2 CONTEXT

Advancing Science for Sustainable Forestry

When they began their work, the Commission members found an abundance of scientifically sound research on biodiversity and sustainable forestry. Thousands of individual studies by government, academic, industrial, and environmental organization researchers yield a constant flow of bits and pieces of information.

The problem is that no well established institutional processes exist to assemble this diverse information into a coherent picture and translate the results into useful knowledge and tools for practitioners, managers, and policy makers. The Commission addresses this problem by establishing consensus on the science and its implications as a credible independent group of respected individuals with a broad range of expertise and stakeholder perspectives.

BUREAU OF LAND MANAGEMENT

The Commission's approach is first to synthesize and draw upon the extensive research that has already been done. Then they work together to identify gaps in the collective results of that work and collaboratively define research and other activities to fill the most important ones with new knowledge that will improve the scientific basis for practice, management, and policy. The Commission has summarized what it has learned in this report and is using other communication channels to share the consensus that its members have developed.

Forests in Context

The area of the earth's surface covered by forest—defined as 10% or greater land cover in trees—was estimated to be about 9.6 billion acres in 2000 (UN FAO 2003). Over time, forestland has been lost principally through the conversion of forests to agricultural, residential, commercial, and industrial land uses that came with human population and economic growth. Net forest loss appears to have stopped in developed nations, mostly in the temperate zones, while it continues in developing, mostly tropical countries.

In developed nations, forest management and harvesting of trees for various wood products are well into a major transition similar to the changes that agriculture has experienced over the past several centuries. Until the late twentieth century, most industrial wood came either from forests that were being harvested for the first time or ones that had naturally grown back following earlier harvesting or fires. The world now gets approximately 33% of its industrial wood from planted forests and is expected to obtain around 80% or more of its wood from such forests by 2050 (Sedjo and Botkin 1997, Victor and Ausubel 2000, World Wildlife Fund 2001). It appears that planted forests can meet future wood demand.

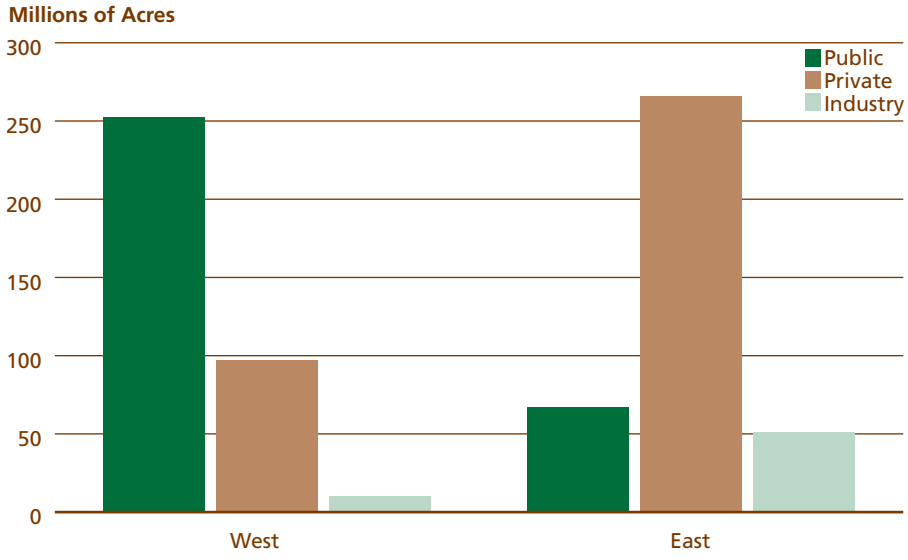
The transition from obtaining forest products from extensive natural forests to producing them from smaller, intensively managed planted forests will have significant implications for sustainable forestry and biodiversity conservation.

U.S. forests now cover roughly the same amount of land as they did in 1920—749 million acres, or about one-third of the nation's land area. Most North American forestlands have been impacted by human activity for thousands of years. Native Americans cleared agricultural plots and burned forests to provide openings and wildlife habitat. European settlers cleared large forested areas, for agriculture in the seventeenth to nineteenth centuries, but as U.S. agriculture moved westward, abandoned farm lands in the Northeast were widely reforested in the twentieth century.

Past land uses have greatly influenced current forest conditions, and some have left long-lasting impacts on the landscape. Over the past 400 years, U.S. forests have declined in area by at least one-third, and the ecological quality of what remains has often changed. As with global forests, most of these losses resulted from forest conversion to agricultural, urban, suburban, and industrial uses. Most of the conversion occurred between 1860 and 1920 (Williams 1989, Perlin 1991, MacCleery 1992, FAO 2002, USDA Forest Service 2003). The total forested area of the United States has been relatively stable since 1920, although changes are still occurring in individual states.

U.S. public and private lands are often intermixed in a patchwork of ownerships and different land uses. Most publicly owned forestland is in the West, while most privately owned forestland is in the East (Figure 3). Approximately 10 million non-industrial private landowners hold about 58% of the nation's forestland. These privately owned lands not only are the largest area of forest ownership in the United States; they also comprise the nation's largest area of the most biologically productive forestland (USDA Forest Service 2004).

Figure 3
U.S. Forest Ownership



Source: USDA Forest Service 2004

About two-thirds of the forested land in the U.S., or 504 million acres, is classified as commercial forestland, or timberland. Repeated growing and harvesting of trees for wood or wood-based products is economically feasible on commercial forestlands. About 72% of these commercial forestlands are in the East. Some 52 million acres of U.S. forests are reserved or dedicated for non-timber uses as parks, refuges, or wilderness areas managed by a variety of public agencies. The U.S. Department of Agriculture (USDA) Forest Service manages 19% of the nation's forestland, the forest industry owns 13%, and other public agencies own 10% (USDA Forest Service 2001).

Growing demand for wood and the economics of wood production are encouraging more intensive management of the most productive forestlands. As noted earlier, individuals own about 58% of U.S. forests and private forest industry owns another 13%. Together, those forests provide most of the wood that the nation uses and exports, and they are now almost entirely second-, third- or fourth-growth forests, some reconverted from agriculture. This creates opportunities and challenges for integrating biodiversity conservation into sustainable forestry. There are opportunities to enhance biodiversity in intensively managed forests, e.g., by incorporating small reserves and other conservation measures, and to de-emphasize wood production on lands that are better suited for other purposes. The challenge is to achieve sustainable *mixtures* of forest uses and management incentives at scales ranging from a single ownership to a large region.

As the demand for wood has grown, so has the demand for virtually every other forest benefit, primarily water. Forests in the United States are commonly the headwaters for major river systems. High water quality and normal flow patterns have been reasons for protecting forests in the United States since the late 1800s (Adirondack Forest Preserve 1885, Organic Administration Act of 1897). More recently, recreational uses of forests, the role of forests in storing atmospheric carbon, and the conservation of biodiversity have become highly valued forest benefits.

The Forest Continuum

Forests provide benefits that are based on the management goals for each forest as well as its natural potential. The role of biodiversity in sustainable forests and the contribution of each kind of forest to overall biodiversity conservation vary across a broad continuum of forest purposes.

At one end of this continuum are traditional *reserves*—often large contiguous areas protected from development and focused on preserving native species, "wild" ecosystems, and natural processes. Reserved forestlands, including state and federal parks and wilderness areas, have doubled since 1953 and now comprise 7% of all U.S. forests. However, some regions don't have appropriate lands and/or conditions for large reserves, and the scientific and conservation communities now recognize that reserves are necessary but not sufficient to maintain biodiversity in its fullest dimensions. For example, entire ecoregions—very large geographic areas that usually cross ownerships and include a diversity of habitat components—have been shown to have an important role in sustaining certain wildlife and fish such as grizzly bears and salmon.

At the other end of the continuum of forest purposes are *wood production forests*—plantations that are managed primarily for industrial wood. These forests tend to have a broad distribution of age classes, including significant early successional stages, which reflect planned disturbance by harvesting at regular intervals. Forest plantation biodiversity is often augmented by retaining biological legacies such as snags, large live trees, downed woody material, streamside management zones, and small, scattered conservation plots as miniature reserves.

Multi-resource forests where no single purpose dominates lie between the reserves and wood production forests. The majority of America's forests are multi-resource. *Urban forests* are a special and growing type of multi-resource forest. U.S. urban areas have doubled in size over the past 20 to 25 years, and 28% of the nation's forests are in counties with urban populations greater than 20,000. As urbanization spreads into less developed rural areas, a growing percentage of the nation's natural resources will become part of urban forest ecosystems (Dwyer et al, 2000). Multi-resource forests, including urban forests, are the next frontier in overall biodiversity conservation.

Fortunately, the existence of forests across this continuum tends to increase biodiversity of all plants and animals. Conditions within specific parts of it are very favorable for some species, and the survival of some species might be

threatened without the entire continuum. This biodiversity is reflected at the landscape level but not necessarily at the individual forest level.

Changing Forest Ownerships

According to the 2002 USDA Forest Service National Woodland Owner Survey, more than 10 million people own 276 million acres of forestland in the United States for non-industrial purposes. About 4 million of those owners hold less than 10 acres that are essentially extended home sites. Another 4 million of those owners hold 220 million acres in parcels of 10 to 1,000 acres.

The average tenure of family forest ownerships is 10 to 15 years. Trends suggest over the next two decades, the number of family forest owners will increase to 12 million, but the total amount of forest acreage will remain the same. This large-scale turnover of forest ownership is leading to increasing conversion of forests at the urban-rural interface to other uses and increasing fragmentation of the remaining forests.

At the same time, economic forces are triggering change in the forest products industry. Pension funds, investment trusts, and timber investment management organizations (TIMOs) are buying large amounts of industrial timberland. Some of this forestland is being converted to other uses, such as large home sites. In general, each transaction further fragments ownership.

Some large private forests are being identified and managed to protect their significant cultural and biodiversity values. Large easements, such as 170,000 acres in New Hampshire acquired in 2003 from International Paper Company, have explicit biodiversity goals. While similar opportunities still exist, resources are not always available to acquire and establish additional conservation easements at this scale.

America's mix of forestland ownerships requires us to achieve biodiversity across diverse landscapes rather than relying solely on large public reserves. Comprehensive biodiversity conservation must appeal to private-sector forestland managers. They aren't likely to dedicate large parts of their ownerships specifically to biodiversity, but they may be willing to incorporate small reserves and some biodiversity values into their overall goals.

The conversion and fragmentation of private forests will continue to challenge policy makers and forest managers who are working to maintain biodiversity. This is especially important in regions where private lands dominate, such as the eastern United States.

Forestry and Sustainability

The greatest threat to forest sustainability and biodiversity is conversion of forests to other land uses, which often results when markets undervalue natural systems and populations. Traditional forest management, often called sustained-yield forestry, has sought to provide forest values, uses, products, and services such as wood, water, and wildlife for society and landowners. It has focused on large plants and animals and on recreation—trees for wood products, birds and mammals for hunting, fish for catching, and woods for hiking and camping.

The Value of Biodiversity

Conserving and sustaining biodiversity is important for many reasons, including but not limited to:

1. Biodiversity supports the functioning of the ecological systems upon which humans depend, provides genetic material for new agricultural and silvicultural crops, and provides resilience necessary for ecosystems to withstand climatic changes, disease and pest out-breaks, and other environmental stresses (Keystone Center 1991).

2. Nearly half the world's medicines are derived from living plants or animals, and the potential exists to develop additional pharmaceutical products as new species are screened (Keystone Center 1991).

3. Biodiversity conservation makes good economic sense. Humans are dependent on natural resources for both commodities such as forage for livestock and lumber for homes and for ecological services such as flood control, waste detoxification, and creation of soil (Brussard 1994).

4. Many people assign intrinsic value to biodiversity because of ethical concerns or personal interests and affections. Through actions such as contributions to conservation organizations and ecotourism, these concerns, interests and affections translate directly to economic value.

People increasingly understand that forest values extend beyond these traditional resources and they expect more. Forest managers in turn seek policies, plans, and practices to sustain a more diverse array of forest benefits.

Sustainability has three essential, interacting components: (1) economic, (2) environmental, and (3) social. The typical definition of sustainable forestry—meeting the needs of today's people without compromising the needs of future generations—is derived from a set of non-binding "forest principles" developed at the 1992 United Nations Conference on Environment and Development (UNCED).

Over the past 10 to 15 years, a more comprehensive approach to biodiversity has been integrated into sustainable forestry. Central features of this approach include:

- identifying forest values to be sustained in the place(s) under consideration
- specifying indicators for the biological and ecological values to be sustained at various scales in the place(s)[1]
- exploring the effects on biodiversity of natural processes such as wildfire, invasive species, insects, diseases, and climate change in sustaining habitat diversity, productivity, and resilience; these effects ideally would be assessed through the selected indicators
- addressing the effects of human uses on biodiversity, i.e., native species, forest structure, and composition at the stand, watershed, and/or landscape scales, also assessed through the selected indicators
- managing forests to maintain and enhance the biodiversity values identified above, including establishing "reserves" at appropriate geographic scales for species that can't be accommodated without such special provisions
- monitoring and evaluating indicators and making appropriate adjustments in management.

This broader concept of sustainability needs a broader foundation of science and practice than the one that has supported sustained-yield forestry since the 1950s.

Efforts to maintain biodiversity and sustainability are driven by such things as federal water and endangered species laws, state forest practice acts and regulations, forester licensing and certification, and forest policies. Sustainable forest management certification encourages, documents, and recognizes landowner commitments to sustaining biodiversity and other forest values. Major U.S. forest certification programs include the Sustainable Forestry Initiative, the Forest Stewardship Council, and the American Tree Farm System.

Biodiversity Indicators

The biodiversity of any forest is very complex. Many aspects of this complexity are hidden and can't feasibly be observed, let alone understood. Thus it is essential to use indicators—a relatively few measures that provide information about the status of as many unmeasured biodiversity elements as possible—to represent major biodiversity values in a particular area.

Many Federal and state agencies in the United States have used the Montreal Process Criteria and Indicators (C&I), an international guide for evaluating progress in achieving sustainable forests at state and national scales. The C&Is are applicable to large regions, across multi-owner landscapes of Federal, state and private lands, but they are poorly suited to single ownerships or smaller geographic scales. An objective of NCSSF is to provide tools for developing criteria and indicators at multiple scales.

One challenge in implementing sustainable forestry across ownerships and regions is that there is no national definition or standard approach, and the forest certification and C&I systems do not mesh well as one goes from one geographic scale or ownership to another.

Indicators represent what biodiversity means for any forest, and they tell managers and others what is to be sustained in those forests. Because forests exist over a continuum of capabilities, conditions, and management purposes, forest biodiversity indicators will also be a continuum, with no single set appropriate to all forests in all places.

[1]Indicators are also needed for other forest values to be sustained but those are beyond the scope of NCSSF Phase 1 work.