

## Interrelationships Among Sustainability Criteria

The criteria and indicators are useful as a tool for comprehensively tracking trends in the components that are important to sustainability and evaluating them in relation to one another. It is essential to look at the big picture to determine how the environmental, social, and economic systems are interconnected. Taking this extra step helps identify pressing issues that have implications across the criteria and are critical to preserving the health of forest ecosystems for future generations. In the course of the assessment of forest sustainability for the Northern United States, several such issues have surfaced—the size of the forested land base, the degree of forest fragmentation, the age of the forest, the spread of exotic and invasive insects, diseases, and plants, and land ownership patterns.

### The Size of the Forested Land Base

The increases in the forested land base over the last century are coming to end, and decreases are projected for the future. Genetic, species, and ecosystem diversity depend on the presence of forests and their associated plants and animals, as well as forest composition and distribution. The magnitude of forest land loss can have implications for the natural processes critical to ecosystem health. Social and economic benefits are affected by the amount of forest land available for harvesting wood and nonwood products, for recreation, and for general well-being. The size of the forested land base also influences environmental services related to clean air, water quality, and carbon storage. As less land is available to meet stable or increasing demands, competition among incompatible uses will increase, as will the need for public and institutional intervention in the provision of social goods and services.

### The Degree of Forest Fragmentation

Forest fragmentation due to urban and suburban development is expected to have long-term negative effects across multiple criteria. The degree of impact varies across the region. The loss of large blocks of forested habitat for interior forest species and connectivity among remaining forest habitat raises concerns for biodiversity. The degree of fragmentation can affect the spread of insects and diseases, and reduce the quality of wildlife habitat for some species. Watershed hydrology is altered by the pattern and degree of development. Fragmentation affects the economic viability of wood harvest operations and, when associated with increased parcelization, often results in reduced public access for recreation. It also leads to changes in research and technical assistance needs and demands for services.

### The Age of the Forest

The proportion of mature forests is increasing on a regional scale, with exceptions at subregional and landscape scales. The natural aging of forests provides opportunities to meet old growth and late successional wildlife management objectives, although at the landscape scale, management intervention may be necessary to maintain representative mid- and early successional communities. Large woody debris contributions to lakes, streams, and the forest floor may increase and improve habitat for some terrestrial and aquatic species. Forests of healthy mature trees have high economic and aesthetic value. As trees enter senescence they become more vulnerable to insects and disease, which may also affect their market value. Research, management, and public debate are likely to affect the desired balance among

## Interrelationships

---

age classes for the purposes of biodiversity, investment in forest industry, and community economic stability.

### **The Spread of Exotic and Invasive Insects, Diseases, and Plants**

Exotic and invasive insects, diseases, and plants impact forest health and forest uses. The effects can be discerned at subregional, landscape, and local scales. Exotic and invasive species can alter the composition, structure, and processes of natural communities as well as wildlife habitat. Damaging agents can reduce both the resilience of forest ecosystems to environmental stresses and their productive capacity. Infestations can alter a forest's aesthetic qualities and its desirability for recreational purposes. Forest, recreation, wildlife, and nursery managers need to be alert to their roles in controlling and spreading insects and diseases. Management costs may increase as a result of needed control, and woodland owners and sawmill operators may see reduced values of harvested products.

### **Land Ownership Patterns**

Landownership patterns in the Northern United States affect our ability to respond to forest health needs and management opportunities. Federal, State, county, municipal, industrial, and private lands each have important roles to play in achieving sustainability. They differ in their suitability for biodiversity conservation, wood production, recreation, and research, as well as offer varying levels of accessibility for management and recreation. Because the majority of forest land in the Northern United States is in private ownership, partnerships involving government and nongovernment organizations and individuals are not only desirable but necessary for the conservation and maintenance of forest ecosystems and the economic and social benefits derived from them. Laws, regulations, and voluntary approaches all have a place in efforts to achieve sustainability. In this environment, progress toward sustainability requires continuous public education and discourse. The availability of highly credible information is critical to informed discussion.

The issues identified deserve attention in an effort to develop effective programs and policies to achieve sustainability in the Northern United States. Changes in the size of the forested land base may lead to an increased need for public policy to address the availability of forest goods and services. Forest fragmentation can also lead to increased pressure on forest resources. The implementation of acceptable forest management practices are critical to meet biodiversity and economic stability. Controlling the spread of exotic and invasive pests is important to reducing their impact on the value of forest products. Overall, because so much forest land is in private ownership, partnerships between government, private organizations, and individuals are imperative to address sustainability within the region.