 3.67 |
| Protect Wildlife and Endangered Species | 4.55 | 4.43 | 2.86 | 2.77 | 3.24 | 3.22 |
| Enhance Recreation and Aesthetics | 4.44 | 4.72 | 3.06 | 3.22 | 3.83 | 1.94 |
| Mean Rank | 4.08 | 4.61 | 2.84 | 3.16 | 3.69 | 2.87 |

[a]Effectiveness ratings assigned by program managers using an ordinal scale of 1 = very ineffective; 6 = very effective.

Source: Ellefson et al. 1995.

APPENDIX
B

# I. Federally Directed Assistance and Incentive Programs

## FOREST HEALTH MANAGEMENT

### Federal Lands Forest Health Management and Cooperative Lands Forest Health Management Programs

A major function of the Federal and Cooperative Lands Forest Health Management programs is to provide technical and financial assistance to states and other federal agencies. The USDA Forest Service cooperates with state governments to survey and evaluate insect and disease epidemics and provides public nonfederal and private landowners with technical assistance and training. The USDA Forest Service also provides information needed to assess the health of all the nation's forests, to identify ecosystem conditions conducive to insect and disease epidemics, and to plan coordinated pest-management activities when insect and disease epidemics threaten federal, state, county, municipal, and private forestlands. The cost of this program is shared by the USDA Forest Service and state governments. States provide 50 percent or more of survey funding. Financial assistance is also provided to state agencies and a number of insect- and disease-suppression activities based on the following rates: 25 percent on public nonfederal lands, 33 1/3 percent on industrial lands, and 50 percent on nonindustrial private lands.

### Cooperative Lands Fire Protection Program

The Cooperative Lands Fire Protection Program is made up of several smaller programs that provide technical and financial assistance to state gov-

ernments. Fire protection needs are expected to increase gradually over time to support the level of fire protection needed for valuable wildlands and structures and to meet the increased threat of fire resulting from human habitation in places where wildlands and urban areas meet. The objectives of the smaller programs include: reducing the risk of wildfire; improving the efficiency of state government fire protection programs; organizing, training, and equipping rural fire departments; and encouraging more regional and national cooperation. To accomplish these objectives, excess federal equipment is recycled and loaned to state agencies for wildfire protection and suppression; assistance to the states, primarily in the form of technical advice during extreme fire emergencies is provided; and individual fire prevention and protection awareness is promoted.

## COOPERATIVE FORESTRY

### Economic Action Programs

Funded at $14.5 million in FY 1996, these programs collectively are designed to strengthen communities, diversify local economies, and integrate economic and environmental concerns. Specific activities include research to improve the efficiency of wood uses, expand recycling, and extend the useful life of wood products; development and expansion of marketing strategies that increase the economic activity associated with forest resources; and providing broad-based assistance that helps communities diversify and expand their economies through the use of natural resources.

### Forest Legacy Program

Funded at $3 million in FY 1996, this program uses conservation easements and other mechanisms to protect forests from conversion to nonforest uses.

### Forest Stewardship Program

Funded at $23.4 million in FY 1996, this program assists private landowners in the application of biological, ecological, and economic resource management principles and seeks to balance commodity outputs with noncommodity resources.

### Natural Resource Conservation Education

Although not funded in FY 1996, this program is designed to facilitate learning about ecosystems and natural resources, and their conservation, management, use, and value to society.

### Pacific Northwest Assistance Program

Funded at $16 million in FY 1996, this program provides economic adjustment assistance to states and communities affected by the President's Forest Plan for the Pacific Northwest. It includes the Old Growth Diversification Program.

### Stewardship Incentives Program

Funded at $4.5 million in FY 1996, this program is designed to enhance the management of nonindustrial private forestlands through financial assistance in the form of cost sharing. Practices funded include the development of forest stewardship plans, reforestation and afforestation, forest improvement, agroforestry projects, soil and water protection and improvement, riparian and wetland protection and improvement, fisheries habitat enhancement, wildlife habitat enhancement, and forest recreation enhancement.

### Urban and Community Forestry

Funded at $25.5 million in FY 1996, the USDA Forest Service, in partnership with the state forestry agencies, provides technical information on planning and managing urban forests. It works to improve communities through the planting and managing of trees, shrubs, and other vegetation (USDA Forest Service 1989a).

## TRANSFER AND COST-SHARE PROGRAMS

### Conservation Reserve Program

Authorized by the Food Security Act of 1985, the CRP targets the most fragile farmland by encouraging farmers to stop growing crops on cropland designated by soil conservationists and to plant a permanent vegetative cover instead (for example, grass, trees). In return, farmers receive an annual rental payment for the term of the multiyear contract. Cost-shares are also available to help establish the permanent planting of grass, legumes, trees, windbreaks, or wildlife flora. Through 1992, 2.3 million acres of trees have been planted under this program (Kurtz et al. 1994).

The 1996 farm bill adjusted the CRP, and reauthorized it through 2002. Currently, up to 36.4 million acres can be enrolled at any one time. New enrollments can replace expired or terminated contracts. Owners or operators who entered into a contract before 1995 can terminate contracts on certain acres after giving written notice. Their contracts must have been in effect for at least five years. Lands with high environmental values are not eligible for early release. The Secretary of Agriculture has discretionary authority to offer future early withdrawals of CRP acres.

### Wildlife Habitat Incentives Program

The Wildlife Habitat Incentives Program, a recent addition to CRP, is designed to help landowners improve wildlife habitat on private lands. The program's funding ($50 million in CRP funds) is to be expended over several years. The program provides cost-sharing to landowners for developing habitat for upland wildlife, wetland wildlife, endangered species, fisheries, and other wildlife. It also provides for consulting with state technical committees to set priorities for cost-share measures and habitat-development projects.

### Environmental Quality Incentives Program

EQIP is a new program that combines the functions of the Agricultural Conservation Program (ACP), the Water Quality Incentives Program, the Great Plains Conservation Program, and the Colorado River Basin Salinity Control Program. EQIP is funded at $130 million in FY 1996 and $200 million annually thereafter. Livestock-related conservation practices will receive 50 percent of program funding, and the remainder can be used for other conservation concerns. Land eligible for EQIP contracts is agricultural land that poses a serious problem to soil, water, or related resources. The program is to be implemented through 5- to 10-year contracts to provide technical assistance and pays up to 75 percent of the costs of conservation practices. Activities under the contract must be carried out according to a conservation plan. Total cost-share and incentive payments to any person are limited to $10,000 annually, and to $50,000 for the life of the contract.

### Forestry Incentives Program

The Forestry Incentives Program (FIP), established in 1973, provides financial assistance to private forestland owners for tree planting and timber stand improvement. Between 1974 and 1992, approximately 3 million acres of nonindustrial private forestlands were planted (Kurtz et al. 1994). The requirements for participating landowners include a minimum quality site and a minimum plantation size. Funding for the program flows through the USDA Natural Resources Conservation Service, which issues the cost-share payments to participants. However, the USDA Forest Service, in cooperation with the state forestry agencies, provides technical assistance to private landowners participating in the program. This program has been authorized through 2002. Total cost shares provided in 1995 were $9,258,119.

### Tree Assistance Program

The Tree Assistance Program (TAP) provides financial assistance to cover losses such as orchard trees, forest-tree seedlings, and nursery inventory. The trees

eligible for relief vary slightly from year-to-year. Eligibility for relief comes primarily from weather-related causes, such as drought, flood, ice storms, or similar conditions. The program is administered by USDA Farm Service Agency. Total cost-shares provided in FY 1995 were $3,781,891.

# II. Federal Regulatory Programs

*Clean Water Act* of 1972 (as amended) charges states with the responsibility of developing plans to manage and assess the extent of impact of nonpoint sources of water pollutants. The plans chosen must be approved by EPA. In some cases the plans have been the genesis of a state's forest-practice regulatory program. Enforcement of the nonpoint-source provisions are a state responsibility. Section 404 of the act authorizes the U.S. Corps of Army Engineers to regulate wetlands, although "normal" forestry practices are exempt. The act also requires permits for placement of dredge or fill material in wetlands, although normal silvicultural activities are exempt (U.S. General Accounting Office 1993). The U.S. Army Corps of Engineers enforces the dredge and fill program, although the EPA retains ultimate authority over exemptions and their interpretation.
(Reference: 33 U.S.C. 1251 et. seq.; Clean Water Act [CWA] Sections 301-404; 40 C.F.R. Sections 110-129)

*Coastal Zone Management Act* Re-authorization Amendments of 1990 charge states with implementing in coastal zones various forest-management measures that must be in conformity with guidelines published by EPA and the National Oceanic and Atmospheric Administration. States must demonstrate that their implementing programs are as effective as measures recommended by EPA. In some states, state programs have included regulatory actions. This act requires states to devise and implement programs to preserve, protect, and restore coastal resources. Program implementation must be consistent with federally established forest-management measures. Implementation of the latter must be with enforceable policies and procedures. Administrative responsibility rests with EPA and the National Oceanic and Atmospheric Agency (NOAA).
(Reference: as amended by PL 92-583; 16 USC 1451 et seq.; 15 C.F.R.; Federal Consistency With Approved State Coastal Management Programs 15 C.F.R. 930)

*Clean Air Act* authorizes EPA to establish air-quality standards that are to be met primarily via state implementation plans. In addition to health concerns, states programs are to prevent "impairment of visibility" in certain designated areas (urban areas, national parks, wildlife refuges, and wilderness areas). States must adopt programs that accomplish federally established air quality standards. From a forest-practice perspective, prescribed burning is the primary focus of current

programs. State forestry offices usually administer smoke-management programs. The visibility-impairment provision in implementing the law continues to cause confusion. EPA is responsible for administering the act.
(Reference: 42 U.S.C. Sections 7401 - 7671q; Clean Air Act [CAA] Sections 101 - 618; 40 C.F.R. Sections 50 - 95)

*Comprehensive Environmental Response, Compensations, and Liability Act* of 1980 (Superfund) authorizes federal remedial action on hazardous-substance disposal sites that are a danger to public health. EPA is authorized to clean up the site and recover the costs of doing so from the parties responsible for the hazardous site. Forest landowners can be held liable for hazardous-waste disposal by previous parties. This act imposes liability (for example, cost recovery for cleanup) on private parties that contribute to the improper disposal of hazardous substances, (such as cleaning solvents, wood-treating chemicals, and old chemicals). EPA is responsible for administering the act.

*Federal Insecticide, Fungicide, and Rodenticide Act* of 1991 (amended) regulates pesticide application by requiring that restricted-use pesticides be applied only by certified applicators. U.S. Environmental Protection Agency rigorously enforces the act in any state that does not fully implement a plan that is consistent with the requirements of the act. In some states, county and municipal requirements might be more stringent than federal requirements; that has caused considerable confusion. The Agricultural Worker Protection Standard (WPS) is also a noteworthy provision of the act that requires landowners to protect workers from pesticides (for example, by providing warning signs). This act requires federal standards for registration, distribution, and use of pesticides, including protection of workers from pesticide exposure. Conditional authority is authorized to remove from use any unregistered pesticide. Most pesticide application is limited to certified applicators. Enforcement rests with EPA, although state and local governments may (within limits) regulate pesticide use. (References: 40 C.F.R Section 151 et seq.)

*Endangered Species Act* of 1973 (as amended) authorizes regulatory actions to conserve endangered and threatened species and their ecosystems. Regulations for terrestrial and fresh water species are administered by the U.S. Fish and Wildlife Service; for marine and anadromous species, the National Marine Fisheries Service. Species listing and habitat designation is undertaken by a lengthy rule-making process; a decision to list a species is based solely on biological factors. For listed species, federal regulatory action can be initiated for (1) forestry practices that jeopardize any species' existence (or destroy any species' habitat); and (2) persons that harass, harm, kill, or capture listed species. The first regulatory action applies primarily to federal lands but can involve private land if the landowner seeks some form of federal action (for example, supplying a per-

mit). The second action can be taken against both public and private forest landowners. The law also regulates removal or damage to any endangered plants on federal land; private landowners can proceed without regard to listed plants if they are not in violation of state law. This act prohibits harmful actions, including habitat modification, that would harass, harm, kill, trap, or involve collection of endangered or threatened species of flora and fauna. Habitat conservation plans might be required. The act is enforced by the U.S. Fish and Wildlife Service and the National Marine and Fisheries Service. Citizen lawsuits can also be initiated.

*Rivers and Harbors Act* of 1890 regulates water-borne transportation of logs. A permit for obstructing waterways must be obtained from the U.S. Army Corps of Engineers. For all practical purposes, modern forestry practices are little affected by the act.
(Regulatory reference: 16 U.S.C. Sections 1531-1544)

*Occupational Safety and Health Act* requires the establishment and implementation of workplace safety and health standards. The act affects forest-related occupations, such as pulpwood workers, by setting standards for use of explosives, protective measures for chain-saw users, field sanitation conditions, and ways of felling, bucking, and limbing trees. The U.S. Department of Labor is responsible for administration and enforcement of the act.

# III. State Directed Forestry Programs

## ASSISTANCE AND INCENTIVE PROGRAMS

*Educational and technical-assistance programs* are commonly used by state forestry agencies as means of accomplishing any one of the above forestry activities (Table A-27). Although state interest in promoting reforestation is accomplished primarily by educational and technical-assistance programs, nearly 8 out of 10 states also use fiscal-incentive programs for such purposes.

*Voluntary-guideline programs* accounted for 13 percent of program applications. Again, depending on the forestry activity, voluntary-guideline programs exist in 30 to 68 percent of all states (Table A-27). Voluntary-guideline programs provide information about the best management practices for protecting aesthetics, wildlife, and water quality. Typical topics include the location, construction, and maintenance of roads; stream-crossing systems to protect streambeds; buffer strips or management zones along streams to reduce soil disturbance during harvesting; and the application of chemicals during site preparation for reforestation after harvest.

*Tax-incentive program*, which represented only 6 percent of program applications, is the program type least used to influence the forestry activities of private landowners. Depending on the purpose, only 6 to 32 percent of states have such programs (Table A-27). Although a majority of states do have special property tax assessments for private timberland used for general forestry or conservation purposes, tax incentives are generally not used to influence the application of specific forest practices. Tax incentives are usually part of a larger and more complicated system of state tax policies.

*Fiscal-incentive programs* comprised 15 percent of the 1992 program applications nationwide. Depending on program objectives, fiscal-incentive programs exist in 26 to 78 percent of all states (Table A-27). Financial assistance might be provided for timber production and stand improvement, fish and wildlife habitat management, re-establishment and management of forested wetlands, establishment and maintenance of windbreaks and shelterbelts, aesthetics management, management of recreational opportunities, and management of native vegetation.

## REGULATORY PROGRAMS

### State Level Programs

Regulatory programs account for 11 percent of state program applications nationwide. They exist in 16 to 54 percent of the states, depending on the forestry objective of the regulatory program (Table A-27). Although regulatory in nature, not all of these programs deal exclusively with forestry; they might, for example, represent authority to regulate nonpoint sources of water pollutants generally—of which forests might be only one of the sources. Though less common, regulatory programs administered by a state's chief forestry agency also protect forests from wildfire, insects, and diseases (54 percent of states) and protect wildlife and threatened and endangered species (40 percent) (Table A-27). Least common are regulatory programs that promote reforestation (28 percent) and enhance the recreational and aesthetic opportunities associated with private forests (16 percent).

### Local Level Programs

Municipalities and townships are the most common units of government enacting regulations. The most common goal for local regulatory ordinances is the protection of environmental benefits associated with forests—aesthetics, erosion control, water and air quality, and diverse wildlife habitat. In 1991, the number of local governmental units regulating forestry practices and the total number of these units were as follows: Colorado, 3 of 63 counties; Delaware, 1 of

3 counties; Florida, various of 57 counties; Georgia, 11 of 159 counties; Illinois, 100 of 1,200 municipalities and 1 of 102 counties; Louisiana, 1 of 64 parishes; Maryland, 20 of 23 counties; Michigan, 10 to 15 of 1,200 townships; Minnesota, 1 of 87 counties; New Jersey, 300 of 567 municipalities and 15 of 21 counties; New York, 70 of 900 municipalities; North Dakota, 7 of 53 counties; Pennsylvania, 13 of 420 municipalities; Vermont, 2 of 251 municipalities; and Wisconsin, 3 to 4 of 1,500 municipalities and 2 of 72 counties.

Source: Ellefson et al. 1995.

APPENDIX

# C

# Definitions of New Paradigms: Forest Health, Ecosystem Management, and Sustainable Forest Management

Paradigms guiding the use, management, and protection of forests in general are a reflection of society's interest in forests. In this respect, a number of new terms suggesting new paradigms have recently been introduced. Often rooted in principles of sustainability, concepts of "forest health," "ecosystem management," and "sustainable forest management" have been introduced to describe new paradigms. Although often lacking complete scientific and political acceptance, these terms convey concepts that can be useful in defining future directions for the use, management, and protection of forests.

## FOREST HEALTH

The definition of forest health is continually being reevaluated. For instance, where once forest fires and insect infestations were seen as indicators of unhealthy forests, and thus great effort was made to suppress them, forest landowners and managers today are appreciating the long-term contributions that these conditions can make to a healthy ecosystem. It may be said that the standards by which we measure forest health are determined by the objectives we aspire to. Forests managed for maximum timber yield will require different criteria for judging forest health than those managed for old-growth forest purposes. Likewise, the health of forests adjacent to or in urban communities will be judged with criteria that are quite different from those used to judge forests in rural areas where population densities are quite low.

Although there may not be a single, all-encompassing definition of "forest health," efforts are continually being made to articulate desired end-state condi-

tions of forests (DellaSala et al. 1995a). For instance, Costanza (1992) has stated, "To be healthy and sustainable, a system must maintain its metabolic activity level as well as its internal structure and organization (a diversity of processes effectively linked to one another) and must be resilient to outside stresses over a time and space frame relevant to that system." The author further proposes that an index of ecosystem health should include three parts: vigor, organization, and resilience. Vigor is measured by the productivity, or output, of timber, food, recreational opportunities, species populations, or other products of forest ecosystems. Organization is measured by the complexity of forest structures and by the diversity of the species present. Resilience describes the response of a system to disturbance.

Natural disturbances are a normal part of the long-term functioning of healthy forest ecosystems. The intensity of natural disturbances is generally inversely related to their frequency. Most disturbances of high intensity and low frequency, such as sustained high winds from hurricanes or wildfires under high winds in dense, dry forests, cannot be prevented by humans. Such disturbances tend to occur over a large geographic area and across land ownerships. Low-intensity natural disturbances, such as insects, diseases, and ground-level fires in other forest types, often can be managed by humans to either prevent or reduce the damage. These disturbances often occur at a local level and within one ownership.

The U.S. Department of Agriculture's (USDA) Forest Service (1993) has identified a number of issues in three forest-health categories: potentially acceptable resource situations, potentially deteriorating resource situations, and potentially serious resource situations. Nonfederal forests would be included in the categories of potentially deteriorating and potentially serious resource situations and would be important in any responses to them.

The 28 percent increase in the number of forest landowners over the past 15 years (Moulton and Birch 1995) and the associated decrease in the average size of ownership parcels of nonfederal forestlands (Chapter 2) document a clear trend toward increased parceling of nonfederal forestland. The impact of parceling might not affect the health of any one ecosystem. In fact, some evidence indicates that timber-harvesting behavior is inversely related to parcel size, the smaller owners being less likely to harvest (Moulton and Birch 1996). However, the recognition that ecosystems have functions in aggregate has important implications for the management of a single forest tract.

In relation to biodiversity, a decrease in the area of a particular forest tract should result in a decrease in the number of species the ecosystem can support, according to the theory of island biogeography and accepted species-area relationships (Soule 1991). However, assumptions of such equilibrium theories might be unrealistic. First, the productive potential of nonfederal forests has changed over time and future changes promise to be even more dramatic. Second, evidence is increasing that biodiversity is affected by landscape scale dynamics.

Third, nonfederal forests are not uniform and frequently must be considered within the context of adjacent federal lands. (The importance and management implications of federal ownership are highly variable by region.) On the other hand, the productive capacity of a forest tract, whether defined in terms of timber, pulp fiber, recreation, or watershed values, might be more affected by the tract's characteristics, such as the degree of canopy closure, age, and intensity of human management (including fire exclusion), than by the tract's physical relation to adjacent lands.

National programs addressing some aspects of forest health have been in place for decades, most focusing on timber supplies. The first program created to specifically monitor insects and diseases was the Cooperative Pest Action Program, which was renamed the Cooperative Forest Health Program. Air quality and other broad concerns fostered the development of a federal program to monitor long-term trends in the health and productivity of forested ecosystems (see Box Appendix C-1), although this program focuses on federal lands and the program currently operates in only 18 states.

**Box Appendix C-1**
**National Forest Health Monitoring Program (NFHMP)**

The overall goal of the National Forest Health Monitoring Program, initiated in 1990, is to monitor, assess, and report on the status, changes and long-term trends in the health of the nation's forest ecosystems. The Program is sponsored by the USDA Forest Service and the U. S. Environmental Protection Agency, in addition to three other Federal agencies, the National Association of State Foresters, about 20 universities, and the 18 states currently involved in monitoring activities. About 3,800 of the 12,600 permanent plots nationwide (excluding Alaska and Hawaii) are forested. In addition, off-plot monitoring, such as aerial surveys for defoliation, and analysis of other plot-based data such as the Forest Inventory and Analysis (FIA) database, are part of the Program. The current set of indicators for permanent plots include:

| | |
|---|---|
| Ozone bioindicator plants | Tree damage |
| Crown condition | Tree growth |
| Lichen communities | Tree mortality |
| Plant biodiversity | Tree regeneration |
| Photosynthetically active radiation | Vegetation structure |

Minimum detection standards are relatively coarse (e.g., for tree damage: 30-50 percent of trees affected over 30-50 percent of area). Funding is cost-shared with participating states. Each state receives a minimum of $20,000 per year with an additional $7 per thousand acres of nonfederal forest, with no state funds required in year one, graduating to 50 percent after year 3.

## ECOSYSTEM MANAGEMENT

Ecosystem management is a process-oriented approach to resources management, an approach that has been discussed largely as a paradigm for federal-land management (Agee and Johnson 1988, Clarke and McCool 1996, Overbay 1992). It recognizes that resource issues often cross property boundaries and that solutions to problems, whether they are forest fire, alien plants, or insects and disease, require coordinated strategies; in this respect, "landscape management" might be a more appropriate term. Ecosystem management does not necessarily imply increased government control of nonfederal lands but might result in increased federal involvement through cost-share programs, tax incentives, and cooperative management negotiations. Specific federal-agency focuses within the context of ecosystem management, such as the recent USDA Forest Service emphasis on reintroducing "natural ranges of variation" for processes like fire (Swanson et al. 1994), are not necessarily appropriate for nonfederal lands.

The wide range of definitions of ecosystem management has caused confusion and even threatens its future as a management paradigm. Divergent understandings of the concept have important operational implications (Bradley et al. 1995). Such words as "sustainability" or "integrity" have diverse connotations, and differences in the perceptions of an issue make communication difficult. Increased involvement by nonfederal-forest landowners in ecosystem management, if that is an agreed upon objective, cannot occur without increased communication.

Since being formalized through federal land-management policies, ecosystem management has become a driving force for federal involvement in nonfederal-forest land management for some time. Many nonfederal-forest landowners clearly do not accept the concept of ecosystem management. Nonindustrial private-forest landowners in three regions (Southeast, Midwest, and Interior West) surveyed in 1994 (Brunson et al. 1996) supported the general concepts of ecosystem management but were wary of a loss of property rights, a sentiment echoed nationwide by nonindustrial private-forest landowners (Argow 1996). Many said that they would be involved only if the partnership involved most of their neighbors, commodity values were expressly protected, and the federal government was not involved. Successful ecosystem management on nonfederal forestlands might involve limited or no federal involvement in some cases.

## SUSTAINABLE FOREST MANAGEMENT

The long-term efficacy of particular management regimes applied to specific forestlands whether federal, nonfederal, or private forests can be determined only in retrospect. Historical definitions of sustainable forest management have focused on the sustainability of timber yields (MUSY 1981, NFLC 1994). Recent international and domestic dialogues have identified broader sets of criteria

against which specific management regimens can be evaluated for their known or expected effects on the sustainability of the multiple resources of forests. In the absence of absolute measurements, various indicators have been proposed, so that relative sustainability from forest management can be scored for each criterion. Various sets of criteria and indicators for sustainable-forest management have been proposed. They range in applicability from national and international management levels (ITTO 1992, CSA 1994, UNCED 1995) to local forest-management units and operations. When the criteria and indicators are formalized through on-the-ground documentation and monitoring of specific local management operations, this market-driven process has become known as "forest certification," "green certification," "ecolabeling," or other synonymous terms (Viana et al. 1996).

Approaches to certification of local forest-management operations also range in specificity and scope, from the more narrowly applied Sustainable Forestry Initiative, a self-certification program adopted by the U.S. forest industry (American Forest and Paper Association 1994), to the more detailed and broadly applied voluntary certification programs of numerous nongovernmental organizations that offer independent, third-party verification and monitoring (Elliott and Donovan 1996). Most of the latter adhere to the principles and criteria for sustainable forest management derived by the Forest Stewardship Council (FSC 1994), an international nongovernmental and nonprofit accrediting organization. There is no universally agreed upon set of criteria and indicators, and there might never be, given the various motivations for their derivation.

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# About the Authors

**Paul V. Ellefson (Chair)** is a professor of forest policy and administration at the University of Minnesota where he has taught since 1975. Dr. Ellefson has extensive experience as chair of various state, national, and international forest policy initiatives. He currently is chair of the Minnesota Governor's Forest Resources Council. He is the author of four books on forest resource policy and has traveled extensively throughout the forested regions of the world. Ellefson is a Fellow of the Society of American Foresters and is a recipient of a Norwegian Marshall Fund Award. Dr. Ellefson received his academic training at Michigan State University and the universities of Michigan, Minnesota, and New Mexico.

**James K. Agee** is a professor of forest ecology at the University of Washington where he has worked since 1978. His research interests include the role of fire in natural ecosystems and the management of natural disturbances in park ecosystems. Dr. Agee is a member of the Ecological Society of America and the Forest Historical Society. He received his Ph.D. in wildland resource science in 1973 from the University of California–Berkeley.

**Keith A. Argow** is president of the National Woodland Owners Association and also president of American Resources, Inc. (a nationwide forestry support organization). He was formerly a research forester and a district ranger with the U.S. Forest Service, and associate professor of forestry at Virginia Tech. Dr. Argow earned his Ph.D. in forestry and political science from North Carolina State University with additional degrees from Colorado College (economics) and the University of Michigan (forestry). He is a Fellow of the Society of American Foresters and a member of Phi Beta Kappa National Honor Society.

**Jeanne Nienaber Clarke** is a professor of political science at the University of Arizona. She specializes in American politics, the history of natural resources policy in the United States, and organizational behavior. Her several books include a biography of former Interior Secretary Harold L. Ickes and a comparative study of federal resource managing agencies. Dr. Clarke is active in the American Political Science Association, the American Association of University Women, and Phi Beta Kappa National Honor Society. She received her Ph.D. from the University of California–Berkeley.

**Preston D. Cole** is the forester for the city of Milwaukee, Wisconsin. Mr. Cole is an expert in the management of urban ecosystems and was the first African-American hired as a forester by the Missouri Department of Conservation. He received his educational training in forestry and agronomy at the University of Missouri.

**Dominick A. DellaSala** has served as the Director of Forest Conservation at the World Wildlife Fund since 1993. His responsibilities include developing and managing the organization's temperate forest and carnivore conservation programs in the western United States and Canada. He has been active in many conservation efforts across the country including forest certification, landscape ecology, endangered species, and ecosystem conservation. Dr. DellaSala received his Ph.D. in natural resources from the University of Michigan–Ann Arbor in 1986.

**Henry Gholz** is professor of forest ecology and graduate coordinator at the University of Florida's School of Forest Resources and Conservation. In addition to his teaching and research responsibilities, Dr. Gholz holds affiliate appointments in the College of Natural Resources and Environment, the Center for Latin American Studies, and the Center for African Studies. In 1994–95 he was selected as a Science and Engineering Diplomacy Fellow for the U.S. Agency for International Development by the American Association for the Advancement of Science. Dr. Gholz received his Ph.D. in forest ecology/science from Oregon State University in 1979.

**J. Keith Gilless** is an associate professor at the College of Natural Resources at the University of California – Berkeley. His research studies include fire management on public and private lands and forest management issues on tribal lands. He received his Ph.D. in economics from the University of Wisconsin.

**Perry R. Hagenstein** is a consultant who works with government and industry on resource policy and management issues. He is also president of the Institute for Forest Analysis, Planning and Policy, a nonprofit research and education organization. He has served on many resource-related boards and committees

such as the American Forestry Association and the New England Natural Resource Center. Dr. Hagenstein received his Ph.D. in forest and natural resource economics from the University of Michigan in 1963.

**Neil D. Hamilton** is a professor of law and director of the Agricultural Law Center at Drake University Law School in Des Moines, Iowa, where he has taught for 14 years. He is a past president of the American Agricultural Law Association and in 1996 he received the association's distinguished service award. Professor Hamilton has an undergraduate degree in forestry from Iowa State University and in 1996 he was awarded the College of Agriculture's "Innovator in Agriculture" award.

**James E. Hubbard** has served as the state forester for the Colorado State Forest Service since 1984. Mr. Hubbard has been actively involved in local, state, and regional efforts to address questions in the management of private forests. Mr. Hubbard served as president of the National Association of State Foresters (1990) and American Forests (1996).

**Keith Ross** is a vice president and the director of land protection for the New England Forestry Foundation, a 52-year-old private, nonprofit owner of over 18,000 acres of forestland whose mission is to protect New England's working forests through land conservation, education, and regional forest policy. Mr. Ross is a forester and holds a Masters of environmental law from Vermont Law School.

**John T. Shannon** has served as the Arkansas state forester since 1994. He has also practiced law and has worked with state forestry agencies in Florida, Oklahoma, and Arkansas. He received his Master of forestry degree from Duke University in 1980 and his Juris Doctorate from the University of Arkansas–Little Rock in 1989.

**Ronald L. Trosper** is professor and director of the Native American Forestry Program at the Northern Arizona University. His research interests include the study of tribal management of natural resources on reservations. Dr. Trosper is a member of the Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation in Montana. He received his Ph.D. in economics from Harvard University in 1974.

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