Chapter 9

THEMES, RESEARCH, AND INFORMATION NEEDS

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...to accept certain kinds of change is not to accept all kinds of change. Moreover, we must focus our attention on the rate at which changes occur, understanding that certain rates of change are natural, desirable, and acceptable, while others are not (Botkin 1992).

Introduction

Driven by social forces discussed in this Assessment, change is sweeping across the southern landscape unlike anywhere else in the United States. These changes are affecting forest ecosystems and creating challenges for managers of natural resources. Current knowledge, skills, and approaches are insufficient to meet these challenges. There is little doubt that research could contribute much to the solution of natural resource concerns in the interface. ▶

Photo courtesy of USDA Forest Service

Figure 9.1
Wildland-urban interface issues are about people and their relationship with and effect on natural resources.

In the South, where the wildland-urban interface is expanding most rapidly, ecological and sociological effects are readily apparent. In the foregoing chapters, where these effects were examined, four major themes emerged:

1. Wildland-urban interface issues are about people.
2. Public policy plays an important role in creating and solving interface problems.
3. Interface issues are interdisciplinary.
4. Issues involve multiple ownerships, jurisdictions, and scales.

Results of the Assessment suggest four major areas for research:

1. Explaining and adapting to human influences on forest ecosystems.
2. Identifying the influences of public policies on forest ecosystems and their management.
3. Identifying and reducing risk to ecosystems and people in the wildland-urban interface.
4. Understanding and communicating public attitudes, perceptions, and values.

The remainder of this chapter addresses the major themes that were found and the research areas that were identified.

Major Themes

Wildland-Urban Interface Issues are About People

The first major theme of the Assessment is that wildland-urban interface issues are about people and their relationship with and effect on natural resources (**fig. 9.1**). This theme first emerges in chapter 2 (Population and Demographic Trends in the South), which demonstrates how significant population and demographic trends, shifts in land ownership, and the dramatic transformation of the landscape alter forest ecosystems in the South. Alterations are caused not only by population increases, but also by changes in attitudes, perceptions, and priorities of this population with respect to land use. These new values can be attributed to a populace that is moving, aging, and becoming more culturally and ethnically diverse.

Changing perceptions, attitudes, and values affect the way in which forests are perceived and managed in the transition from rural to interface, and eventually, to urban use. Along this gradient, predominant forest values change from traditional forest products, such as wood and fiber, to noncommodity benefits such as improvement of air and water quality and conservation of energy. Multiple ownerships and jurisdictions, increased recreation demand, and pressures from adjacent homeowners and landowners complicate forest management. As a result, forest management objectives change. These human influences ultimately determine future forest management strategies in the wildland-urban interface.

With increases in the South's population come even more dramatic increases in the conversion of rural and forest land to urban uses. Six of the ten U.S. States with the highest rates of rural-to-urban conversion are in the South. Chapter 5 (Urban Influences on Forests) shows that urbanization directly alters forest ecosystems by removing or fragmenting forest cover. The rate and scale of change that is occurring in the South significantly affect forest health and the goods and services that people rely on from forest ecosystems. Consequently, human health and quality of life are affected.

Relationships between people and natural resources are intricate and complex. Research can help us to better understand and predict these relationships. Education plays a key role in helping people to understand these relationships and the consequences of their actions.

Public Policy Plays an Important Role in Creating and Solving Interface Problems

The second major theme of this Assessment is the important role of public policy in the wildland-urban interface. This theme closely links with the first because public policy is driven and shaped by people's attitudes, values, and perceptions. Policy issues in the wildland-urban interface are complicated by the diversity of landowner objectives, by property rights issues, and by land use impacts across property boundaries. Some public policies help to protect and conserve natural resources, while others create incentives for urban development (**figs. 9.2A, 9.2B**). Thus, public policies can create problems as well as provide solutions in the interface.

One way that public policies affect the interface is by influencing land use change. Chapter 4 (Land Use Planning and Policy Issues) shows that Federal

Photo by Larry Korhnack, University of Florida

(A)

Photo courtesy of USDA Forest Service

(B)

Figure 9.2
(A) Some public policies help to protect and conserve natural resources; (B) other policies create incentives for urban development.

"Natural resources accounting is needed to point out to people what is being lost. We need a whole new way of taking into account the value of the resources that is potentially being lost to urbanization." Virginia

policies provide incentives for migration to and subdivision of land in the interface. Often, however, the greatest effects on land use decisions come from local public policies, especially land use planning. It is at this local level where public values and perceptions have the greatest effect on policy. For example, citizens opposed to activities that could result in deforestation, such as land development for urban uses, may push for conservation regulations that may inadvertently interfere with traditional forest management practices.

Conflicting policies at various levels can set up complex situations. Chapter 8 (Fire) discusses one such situation. Local and State governments can establish ordinances to reduce the risk of wildland fire by lessening fuel loads. Prescribed fire is the least expensive way of reducing fuel loads, but the particulate matter in the smoke can create health problems. Fuel reduction policies, therefore, may conflict with Federal clean air policies (**fig. 9.3**).

Because public values and perceptions ultimately dictate policy, accepted policies will be those that an informed public supports. Chapter 2 points out that population growth is greatest in urban areas. Urban constituencies, therefore, will have the greatest impact on national and State policies affecting natural resources and the management of public land. Though natural resource information and technology transfer programs must be targeted to a variety of audiences, those that focus on urban constituents and policymakers may well have the greatest influence on the creation of policies that support natural resource management and conservation, and begin to address complex interface-related issues.

In the changing political environment of the interface, it is critical that natural resource professionals understand the various policies and decisionmaking processes unique to the interface. The most important role of resource professionals in this decisionmaking is to provide the best available natural and social scientific information. This information should come from an aggressive program of research and technology transfer.

Photo by Cotton Randall, University of Florida

Figure 9.3
Prescribed fire offers a management tool that temporarily reduces fuel loads, but particulate matter found in smoke can create air quality and health concerns. Fuel reduction policies, therefore, may conflict with Federal clean air policies.

Interface Issues are Interdisciplinary

The third major theme of the Assessment addresses the interdisciplinary nature of wildland-urban interface issues. Any one wildland-urban interface issue cannot be addressed in isolation. Chapter 8, for example, shows us that fire concerns in the interface cannot be resolved solely from a resource management perspective. Land use planning and policy, economics, social dimensions, and demographics must also be taken into account. Building relationships across multiple disciplines enhances opportunities for addressing interface issues.

Many other examples throughout the Assessment could be used to illustrate the interdisciplinary nature of interface issues. The push to diversify the southern economy (chapter 3) helped create a climate conducive to the migration to the South. As more diverse employment opportunities have increased in both urban and rural areas, there has been a corresponding increase in urban sprawl. Local policy (chapter 4) has helped to fuel this migration by providing incentives for economic development and exploitation of the interstate highway system.

As land uses change in the interface, property values and taxes often increase. Consequently, the sale of subdivided land can become more profitable for the landowner than continuing to practice forestry. Upfront costs for improving infrastructure and providing public services are extremely high. Often, these costs exceed the tax revenues for local government generated by conversion of forest land (chapter 3).

Urbanization has many direct and indirect effects on forest ecosystems (chapter 5). Changes significantly affect forest health and modify the goods and services provided by forest ecosystems. These changes also create environmental risks. While human modification of forest ecosystems is not unique to the South, the current rates, patterns, and permanence of modifications are.

As cities grow and the wildland-urban interface expands, interactions between new and traditional landowners increase. These two types of landowners may have different attitudes about how forests should be used and if they should be managed. As a result, forest management practices may be regulated and must be adapted (chapter 6). Chapter 8 uses fire management to show the kinds of issues that can arise. For example, negative public perceptions about smoke production can influence the ability of managers to use prescribed fire in the interface.

Settlement of the interface raises quality-of-life issues (chapter 7) (**fig. 9.4**). Obvious benefits of settling the wildland-urban interface include cleaner,

Photo courtesy of USDA Forest Service

Figure 9.4
Settlers of the wildland-urban interface may seek an improved quality of life.

healthier, and safer lifestyles. As the density of settlement increases, however, benefits that early settlers sought will change. Some may move farther from the city to a new interface. Those who stay may influence local public policies affecting natural resource management.

Interface issues, therefore, must be addressed simultaneously by a variety of disciplines. The resource professional must take an interdisciplinary view of interface issues and work with a diverse group of professions including biologists, planners, economists, policymakers, and many others that influence interface forests.

Issues Involve Multiple Ownerships, Jurisdictions, and Scales

The fourth theme addresses challenges associated with multiple ownerships, jurisdictions, and issues related to scale. Subdivision of interface tracts results in a diversity of owners and management objectives. Urbanization and the resulting changes to forest ecosystems extend over large regions and cross multiple jurisdictional boundaries. Multiple ownerships, jurisdictions, and scales create pressures on forest resources and complicate efforts to manage them.

Chapter 6 shows that as tract size decreases and the number of landowners increases, landowner objectives become increasingly diverse and the need for small-scale management techniques becomes more critical. Many new landowners prefer noncommodity values to timber harvests. Conflicts may result when adjacent landowners implement practices for different management objectives. Techniques for small-scale management do not yet exist or are not cost effective. These complexities underscore the importance of developing adaptive management techniques, new technologies, and education techniques to address the changing conditions and increased human influence characteristic of the interface.

Management and conservation of forest resources in the interface is further complicated by scale. For an individual landowner, the scale may be 1 to 10 acres. However, ecological concerns, such as invasive exotics or wildland fire risk, often exist at the landscape or even the watershed scale. Policy and regulatory units also cover large scales, but rarely match the problems that are being addressed. For addressing air and water pollution concerns, for example, the appropriate scale may be regional, but regulations may exist only at the county level. A typical landscape comprises many distinct yet interconnected ecosystems that cross ownership and jurisdictional boundaries. Forest ecosystems become fragmented when adjacent landowners implement varied and uncoordinated management practices. Local, State, and Federal Governments can impose different and often conflicting policies that complicate land use and management of forest resources.

These challenges are addressed most effectively when efforts are coordinated across the landscape. Landscape-scale management requires collaboration among public and private landowners and public participation in planning processes. Cooperative programs are needed to bring together landowners in a geographic region and establish common goals and practices. This approach could make possible some practices, such as harvesting and burning, which would otherwise be socially unacceptable or economically infeasible. Involvement of multiple stakeholders is important for effective forest resource management that meets diverse objectives across multiple ownerships and jurisdictions. Landscape level management must also incorporate ecological, social, and physical components of several ecosystems to solve the complex challenges of managing forests in the interface.

Research Areas

This Assessment describes the changes that are occurring in the South's wildland-urban interface. It lists factors driving these changes, as well as the influences on forest ecosystems, the challenges to forest management, and the social consequences of the changes. Forest resource professionals must adapt existing management techniques and develop new ones to positively influence ecological and social changes occurring in the wildland-urban interface. Part of this challenge is met outside of the forest through participation in community land use planning, collaboration with new partners, management through cooperatives, work across boundaries, and education. Natural resource professionals must also understand the complexity of interface issues, such as complications presented by multiple scales and jurisdictions.

Do we in the forestry community fully understand the complex array of issues in the wildland-urban interface? Do current programs, tools, and resources meet our needs? Are we adequately educating and training resource professionals to meet these challenges? Does research address identified needs, and are practical applications of research findings being built? At present, the answer to each of these questions is "No." This Assessment, therefore, must conclude with a call for a new and fully integrated program of basic and applied research, the development of new technologies, and a comprehensive approach to information dissemination. Resolution of wildland-urban interface issues requires information based on the best available research, communicated in an understandable way to decisionmakers, practitioners, and the public.

The Assessment has identified critical research and information needs. Those needs fall into four cross-cutting areas.

Photo by Charles Fryling

Figure 9.5
There is a need to better understand the effects of nonnative species, such as common privet (*Ligustrum vulgare L.*), on ecosystem structure, function, composition, and processes.

Explaining and Adapting to Human Influences on Forest Ecosystems

This research area addresses the need to understand the effects of land conversions, forest fragmentation, altered disturbance regimes, pollution, and nonnative species on ecosystem structure, function, composition, and processes (**fig. 9.5**). Applied research in this area must also develop adaptive management practices, such as small-scale forest management techniques. It must develop the tools necessary for management agencies to address challenges presented by urbanization and multiple small-scale land ownerships.

"Is it possible to develop alternatives to the current development schemes where you can still maximize the economic benefits while protecting the environmental values?" Georgia

Modeling and long-term monitoring that assess urban effects on forest ecosystems are also needed. Models are needed to predict the impacts of land use changes on landscape heterogeneity, and ecosystem composition, structure, and function. Monitoring that includes remote sensing and computer-mapping technology is essential to address the issues presented by multiple scales, landownerships, and jurisdictions. Through map overlays, it is also possible to integrate contributions from different disciplines. The measurement of change at various scales and

Photo by Cotton Randall, University of Florida

Figure 9.6
More needs to be known about the use of prescribed fire for reducing fuel accumulations in the wildland-urban interface.

across multiple disciplines, and the development of indexing systems and forecasts will allow us to put the best available science behind decisionmaking.

Identifying the Influences of Public Policy on Forest Ecosystems and Their Management

This problem area addresses the need to better understand the relationships among policy, land use change, and the resulting effects on forest ecosystems. Policies influence natural resources in many ways. They set standards for air and water quality. They limit land management practices. They affect the economics of land use. They affect taxation, land use planning, and transportation. There is also a need to understand the roles, strengths, and weaknesses of various policies that address natural resource management and conservation issues in the wildland-urban interface.

Reliable interdisciplinary models are needed for land use and natural resource decisionmaking at various scales. There is also a lack of reliable natural resource information about critical wildlife habitats, aquifers, and other environmental quality indicators for interface policy analysis. In the absence of relevant scientific and technical data, environmental needs cannot be prioritized and long-term threats may not be identified.

The most important contributions of science to resolution of interface issues may be in the policymaking arena. Needs include basic discovery, modeling, and an aggressive program of information and technology transfer.

"We need to listen to the public and understand what they want and then translate that into something that is going to work." Texas

Identifying and Reducing Risk to Ecosystems and People in the Wildland-Urban Interface

In the interface, important risks associated with urbanization include fire, invasive species, groundwater contamination, forest health, and environmental changes. Such factors create risks for both forest and human communities. Controlled experiments and historical studies are needed to assess the synergistic effects of various land conversions, altered disturbance regimes, atmospheric pollution, and nonindigenous species on environmental quality, forest health, and the

establishment and growth of native and nonindigenous species. This work should include assessing how nonindigenous species are altering composition, structure, and function in the numerous ecosystems of the South.

Some specific research needs related to fire include: (1) using prescribed fire to maintain and enhance ecological process and reduce accumulations of fuels (**fig. 9.6**); (2) studying alternative hazardous fuel reduction techniques; (3) validating and improving smoke and fire behavior prediction models; (4) determining the flammability of exotic species and landscape products; (5) developing defensible space models; and (6) determining the effectiveness of various landscape and structural characteristics that protect homes from fire.

Two important research needs in this problem area cross into other problem areas. The first is the role of public policy in altering wildfire risk in the interface. The second issue is how public values, attitudes, and perceptions influence policies related to wildland fire prevention and mitigation activities.

Technology also plays an important role in this problem area. It could help us to predict land use impacts on ecosystems, forest health, and the environment. It could also help us to determine thresholds of responses in the form of resource management and public policy. Long-term monitoring is needed to assess urban effects on ecosystem processes, such as nutrient and carbon cycling, hydrology, and productivity, as well as effects on air and water quality and forest health.

Understanding and Communicating Public Attitudes, Values, and Perceptions

An important element of this problem area is to ascertain the knowledge, attitudes, and preferences of urban and interface residents related to the management and conservation of natural resources. It is also important to understand how differences in ethnicity, age, and cultural backgrounds influence public use and management of forests, as well as how these characteristics influence public policy (**fig. 9.7**).

This information must be communicated to natural resource managers and the public for development of effective communication strategies, outreach messages, educational programs and activities, and conflict resolution. New methods for communicating with landowners and distributing forestry advice and assistance are needed, as well as new ways of describing the goals of forest management to homeowners and landowners. Strategies for communicating wildfire risk, for example, that are sensitive to homeowner preferences and values will likely be more effective in changing homeowner behavior.

Demographic research also falls into this problem area. Such research could develop data and models, indexing systems, and other tools for monitoring and forecasting urban expansion, economic development, and resulting human influences on land use change.

Photo courtesy of USDA Forest Service

Figure 9.7
Research is needed to better understand how differences in ethnicity, age, and cultural backgrounds influence public use and management of forests.

Conclusion

The products of interface research will include data, information, models, tools, communication and public participation strategies, educational programs, and adaptive management practices. The research will lead to a greater understanding of changing demographics and resulting influences on natural resources and their management. It will improve public understanding of relationships

between people and natural resources. Studies at various scales and across multiple jurisdictions will help resource managers and policymakers determine what actions are most economically effective and socially acceptable in improving social and environmental conditions in the wildland-urban interface. Putting usable information into the hands of decisionmakers will require comprehensive information and technology transfer. The needs of various groups of customers will have to be identified and addressed. Throughout the research and research application processes, the views of important stakeholders will have to be incorporated. Important stakeholders include natural resource professionals, various types of landowners, and those with control and decisionmaking authority over the land. The responsibility to integrate stakeholders into the decisionmaking process requires open dialogue conducted in nontechnical terms.

Wildland-urban interface issues are about people and their relationships with and effects on natural resources. A main goal of this proposed program of integrated research, information, and technology transfer is to help people understand and influence change in the wildland-urban interface. Armed with this knowledge, people can address interface challenges and make decisions based on the best available information.

Literature Cited

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The Forest Service, U.S. Department of Agriculture (USDA), is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.

Macie, Edward A.; Hermansen, L. Annie, eds. 2002. Human influences on forest ecosystems: the southern wildland-urban interface assessment. Gen. Tech. Rep. SRS–55. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 159 p.

This publication provides a review of critical wildland-urban interface issues, challenges, and needs for the Southern United States. Chapter topics include population and demographic trends; economic and tax issues; land use planning and policy; urban effects on forest ecosystems; challenges for forest resource management and conservation; social consequences of change; fire; and themes, research, and information needs for the wildland-urban interface.

Keywords: Demographics, economics, fire, forest ecology, land-use planning, natural resource management, public policy, taxation, urbanization, wildland-urban interface.