The State of the Forest

and

Recommendations for Forest Sustainability Standards

Draft Report
to the
Joint Standing Committee
of the 119th Legislature on
Agriculture, Conservation and Forestry

January 20, 1999

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January 20, 1999

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Attached is a combined report of the State of the Forest and draft Sustainability Standards as mandated by the 118th Maine Legislature in April of 1998. These products are the first step in a mandated progression of reports over the next several years. The State of the Forest report discusses major forest issues, with greater detail and analysis on key issues. Since the Maine Forest Service is required to report on the State of the Forest biannually, it is appropriate that successive reports focus on those key issues where the most concern and best data exists. Future reports will provide an assessment of the state level of progress in achieving sustainability standards.

The Sustainability Standards section of this report proposes standards for three of the seven sustainability criteria. The 118th Maine Legislature recognized that building these standards would take time, and thus mandated a timetable for completing standards for the seven criteria. This schedule makes sense to us. Each of the individual criteria could present some conflict with other criteria, however this is true regardless of the time table for development and is simply a fundamental characteristic of defining forest sustainability. The Sustainability Standards presented in this report are **draft standards**. The legislation creating this mandate required public comment before final adoption of these standards. It is the plan of the Maine Forest Service, Department of Conservation to present this draft report to the Committee, hold a public meeting on February 17, solicit public comment in writing until February 26, and present "final draft" Sustainability Standards for these three criteria in early March.

Sincerely,

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This report includes a summary of forest management issues that the Maine Forest Service identifies as important public policy issues. It is followed by a discussion of State programs and policies that are already in place to help address these issues. Finally, this report includes a preliminary discussion of new forest sustainability benchmarks as mandated by the 118th Maine Legislature, Public Law Chapter 720, in April 1998.

This report is guided by the principle of balance between ecological concerns and economic opportunities. The foundation for the Maine Forest Service, as the implementing agency for State forest policy, is to ensure that the Maine's forests continue to provide a full range of benefits to present and future generations of Maine people. The Maine Forest Service does this by:

- Developing, advocating for, and promoting activities that encourage the sound long term management of forest resources.
- Protecting the forest resource from the effects of fire, insect, disease and misuse.
- Providing reliable, timely and accurate information about the forest resource.

This report is presented as a practical extension of these functions and expectations for the Maine forest on behalf of Maine citizens.

I. State of the Forest

INTRODUCTION

Maine is the most forested state in the United States. Approximately 17.7 million acres are forested, 89% of the state's total land area. The forests of Maine play a major role in shaping the State's economy and environment. Maine's forests provide much of the raw material to fuel Maine's mills and serve as a backdrop for forest-based recreation. Forest-based recreation and manufacturing have had a dominant presence in the Maine forest for over 200 years and today generate over $6 billion of total economic activity (18% of the gross state product). In addition to its economic significance, Maine's forests host a wide array of plant and animal species and play a critical role in maintaining clean water.

Timber harvesting has been a major activity in Maine since the late 1700's, and has periodically generated debate and concern. Recent debate and discussion has focused on whether Maine's forests are managed sustainably. What has the long history of timber harvesting taught us? How do we define forest sustainability, and how do we measure progress in managing for sustainable forests? This report is intended to be a baseline assessment of what we understand and what we need to do. But these questions can be answered in a simple summary:

- History teaches us that Maine's forest is a resilient resource capable of supporting a strong industry, and new knowledge tells us we can do a better job of managing Maine's forest for both timber productivity and ecological health.
- There is no simple way to prescribe the best forestry that satisfies the biological needs of all the diverse forest conditions in Maine.
- Our understanding of how to best balance timber productivity and ecological health changes and improves over time.

These statements lead us to conclude that both private forest management and public forest policy must be adaptive and flexible. This theme lies at the core of the discussion and actions recommended in this report.

ISSUES

All of the issues discussed in the following text relate to forest structure and forest development in Maine. A basic understanding of these forest dynamics begins with forest regeneration. A distinguishing characteristic of Maine's forests is their ability to naturally regenerate. Maine's native tree species have demonstrated their resilience over the past 200 years by regenerating under a variety of timber harvesting practices, natural disturbances, and changing land uses. The key ingredients to this regenerative success are abundant seed production and a combination of soils and climate that fosters seed germination and development. Maine's climate generally provides precipitation evenly distributed throughout the year, resulting in plentiful moisture for newly germinated seedlings. This combination of soils, climate, and prolific natural seeding by native tree species produces abundant regeneration that is among the most successful across all forest regions of the world.

As the forest grows and develops after regeneration, the key to a healthy and productive forest becomes ensuring that appropriate number of trees occupy every acre and take full advantage of the growth potential of the site. The soils, characteristics of each tree species, and the actions of the forest manager are the dominant ingredients. Landowners make forest management decisions as the forest develops that determine the quantity and quality of forest growth. These actions can be made thoughtfully, with a long term goal of growing a fully developed forest with high quality trees, or they can be made thoughtlessly without care for the future so that the forest loses its highest quality growth for a period of several decades.

A. FOREST PRACTICES

1. Harvest Practices

Forest practices in Maine have generated debate and controversy since the middle of the 19th century. In the last decade, public debate over forest practices has occurred every year since passage of the **Forest Practices Act of 1989**. Recent legislatures have considered forestry bills that would ban clearcutting, require permits and silvicultural justification for clearcuts, reduce maximum clearcut size, establish minimum

stocking standards after any timber harvest, require minimum stocking standards for participation in the **Tree Growth Tax program**. And yet, a common vision for Maine's forests has yet to develop from these discussions.

No single issue has catalyzed recent public concern about Maine's forests more than clearcutting. **Clearcutting** that lacks a silvicultural basis is ecologically more disruptive, creates more profound aesthetic impacts, and often limits future options more so than less intensive harvest methods. But at the same time, research and experience with clearcutting has identified it as a practice with a legitimate role in forest management. Natural disturbances from insect or weather events can require clearcutting as a means to salvage valuable timber crops.

Harvest practices other than clearcutting account for more than 90% of all harvesting in the state. Poorly conducted non-clearcut harvests can also have severe impacts on the continuous flow of products and values from Maine's forests.

Landowners in Maine use three general silvicultural harvesting systems.

Selection harvests remove some trees in all size classes, either singly or in small groups, in order to regenerate and maintain a multi-aged stand structure.

Shelterwood harvests remove trees from a forest stand in two or more stages. The initial harvest removes most of the mature trees, leaving enough trees to serve as a seed source and to provide sufficient shade to produce a new crop.

Clearcut harvests remove essentially all trees in one operation. Regeneration of the next stand can be from natural seeding, planted seedlings, or advanced natural reproduction.

Over the past decade, annual harvest acres in Maine increased from about 400,000 acres to 500,000 acres. During the same period, clearcutting fell from a high of about 18% of all harvests to about 6% in 1997. The 1997 harvest acres were distributed among the three silvicultural harvesting systems as follows:

Selection	75%	379,000 acres
Shelterwood	19%	94,000 acres
Clearcut	6%	31,000 acres
Total harvest acres		504,000 acres

Summary Statement: Maine's success with regeneration does not alleviate all concerns about future forest growth and development. Assuring forest health and productivity also requires culturing the appropriate number of trees to fully occupy a site. Beyond forest regeneration, the most important factor of forest practices is the proper use of each silvicultural system. Research and experience demonstrate that all silvicultural systems, including clearcutting, have circumstances where they can be wisely and appropriately used.

High-grading

High-grading is the harvesting of higher value, better growing trees while leaving inferior trees behind to occupy the land. Such harvests are not always easy to identify, and can come in many different applications. Repeated, light high-grading can slowly, almost imperceptibly, degrade the quality of a stand.

A 1994 field study of the Forest Practices Act by the Maine Forest Service concluded that high-grading to minimum standards occurred on approximately 31,900 acres each year (8% of all non regeneration harvest acres). The study also reported low quality residual stands (including the stands mentioned above) on about 59,800 acres (16% of all non regeneration harvest acres).

Liquidation harvesting

Liquidation harvesting, generally viewed as inconsistent with accepted principles of forest management, often leads to indiscriminate harvesting. It is often a speculative practice resulting in hasty land subdivision, and is characterized by disposition of land with little regard for its continued long-term use as productive forest land.

An 1998 study by the Maine Forest Service examined the nature and extent of timber liquidation in Maine. The study defined liquidation harvesting as the purchase of timberland, followed by the removal of most or all commercial value in standing timber and subsequent attempted resale of the land.

Key findings are:

- Liquidation harvesting occurs throughout the state, predominantly in organized towns.
- Between 3% and 12% of all harvested acres were identified as liquidation harvests (between 12,000 and 55,000 acres annually).
- Liquidation harvesting is conducted primarily by landowning logging contractors or realtors.
- Liquidation harvests retain some stocking of low-quality timber, but generally do not meet the definition of clearcuts under the Forest Practices Act.
- The majority of timber liquidations are smaller than 150 acres, and are sold within two years of initial purchase.

Further, MFS has found through its Forest Practices Act enforcement efforts that much of the land sold to non-industrial landowners during the breakup of the Diamond and James River ownerships has been liquidated by contractors. Several of these parcels have been the focus of FPA enforcement efforts, with settlement agreements obtained. The underlying cause of such liquidations and violations is the fact that the new owners, paying higher than average prices, wanted to immediately recover their investment by harvesting heavily.

Summary Statement: Both high-grading and liquidation harvesting fail to meet any definition of good forest practices. Their use reduces both the quality and productivity of the forest for long periods of time, often several decades. The number of acres

harvested by these methods is cause for concern. It is fortunate the resilience and regeneration success of Maine's forests prevent such practices from having an indefinite impact on forest productivity and quality.

2. Intensive Forest Management Practices

Some landowners in Maine use **intensive** or **"high-yield" forest practices** to improve the growth and future yield of young stands. The goal of these practices is to obtain a high level of volume growth and quality per acre by concentrating growth on a limited number of desirable trees. They typically include significant capital investments in young developing forests, with no immediate commercial yield. High-yield practices in Maine include 1) using **herbicides** to release natural or planted softwood regeneration from competing hardwood regeneration, 2) **precommercial thinning** - the spacing of over crowded saplings to a density that allows faster growth of the best quality trees, and 3) planting seedlings of genetically improved stock.

High-yield forest practices are typically considered "short rotation" practices; that is the mature stand is ready for harvesting in 50 years or less. However, several landowners intend to use high-yield forest practices to establish a more productive stand, harvest smaller trees (pulpwood) in an early initial harvest, and ultimately grow sawlog size trees using longer rotations (60 years or longer). Since these management practices have been used for only 25 years, there is no track record with applied rotation length. About 4 percent (650,000 acres) of Maine's forest land is in high yield management practices. New research is underway to better understand the impacts of high-yield forest practices, particularly as it relates to **biological diversity** and wildlife habitat[1].

Summary Statement: High-yield forest practices include a broad range of treatments and management approaches, all of which produce substantial increases in forest growth. Research and experience show that some versions of high-yield practices are more compatible with other forest values than others. High-yield practices that utilize native tree species, and are managed for rotation lengths approaching natural stand rotations (60 years or more), are quite different than those utilizing nonnative species and managed for very short rotation periods (30 - 40 years).

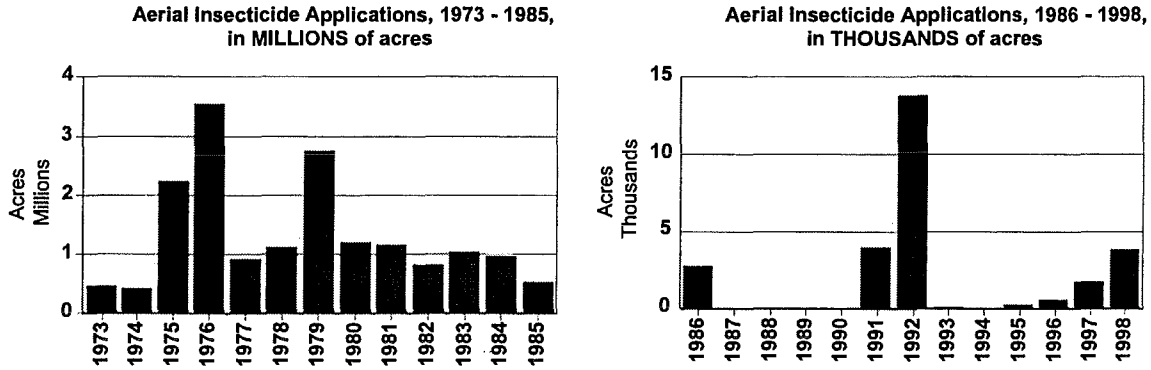
3. Pesticides

Although use of chemicals for control of forest/tree pests in Maine extends back to the early 1900's when arsenicals were widely and heavily used to control gypsy and browntail moths in southern Maine, the issue of pesticides in forestry has its roots in the regional **spruce budworm** outbreak of the 1960's-80's and in the methods used to address that situation. In response to the budworm outbreak and associated tree defoliation and mortality, state and federal governments and forest landowners conducted aerial insecticide applications to reduce budworm populations and protect the standing inventories of spruce and fir.

[1] The Manomet Center for Conservation Sciences is conducting the "Shifting Mosaic Project" on 94,000 acres of industrial forest lands to examine the relationships between a broad range of forest practices and biodiversity.

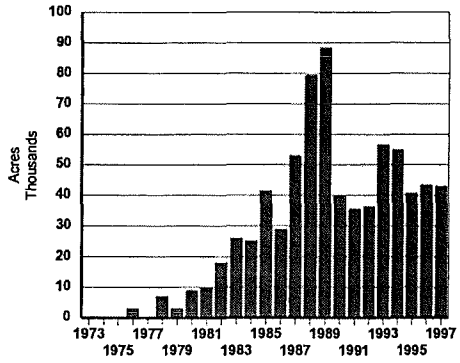
Forest use of insecticides for spruce budworm peaked in 1976 when 3.5 million acres were treated, primarily with Carbaryl. Thereafter annual acreage treated decreased (Figure 1) and the active ingredients of the insecticides tended to be less persistent in the environment and more targeted to specific insect pests. With subsidence of budworm populations in the mid 1980's, the controversy over the role of state government in forest insecticide projects diminished substantially. The current State role is to provide technical advice and assistance for forest-related pests such as yellowheaded spruce sawfly, gypsy moth, and browntail moth. In 1998, the MFS provided assistance to private and municipal insecticide treatments on approximately 3,900 acres.

Figure 1. Aerial applications of insecticides in Maine.



Herbicides are used in Maine predominantly to kill hardwood saplings that compete with more commercially valuable spruce and fir. They were first used extensively in Maine in the early 1980's in regenerated clearcuts that resulted from spruce budworm salvage harvesting. They are also used to weed undesirable species out of young softwood plantations. Use of herbicides peaked at about 87,000 acres in 1989. Herbicides were applied on approximately 40,000 acres in 1997 (Figure 2).

Figure 2. Aerial application of herbicides for forestry in Maine.



Summary Statement: A broad range of remedies and approaches exist for problems associated with forest insect pests and competing vegetation. Each remedy carries its own risks and benefits. Using pesticides as a matter of last choice is the best approach to managing these problems, but this approach does not eliminate the need for chemicals. As an example, the Brown Tail Moth infestation has been managed with a broad range of physical and biological treatments, but chemicals are still a critically important tool in controlling the infestation. Forestry use of herbicides generates a strong concern from the public, but forest management applications of herbicide should be viewed in context with use on lawns, golf courses, utilities, and agriculture. Environmental risk should be assessed based on intensity of use and proximity to human habitation.

B. TIMBER SUPPLY

Maine has a diverse forest industry that utilizes all Maine tree species and all quality of trees within each species. Maine's saw mills and paper mills have evolved over the past twenty years to make use of more abundant, lower cost species. As a result, Maine's forest landowners are fortunate to have markets for everything they grow, particularly the low quality wood that must be removed in early thinnings to allow quality wood to mature.

Key issues relative to timber supply are the long-term balance between forest growth and timber removals, and trends in timber quality and their impact on forest based manufacturers. Timber quality is of special concern for hard maple, yellow birch, white birch, ash, oak, and white pine. These species provide solid wood timber sought by the state's hardwood sawmills that produce high quality wood products such as furniture stock, dowels, and wood turnings. It is very important to sustain this part of the forest manufacturing sector, as it greatly diversifies the forest based economy and is less influenced by world wide commodity trends. The key issue relative to tree quality is understanding the growth trends of these species, and documenting the range of forest practices implemented to enhance growth of quality trees.

In 1995, the USDA Forest Service completed an inventory of Maine's forest resource. This remeasurement, occurring 14 years after the previous inventory in 1982, documented substantial change in the Maine forest. The key items revealed in this inventory were a substantial decline in spruce-fir inventory, and large amounts of tree mortality. The dominant event during this period was the spruce budworm outbreak and salvage harvesting associated with this outbreak. The key underlying question posed by this information was: Is the current harvest level of Maine's forests sustainable? To answer this question, the Maine Forest Service, in partnership with the USDA Forest Service, conducted a long-range computer simulation of Maine's forest growth and harvest. This study, Timber Supply Outlook for Maine: 1995-2045, concludes that:

1. While inventory levels are projected to remain adequate to support current harvest levels over the next fifty years, the current mix of forest management techniques

results in a long-term imbalance between growth and harvest. A projected 14% annual deficit between growth and harvest will result in a decline in total inventory.

2. The large quantity of tree mortality occurring in the Maine forest presents a clear opportunity to increase the harvestable growth of the forest. The analysis found that an average of 27% of Maine's annual forest growth ends up as unutilized tree mortality. Today's forest management activities include a number of practices that can do a better job of harvesting tree mortality early in stand development and increasing growth and yield in residual stands. These practices include high-quality partial cutting techniques, commercial thinning, precommercial thinning, plantation establishment, and control of brush with herbicide applications. It is quite feasible to modify today's forest management practices so that the long-term gap between growth and harvest levels is eliminated.

Tree Species Trends The 1995 USDA Forest Service Inventory documents a decline in the merchantable inventory of red spruce (Maine's most important softwood species), and a corresponding increase in red maple inventory (a lower value hardwood species with good pulpwood value but only marginal lumber value). Part of this trend is certainly explained by the substantial mortality and harvest of red spruce during the recent budworm outbreak. Red spruce can be returned to its historic prominence if red spruce is part of Maine's younger, regenerated forest, and Maine's forest landowners favor the growth and development of red spruce as these younger forests grow. The 1995 Forest Inventory indicates that red spruce continues to be an important component in young forests. We lack the data to answer the second question at this time.

The increased presence of red maple implies that it is gradually replacing other native species of higher value and broader economic importance. Forest management techniques that discriminate against red maple by harvesting it and leaving more valuable species to grow can certainly reverse this trend.

Tree Quality Trends

There are two key aspects to understanding the trends in tree quality:

1) Are we fostering the potential of Maine's forests to grow trees of high economic quality (such as large, saw log quality trees valuable species such as sugar maple, yellow birch, ash, pine, and spruce), and spruce

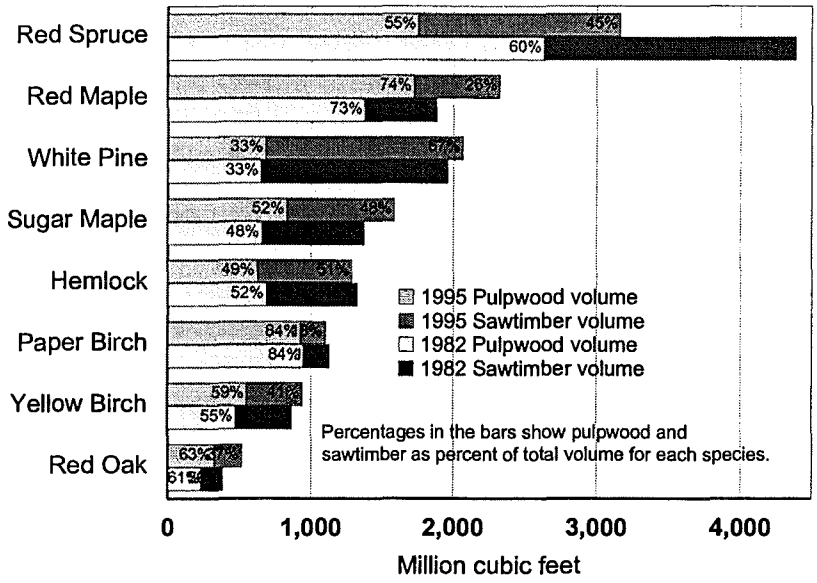
2) Are we managing these trees to grow them into high quality products?

As an example, yellow birch can grow into the highest quality veneer grades by being allowed to grow fast and straight, but also can develop into no more than a pulpwood quality tree if it is deprived of light or damaged during logging.

The 1995 Forest Inventory provides some insights into trends for tree quality, but it is not simply a matter of comparing the total number or volume of sawtimber quality trees with the previous inventory. A better indicator is the percent of merchantable trees or inventory growing into sawlog quality stems.

Even though red spruce volume declined from 1982 to 1995, red spruce sawtimber grew from 40% to 45% of red spruce inventory. Sawtimber percentage of species volume was stable for white pine and paper birch, while sugar maple, yellow birch and red oak show small declines sawtimber as a percent of inventory for each species (Figure 3).

Figure 3. Trends in pulpwood and sawlog inventory for selected species in Maine.



Another important consideration in growing quality timber is the size of trees being cultured through management. Bigger trees provide more economic opportunities, as well as providing an important biological dimension. More analysis and better information are needed to properly track tree quality in Maine, but we have sufficient knowledge of the forest conditions and common forest practices to identify this as an important issue of concern.

Summary Statement: The current rate of growth in Maine's forests cannot sustain indefinitely the current level of timber harvest. However, Maine's forests have a growth potential that has not been fully realized. With investments in intensive silviculture and improved management of natural forest stands, we are capable of fully sustaining the current harvest level. Activities to improve forest productivity need to be broadly implement over the next two decades.

C. FOREST FRAGMENTATION

Forest **fragmentation** develops from both subdivision associated with suburban sprawl, and from harvest practices that break up uniform forested landscapes into smaller isolated habitats. As a result, this is an issue of statewide concern, tracking the renewed public discussions about suburban sprawl, forest practices, and conversion of shore frontage. As Maine's population grows and as lifestyles change, the average size of privately owned forest parcels has declined from about 82 acres in 1982 to about 60 acres in 1993.[2] The number of forest parcels smaller than 50 acres increased by 30% during that time, increasing from 136,800 parcels covering 1.3 million acres to 206,400 parcels covering 1.7 million acres. Most of the increase occurred in parcel sizes ranging from 20 to 49 acres. Corporate ownership declined from 8.6 million acres to 8.4 million acres. Since the 1970's, the creation of a large, private road system in the unorganized territory, changing forest management practices, and the unintended consequences of forest practices regulations have led to a noticeable, but less well documented, change in the size and distribution of forest types and stands.

As forest parcel size decreases, forest management opportunities tend to decline, whether due to changing landowner objectives, the economics of harvesting smaller parcels, local regulations or opposition to logging, or for other reasons. The public values associated with forests, such as traditional open access for recreation, biological diversity, forest productivity, forest-based employment, and others, can all suffer from forest parcel, type and stand fragmentation as well.

Finally, landowners' attitudes about timber harvesting have shifted over the years. More people now choose to live on forested parcels with the intention of having their forests serve as an aesthetic backdrop to their residence, rather than as a source of financial value or contribution to the local economy. Although landowners' attitudes toward timber harvesting may change over time and as the value of all tree species increases, it seems apparent that many acres will drop out of the "wood basket," which could further reduce the wood supply available to Maine's mills.

Summary Statement: Forest fragmentation must be addressed by both the public and private sectors. The difficult issues of smaller parcels and inattentive woodlot owners should be addressed as part of the evolving discussion of suburban sprawl and landowner education. Fragmentation of habitat in the working forest can be more easily addressed by a better understanding of forest ecology and a commitment by landowners to alter their management to address fragmentation. Finally, state policy makers should be vigilant that new regulations and standards do not promote fragmentation.

[2] Birch, 1986. Forest-land Owners of Maine, 1982. USDA Forest Service, Northeast Station, Resource Bulletin NE-90; and, Birch, 1996. Private Forest-land Owners of the Northern United States, 1994. USDA Forest Service, Northeastern Forest Experiment Station, Resource Bulletin NE-136.

D. WATER QUALITY IN FORESTED WATERSHEDS

Water quality is one of the key indicators of both forest ecosystem health and forest sustainability. Forests adjacent to water bodies can moderate water temperature, filter sediment and contaminants from surface flows, stabilize shorelines, and contribute nutrients to support aquatic food webs. Land management adjacent to water bodies can have impacts upon water quality and the ecological integrity of water bodies. For example, stream sedimentation above natural background rates can degrade fish feeding and spawning habitat. Changes in water temperature and chemical characteristics can markedly affect fishery quality as well. The challenge in protecting water quality lies in targeting the actual causes of water quality degradation. Historic evaluation of forest operations have highlighted that poorly constructed and maintained access roads and skid trails have been the principal source of sedimentation from forest operations. Since the 1970's, Maine has developed a strong public policy framework for protecting water quality from degradation by all uses, including forest management. The suite of policies includes the Natural Resources Protection Act, LURC protection zones in the unorganized towns, mandatory Shoreland Zoning in the organized towns, and voluntary Best Management Practices for timber harvesting and logging road construction.

As scientific research reveals new information, however, current policies should be reevaluated and revised as necessary. The regulatory framework is also somewhat fragmented, with timber harvesting regulations for shoreland areas varying by jurisdiction. In addition to recent and ongoing research about the impact of forest management on stream flows, water chemistry and temperature, the emerging discipline of conservation biology and coincident research attention to biological diversity issues have identified the high ecological value of **riparian zones**. Riparian zones contain many important and sensitive plant communities, provide important wildlife and waterfowl habitat, and serve as a nutrient source for the macroinvertebrates that underpin fishery health.

Summary Statement: Good forest management not only protects water quality, but enhances it. This link has been a basic foundation of scientific forestry for over 100 years. Substantial progress in Maine has been made over the last two decades to reduce the impacts from poor road construction techniques and inadequate layout of harvest operations. In spite of this progress, improvements to protect water quality can still be made. Forest management activities around all surface water, including small brooks and streams, need to be conducted with more universal use of Best Management Practices and similar approaches to water quality protection.

E. WILDLIFE HABITAT/BIOLOGICAL DIVERSITY

Over the past 10 years, interest has shifted from the conservation of specific wildlife habitats to conservation of biological diversity. Earlier wildlife conservation issues related to forest practices were concerned with conserving specific wildlife habitat elements for game species or endangered species, such as protecting deer winter habitat and bald eagle nest sites.

Biodiversity refers to the variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur.[3] The maintenance and conservation of biodiversity is best characterized as management practices that assure the continued existence of all species of the forest (including tree, shrubs and other vascular plants; lichens, mosses, and fungi; mammals; birds; amphibians and reptiles; insects and other invertebrates). Since it is neither practical or desirable to maintain all these elements on every acre of in each forest stand, a critical aspect of this new discipline is examining the forest at the landscape level (500 acres to 25,000 acres). Where the traditional forest policy focus had been at the site or forest stand level, we now recognize the importance of looking at forest conditions and changes over larger areas.

Two important efforts are underway to expand our understanding of forest biodiversity in Maine, the Maine Forest Biodiversity Project and Shifting Mosaic Project.

The Maine Forest Biodiversity Project, a collaborative effort, has been working since 1994 toward the general goal of maintaining biodiversity in Maine. Specific activities include: defining biodiversity; assessing forest biodiversity (voids in information, impacts of current land uses, historical records); exploring the feasibility of a proposed system of ecological reserves; identifying forest management options to better conserve biodiversity; and providing educational outreach.

The project has produced several broadly accepted findings regarding biodiversity in Maine:

1. Present information does not indicate a biodiversity crisis in Maine in terms of outright loss of species. Maine has an opportunity to avoid an acute crisis by developing biodiversity maintenance strategies.
2. Eight of the 25 forest community types in Maine are rare; even in well represented forest community types high-quality natural examples are rare. Older forests of all types are becoming less common.
3. A system of ecological reserves (forest which are not managed for timber or other commercial products, where natural processes take place with little or no human manipulation) would provide for the gathering of data all levels, to better understand the range of species in the forest and their requirements, , and to serve as benchmarks or comparisons to managed landscape to better understand human impacts on the forest.
4. The working forest can be managed to maintain most aspects of biodiversity in an economically viable framework, but specific landscape-level measures need to be developed.

The Manomet Center for Conservation Sciences established the Shifting Mosaic Project in 1995. The Shifting Mosaic Project is a model for managing private industrial forestland for both economic and ecological goals. This project has developed to

[3] Maine Council on Sustainable Forest Management. 1996. Sustaining Maine's Forests: Criteria, Goals, and Benchmarks for Sustainable Forest Management.. Maine Department of Conservation, Augusta.

include partnerships with the University of Maine, State natural resource agencies, conservation organizations, and other entities across the US. Using two study sites (52,000 acres in Maine's western mountains and 42,000 acres near Baxter Sate Park), a team of independent scientists and foresters are testing new ways to integrate the economic goal of a long-term sustained wood flow and the ecological goal of self-sustaining populations of all plant and animal species in the working forest.

Summary Statement: The issues of wildlife habitat and biodiversity present a range of both opportunity and concern. As new understanding of these forest dynamics emerges, there is a great opportunity to incorporate new knowledge into day-to-day forest management activities. Both timber management and habitat management are built on the factors of change in the forest - trees grow and habitat changes with the growth. Landowners and managers are finding the common threads of both protecting habitat and promoting timber productivity in many settings across the State.

F. ACCESS FOR PUBLIC RECREATION

Maine's private landowners have a long history of providing forest recreation opportunities to the public. Nearly all of the large industrial and non-industrial lands remain open to traditional activities such as hunting, fishing, trapping, hiking, snowmobiling, camping, and birdwatching, as well as newer activities like mountain biking and ecotourism. This tradition of free and open public access continues, despite pressures to generate revenue to lower the annual carrying costs of owning forest land. Many of the smaller forest ownerships remain open to responsible recreation, although changing landowner attitudes have led to a decline in public access in the southern half of the state.

State and private programs and policies designed to encourage landowners to keep their lands open and available for public recreation are generally regarded as success stories that other states could do well to emulate. These success stories include the Great Ponds Act, **limited landowner liability laws**, privately-managed recreation programs such as North Maine Woods, state and private landowner relations programs, and the Tree Growth and **Farm and Open Space** tax laws. Nonetheless, a number of issues continue to arise that require resolution. These issues include conflicts between motorized and non-motorized recreational activities, pressures for more wild, unmanaged forest areas, and the conversion of scenic and shorefront areas to residential uses. Several task forces convened over the years have identified these issues and recommended a number of actions to address them[4]. However, follow-up action has been fragmented. The challenge for the future will be to maintain an ongoing dialogue between forest landowners, forest users and the public agencies, with concerted, coordinated actions designed to reduce conflicts and maintain the long tradition of reasonable public recreational access to private lands.

[4] Examples include the Governor's Council on Outdoor Recreation, Maine Commission on Outdoor Recreation, Northern Forest Lands Council, and "A Report on the Program of Landowner Relations."

G. SOIL PRODUCTIVITY

Protecting and, where needed, enhancing soil productivity is important in sustaining forests. Healthy associations of soil flora and fauna and forest vegetation constitute an important pathway in forest nutrient cycles and thus maintain forest productivity. Timber harvesting can significantly affect soil properties, including nutrient cycles and structure. There is some indication that whole tree harvesting, if used repeatedly on the same site, will deplete soils by interrupting the supply of leaves, twigs and branches that replenish organic matter and nutrients in the soil. Sustaining soil productivity requires maintaining proper soil structure, texture, organic matter, and adequate nutrient levels. Forest management practices that maintain soil nutrient cycles and structure generally protect other resource values as well.

The major issues related to forest management and soils are minimizing erosion into water bodies, protecting soil nutrient cycles, and excessive biomass removals that deplete important nutrients such as calcium. Soil acidification may also be an issue of concern.

H. AESTHETICS

Forests cover 89% of Maine's total land area. The visual amenities of this vast, forested landscape contribute to the state's character and identity. Whether in the wildness of the northern regions or the settled landscape of southern regions, sustaining the visual quality of Maine's forests is important to our quality of life. Average citizens typically assess the health and integrity of the forest based on how it looks. The citizens of Maine have often expressed their concerns over the condition of Maine's forests through this filter of aesthetics.[5]

Although scenic quality is highly subjective, most people agree that forest management can profoundly impact the forest aesthetic, both positively and negatively, up close and from a distance[6] (Palmer *et al.*, 1995).

Mitigating the negative short-term impacts of timber harvesting is an important way that landowners can communicate to the general public a strong stewardship ethic. Issues requiring attention include the development of voluntary Best Management Practices for aesthetics, as has been done in Minnesota, and encouraging forest landowners to consider minimizing negative visual impacts when making management decisions. Timber harvesting operations that minimize the most visually offensive aspects of logging and associated activities can avoid creating conditions that communicate wastefulness, sloppiness, and site destruction to the general public.

[5] Northern Forest Lands Council. 1994. Summary of Public Comment on "Finding Common Ground." Northern Forest Lands Council: Concord, NH. mimeo.

[6] Palmer, J. *et al.* 1995. Esthetics of Clearcutting: Alternatives in the White Mountain National Forest. Journal of Forestry, May 1995. pp. 37-42.

I. A Stable Public Policy

One consequence of Maine's extensive forest policy debates both in the legislature and by referendum is the creation of an air uncertainty for landowners and confusion on the part of the public. All forest interests express great concern about change, yet the debate itself has promoted change. A stable and predictable forest policy from the State of Maine is necessary to reduce the uncertainty and fear.

- For all forest landowners, a commitment to grow healthy, high-quality forests requires an investment of time and money with a very long-term payback. Many landowners express the fear that these commitments will be undercut by changing public policy. Perhaps the most explicit example of this is Maine's Tree Growth Tax (TGTL) program. Participation in the TGTL requires a commitment by the landowner to manage the enrolled forest land and to maintain the lands as forest land. The law provides penalties when landowners do not fulfill their part of the TGTL commitment. Yet every year, legislative proposals to substantially change the program are debated. While it can be argued the program has not been changed substantially, the nature of the annual debate combined with actual but modest changes results in an atmosphere of uncertainty. This issue has increased in importance as public debate over forest practices has intensified. In general, policy instability promotes a short-term approach to forest management that contradicts the public policy goal of ensuring long-term, sustainable forest management.
- Stable Ownerships and Landowner Accountability. Public concern over stewardship of Maine's forests has driven the many forest policy debates. The frequent changes in forest ownerships that have characterized the past decade raise more questions of landowner commitment and follow-through. Increasing and often conflicting demands upon the forest's resources, the complexity of forest ecosystems, and the public's desire for well-managed forests all point to a need for competent, professional forest management at all levels, and for continuous improvement in knowledge and practice.

Summary Statement: While regulatory programs can prevent specific abusive practices, the more desirable goal of achieving forest management excellence requires a different approach. The key to rebuilding public trust in forest management lies in establishing and maintaining a framework of publicly accessible and credible accountability measures by which forest landowners and managers can demonstrate their commitment to and achievement of an ecologically and economically healthy forest. Further, as our knowledge base increases, forest landowners and managers must demonstrate a commitment to continuous improvement through education and incorporation of research into practice.

II. Policies in Place

The section outlines existing policies and programs that address in some part the previously identified forestry issues.

Protecting Water Quality and other Resources

Regulatory Programs

Erosion and Sedimentation Control Law - 38 MRSA §420-C
The Erosion and Sedimentation Control Law was enacted in 1996 to regulate activities involving filling, displacing or exposing soil anywhere in the organized areas of the state. The law is based on the premise that all areas drain to some type of water body, and erosion of soil material must be prevented to protect water bodies.

The law requires a person conducting an activity to prevent unreasonable erosion of soil or sediment beyond the project site or into protected resources. The law requires that erosion control measures be in place before an activity begins, be maintained, and remain in place and functional until the site is permanently stabilized. Forest management activities and associated road construction are specifically exempted, provided that activities are conducted in compliance with the standards of the Land Use Regulation Commission.

Natural Resource Protection Act (NRPA) - 38 MRSA §480-A to 480-Z
The NRPA (enforced by Department of Environmental Protection) regulates work in and adjacent to protected natural resources, including lakes, ponds, rivers, streams, brooks, tidal areas, fresh water wetlands, vernal pools, and mountain areas above 2,700 feet in elevation. Activities regulated under the NRPA include disturbing soil, placing fill, and building permanent structures in or adjacent to these areas. Forestry related activities that require a permit include: any road building or excavating within 100 feet of lakes, ponds, rivers, streams, non-forested wetlands, and tidal areas; new bridge construction or new culvert installation for road crossings of portions of lakes and ponds, rivers, streams, non-forested wetlands, and tidal areas; harvesting operations above 2,700 feet in elevation; and construction of fords across stream beds.

Mandatory Shoreland Zoning Act - 38 MRSA §435 - 449
The goal of the Mandatory Shoreland Zoning Act is to protect resources along Maine's streams, rivers, lakes and tidal waters. The law targets development along the immediate shorelines of these resources, and requires municipalities to adopt and enforce shoreland zoning ordinances. Municipal shoreland zoning ordinances must be as stringent as a model ordinance adopted by the Board of Environmental Protection.

The law applies to all areas within 250 feet of lakes, ponds, rivers, tidal areas, and freshwater wetlands and areas within 75 feet of certain streams. Forestry related activities that are covered under shoreland zoning requirements include timber harvesting, road construction, and the creation of skid trails and log yards. In general, the law regulates timber harvesting and associated activities within the shoreland zone by setting minimum performance standards.

Land Use Regulation Commission - The Land Use Regulation Commission (LURC) serves as the planning and zoning board for the approximately 10.5 million acres of unorganized territories in Maine. Operating under a comprehensive plan and land use standards, LURC has zoned the land under its jurisdiction into three major districts: Protection Districts, Management Districts, and Development Districts. Mandatory Shoreland Zoning does not apply to LURC jurisdiction, but the goals of shoreland zoning are incorporated into LURC's law and land use plan. LURC land use standards affect timber harvesting, road construction, water crossings, and other land management activities that impact water quality in protection districts and development districts.

Non Regulatory Programs

Best Management Practices (BMP's)
BMP's are voluntary guidelines designed to reduce erosion and sedimentation of water bodies from logging activities. They were developed by the Maine Forest Service and the Department of Environmental Protection and are based on standards of the Land Use Regulation Commission. Careful application of BMP's can provide significant assurance of water quality protection on logging jobs.

Note on Statewide Water Quality Standards

The 118th Legislature (Public Law Chapter 648) directed the Maine Forest Service, in consultation with the Department of Environmental Protection and the Land Use Regulation Commission, to develop recommendations for statewide standards to minimize the impact of timber harvesting on non point source pollution. The proposed uniform timber harvest standards are based on current LURC and DEP shoreland zoning rules. This report will be submitted to the 119th Legislature. The three agencies are also developing a field procedure to monitor implementation of BMP's on timber harvesting operations.

Promoting Stable Land Uses

Forest Taxation Policies

Maine's Tree Growth Tax Law (TGTL) has the policy goal of "encouraging forest landowners to retain and improve their holdings of forest lands upon the tax rolls of the State and to promote better forest management by appropriate tax measures in order to protect this unique economic and recreational resource."[7] The TGTL is founded on the principle that forest land should be taxed according to its productive capacity to grow trees, rather than at its speculative, highest and best use value. It is both a method of more properly assessing forest land to take into account the unique characteristics of forests and a method of current use assessment. The assessed value is based on the capitalized value of the land, given its capacity to grow timber.

Tree Growth Tax Enrollments[8] - Enrollment in the Tree Growth Tax program is entirely voluntary for forest landowners. The number of acres enrolled in the program has

[7] 36 MRSA, § 572.
[8] Data collected by Maine Revenue Services and the Maine Forest Service.

remained remarkably steady in recent years, with total enrolled acreage currently at 11.2 million acres statewide - about 2/3 of the total commercial forest land in the state. The number of parcels enrolled in the program has hovered at or near 20,000 for several years. A large number of landowners withdrew from the program between 1993 and 1994, resulting in an enrollment decline of about 600,000 acres. This large withdrawal was probably triggered by a number of legislative changes to the program in 1993 that included a repeal of the personal use exemption for parcels less than 100 acres in size.

Tree Growth Tax Issues - The TGTL has been and remains controversial. Despite its flaws, the TGTL accomplishes what it was intended to do. It has helped to keep a large portion of Maine's wood basket in management. Above all, it minimizes the effects of the ad valorem property tax, which acts as a disincentive to long-term investment in forest ownership and management. It encourages forestry investments by taxing the value of the annual growth on standing timber, rather than the entire inventory of standing timber on a woodlot. To some extent, it also shields land from development pressures. Numerous commissions, study groups, policy analysts, and others have identified stability as the key element of any tax policy affecting forest lands. Frequent changes to TGTL alienate current participants and discourage new participants, both of whom might be encouraged either to liquidate their timber asset to recover their equity and/or convert the land to another use. Neither is in the best interests of the state.

Three key issues affect the program and require constant attention. First and most important is the loss of revenue to municipalities. Municipal support for the program depends in large part on stable reimbursement levels by the state to the municipalities. A legislative commitment to sound forest policy implies a commitment to maintaining municipal reimbursement at statutory levels. This has been the case for the past biennium, but it was a significant source of tension for many years. Second, some interests perceive the TGTL as a property tax avoidance scheme. The Maine Forest Service disagrees with this assessment. The TGTL is the correct way to tax forest land. The few landowners who may be sheltering their property in the program will eventually be identified and removed as the TGTL requirement for management plans for all properties takes effect. Finally, program critics assert that some enrolled landowners are not doing a good job of managing their lands, contrary to the law's purpose. The management planning requirements, coupled with the accountability imposed upon foresters through the forester licensing law, can address this issue. The TGTL is not a panacea for all forestry issues, and should not be used as a regulatory tool. The program can only create the appropriate taxation environment to foster stewardship - other policy tools are necessary to address abusive management.

Controlling Forest Practices

Regulatory Programs

Forest Practices Act

Maine adopted the Forest Practices Act in 1989. This law defined a clearcut, and authorized the Department of Conservation to establish rules to regulate the use of

clearcutting. The first set of rules was adopted in 1990, and established limitations on the size, regeneration requirements, and standards for separation zones for all clearcutting in Maine. This law also initiated a harvest notification program and formalized harvest reporting requirements to the Maine Forest Service.

After operating with the law and rules for 8 years, the MFS reported to the legislature that there were opportunities to improve and simplify the law for better enforcement. In addition, new information about forest management through the research of the Manomet Center for Conservation Sciences (Report MCDCF-97001) indicated that the initial law and rules promoted forest fragmentation. The law was modified in 1998, with major rule revisions developed and proposed for legislative review in 1999.

The proposed rule changes increase agency oversight of individual clearcuts over 75 acres in size by requiring that a MFS forester visit each site and confirm that a management plan, including proper silvicultural justification for the clearcut, demonstrates compliance with the rule before any harvesting occurs. In addition, the revised rule increases the size requirement of separation zones for certain clearcuts while allowing more flexibility to fit them to the natural landscape. The MFS believes these rule changes maintain or increase the overall standards of performance when using clearcutting, while addressing in part concerns that the law promotes a biologically fragmented forested landscape.

Voluntary Programs

Forest Stewardship Program

The Maine Forest Stewardship Program provides technical and financial assistance to small, non industrial landowners to plan and implement resource management plans on their woodlots. Cost-share practices include: soil and water conservation practices such as road-related BMP implementation; riparian and wetland protection practices; reforestation and tree planting; woodland thinning, pruning and weeding; fisheries and wildlife habitat improvement; forest recreation enhancement. Non industrial landowners with stewardship management plans have given thought to how they will attain their objectives on their woodlot, and have management plans prepared by trained resource professionals. In return, landowners agree to maintain the practices for at least ten years.

Tracking Conditions and Changes in the Maine Forest

Forest Monitoring/Information Programs

Annualized Inventory: Tracking timber supply and quality, forest biodiversity, and forest practices:

The 118th Maine Legislature authorized and funded an annual forest inventory/assessment program. This new program will be in partnership with the US Forest Service's Forest Inventory and Analysis program, which also has a new Congressional mandate for annualized forest inventory nationwide. Maine will be the first state in the northeast to participate in the annualized forest inventory, starting in

April of 1999. The annualized data collection will combine remote sensing and detailed sample plots. The program will inventory 20% of Maine's forest annually, completing a full assessment cycle every five years.

This new assessment program will provide significant improvement to the public knowledge of both the natural changes and harvest activities happening in the Maine forest. The new data will substantially improve trend assessment for issues identified in this report, by being more timely and better focused on critical information. In addition, the new assessment program will be an important tool for determining wildlife habitat trends. An advisory committee representing a broad base of technical expertise has been convened to direct this program.

Reporting Requirements and forest assessment

Under authorization of the Forest Practices Act, the Maine Forest Service collects annual data on timber harvesting, other forest management activities, and the import/export of forest products. This data is used by the Maine Forest Service to provide reliable, timely and accurate information about the utilization and condition of the forest resources of Maine's forest resources.

Landowner Notifications: Landowners must notify the Maine Forest Service before starting harvesting operations. Information provided the landowner includes location of harvest, dates of harvest, and anticipated acreage to be harvested.

Landowner Reports - Confidential Report of Timber Harvest: Any landowner who conducts a commercial timber harvest must report to the Maine Forest Service the following: species harvested; the volume harvested and stumpage prices received; location and size of harvest; harvesting methods employed.

Wood processors and importer/exporters: Sawmills, paper mills, and other manufacturers that process timber must submit annual reports detailing by species the amount of timber processed and the county where the timber was harvested. In addition, any individual or firm that imports or exports forest products to or from Maine must provide an annual report on the origin of the forest products and their destination.

III. Forest Sustainability Standards

Introduction

The 118th Legislature directed the Maine Forest Service (Public Law Chapter 720) to "establish a process to assess forest sustainability". It is important to identify assessing forest sustainability as a continuous process, one in which the available information, our understanding of the forest, economic pressures, and public values evolve over time.

> *"Sustainable forest management enhances and maintains the biological productivity and diversity of Maine's forests, thereby assuring economic and social opportunities for this and future generations. It takes place in a large ecological and social context and achieves a balance between landowners' objectives and society's needs."*[9]

Sustaining the forest is a complex task that involves many variables, including ecological processes, landowner objectives, and market forces. Sustaining the forest wil require an adherence to traditional uses and values, while recognizing the many changes that will occur in the forest. There is no simple path to follow to achieve this result. The structure and outline below is intended to move forward the pursuit of forest sustainability in Maine. The 118th Maine Legislature identified seven basic criteria of forest sustainability:

Criterion 1: Soil productivity
Criterion 2: Water quality, wetlands and riparian zones
Criterion 3: Timber supply and quality
Criterion 4: Aesthetic impacts of timber harvesting
Criterion 5: Biological diversity
Criterion 6: Public accountability of forest owners and managers
Criterion 7: Traditional recreation

As specified by the Legislature, this report proposes sustainability standards for criteria 2, 3, and 6. Standards for the remaining criteria will be completed by 2003.

The Role of Sustainability Standards

The role of sustainability standards is to serve as a clear, measurable expectation of performance or outcome from Maine's forests. These standards are not intended to serve as regulatory standards. They encompass a broad set of conditions and should be used as a framework to measure trends and achievement. The format for these standards is:

1. Define a goal.
2. Identify a measurable indicator(s) for this goal.
3. Set a standard of performance or status for the indicator.
4. Outline how this standard will be tracked, measured, or assessed.

These sustainability goals are applicable to all of the forests of Maine, with each indicator being relevant to as broad a forest condition as possible.

[9] Definition created by the Maine Council on Sustainable Forest Management, 1996

Ensuring Sustainability

The complexity of the sustainability criteria, as well as the array of indicators, dictates that no simple action can be mandated as public policy. There is tremendous public policy value in setting sustainability standards and monitoring progress in meeting those standards. Landowners and managers have clear public expectations, state and federal agencies have clear priorities and goals. Independent certification programs will have more specific measures to meet state level concerns. Where problems are identified, all available tools, both public and private, must be considered to develop a corrective plan.

Forest Policy Statement for Sustainability Benchmarks

These sustainability benchmarks (standards) recognize and support environmentally and economically sound forest practices and promote their application as a beneficial and desirable use of Maine's forest resource. Further, the management and harvesting of the forest resource makes vital contributions to the economy, environment and recreational features of the State. By proposing these sustainability benchmarks the State of Maine sets clear public expectations for measurable outcomes from Maine's private and public forest lands, while providing a more stable and predictable public policy that supports and encourages long-term investment in the Maine forest.

Criterion 2: Water Quality, Wetlands and Riparian Zones

The scope of these benchmarks is limited currently to water quality as influenced by forest management in and around wetlands and riparian zones, including issues of sedimentation, water temperature, and the biological integrity of water bodies. Issues related to wildlife and plant communities in the riparian zone and wetlands will be addressed by 2002 under the biological diversity criterion. The Maine Forest Service also plans to subject these benchmarks to further technical review with particular attention to the effects of forest management on forested wetlands hydrology and biology. Therefore, these benchmarks may be altered or expanded as that work evolves and as further technical review may so indicate. Actions proposed for the Maine Forest Service (BMP monitoring) and other partners (e.g., in-line stream monitoring) are likely to provide additional information that could serve as the basis for further refinement.

Goal: Maintain or, where necessary, restore the chemical, physical and biological integrity of aquatic ecosystems in forested areas.

Indicator 2.1: Percent of water bodies in forest areas (e.g. stream kilometer, lake hectares) in which the aquatic life is **as naturally occurs** (see glossary term).

Process Benchmark 2.1.1: The Department of Environmental Protection should continue to develop and refine a statewide water quality monitoring system that can measure this parameter and which relies on interagency partnerships to achieve by 2000.

Process Benchmark 2.1.2: The Maine Forest Service and the technical advisory group responsible for developing biodiversity benchmarks should review and if necessary modify this parameter for use in this benchmarking process by 2002.

Process Benchmark 2.1.2: The agencies charged with developing such a statewide water quality monitoring system should identify the current conditions and trends in this parameter and recommend desired future conditions by 2005.

Rationale: The resident biological community is a key indicator of the health of aquatic ecosystems. In particular, organisms living at the bottom of water bodies are sensitive to a variety of changes in water and habitat qualities, including silt, oxygen levels, temperature, nutrients and hydrologic regime. Certain fish species can tolerate only a narrow range of temperatures at different times in their life cycles.

Indicator 2.2: Percent of harvested acres on which Best Management Practices for the protection of water quality are utilized effectively.

Benchmark 2.2: The percentage of harvested acres on which Best Management Practices for the protection of water quality are utilized effectively will increase from 47% in 1995 to 75% by 2005.[10]

Rationale: This indicator serves as a proxy for assessing water quality in forested ecosystems, on the assumption that forest management operations effectively utilizing Best Management Practices coupled with progressive management approaches can minimize the effects of forest management on water quality.[11] This assumption will be revisited as more data become available from BMP utilization and water quality monitoring processes.

Indicator 2.3: Percent of water bodies in forest areas (e.g. stream kilometers, lake hectares) with significant variation from the historic range of variability found in relatively

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[10]St. Peter, T. 1996. Memo to Forestry Advisory Team, 19 August 1996. 47% of BMPs rated at "C" or above. The method of aggregating a rating of effective utilization may change, so the current rating serves only as a rough indicator of the situation in 1995; however, the need for improvement was clearly demonstrated.

[11]Briggs, R.D., Kimball, A.J., and Cormier, J. 1996. Assessing Compliance with BMPs on harvested sites in Maine. CFRU Res. Bull. 11. College of Natural Resources, Forestry and Agriculture. Maine Agric. and Forest Exp. Sta. Misc. Rpt. 400. Orono, ME. 35 p.

undisturbed watersheds in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation, nutrients or temperature change.

Process Benchmark 2.3.1: The Maine Forest Service, Department of Environmental Protection and other partners should identify by 2000 a means to establish a statewide water quality monitoring system that can measure these parameters.

Process Benchmark 2.3.2: The agencies charged with developing such a statewide water quality monitoring system should identify the current conditions and trends in the referenced water quality parameters and recommend desired future conditions by 2005.

Proxy Indicator 2.3: Number of and stream miles affected by water quality law violations attributed to forest management operations.

Proxy Benchmark 2.3: The number of water quality law violations attributed to forest management operations will show a continuous decline from the 1992-96 average of 50 per year.[12]

Rationale: Monitoring these water quality parameters over large areas of forest land can provide an initial indication of the impact of activities within or outside such areas on ecosystem health. It may indicate the extent to which forest management affects water quality; however, it is difficult to isolate the impacts of different land use activities when they occur within the same general area.

Indicator 2.4: Percent of mapped, perennial first and larger order stream kilometers with acceptable levels of large woody debris and snags within riparian zones.

Process Benchmark 2.4.1: The Maine Forest Service and the technical advisory group charged with developing forest sustainability benchmarks for biological diversity should identify a range of acceptable levels of large woody debris and snags that should be retained within riparian zones by 2002.

Process Benchmark 2.4.2: The Maine Forest Service should develop a methodology to measure this indicator using forest inventory data coupled with digital hydrological data by 2004.

Rationale: This indicator provides a measure of the extent to which riparian zones are managed to account for essential stream functions and processes, including the provision of nutrients and substrate for in-stream biological activity, control and routing of water and sediment, and habitat features.

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[12]Michael Mullen and William Galbraith, 1997, personal communications.

Indicator 2.5: Percent of stream kilometers in forested watersheds in which stream flow and timing has significantly deviated from the historic range of variability found in relatively undisturbed watersheds.

Process Benchmark 2.5: The agencies charged with developing a statewide water quality monitoring system should assemble existing data sets, identify the current conditions and trends in this parameter and recommend desired future conditions by 2005.

Proxy Indicator 2.5: Percent of stream-flow gauging stations in forested watersheds in which a statistically determinable trend in stream flow and timing can be determined.

Rationale: This may indicate the extent to which water supply conditions are affected by forest management. Some historical data is available for larger, main stem rivers; however, data appears to be lacking for many lower order streams.

Criterion 3: Timber Supply and Quality

The first critical need for Maine is a source of forest information that is more timely and better focused on answering important forest policy questions than the historic USDA Forest Inventory program. In 1999 Maine will initiate, in partnership with the USDA Forest Service, a new annual forest inventory. This new inventory will provide detailed, timely data about Maine's timber quantity and quality. Collecting data annually will allow for frequent periodic analysis that refine important trends in the forest. As demonstrated in the Timber Supply Outlook for Maine: 1995-2045, timber supply issues must be assessed over long periods of time. In addition, evolving forest practices take many years to implement and even longer to show measurable results in the forest.

Goal: To ensure that Maine's future timber supply is of sufficient quantity and quality to support a diverse and economically healthy forest manufacturing sector.

Indicator 3.1: Balance between harvest and growth, as determined by projecting current management practices and trends in forest development.

Benchmark 3.1.1: Show improvement in the balance between projected harvest and growth for the Statewide forest resource by 2005.

Benchmark 3.1.2: Show improvement in the balance between projected harvest and growth for major geographic & ownership divisions by 2005.

Benchmark 3.1.3: Show improvement in the balance between projected harvest and growth for distinct categories of tree species and quality by 2005.

Strategies: Conduct an assessment of future market demand and harvest activity to project harvest needs for 50 years. Every five years, beginning in 2005, use computer

simulation models together with the latest forest assessment data to project harvest to growth ratios for 50 years for the entire State.

Indicator 3.2: Acres by forest type and landowner category that are suitable and available for management and harvest.

Benchmark 3.2.1: Ensure that the number of forest acres available for management and harvest can support projected harvest and growth.

Strategy: Document the number of acres by forest type and landowner category where forest management or timber harvesting are limited by regulation, easement or other restrictions.

Indicator 3.3: Amount of tree mortality occurring that could otherwise be used through the application of sound silvicultural forest practices.

Benchmark 3.3.1: Reduce the measurable tree mortality by 20% in 10 years.

Benchmark 3.3.2: State policy will encourage landowners to implement yield-increasing practices that adhere to sustainability principles and are consistent with landowner objectives. As a result, growth rates should increase 1% per year until potential sustainable harvest levels are increased by 25% from that those documented in Timber Supply Outlook for Maine: 1995-2045.

Indicator 3.4: The ratio of sawlog and veneer volume to total volume for Sugar Maple, Yellow Birch, White Birch, White Pine, Red Oak, Red Maple, and Red Spruce.

Benchmark 3.4.1: Increase the quality of trees growing in the Maine forest. All harvest of commercial forest products should be guided by silvicultural principles that promote long-term productivity of the forest, and high quality growth. As a result, the ratios of sawtimber volume to total volume for important species will increase 10% by 2009.

Criterion 6: Public Accountability of Forest Owners and Managers

Public concern over stewardship of Maine's forests has driven the many forest policy debates. The frequent changes in forest ownerships that have characterized the past decade raise more questions of landowner commitment and follow-through. Increasing, and often conflicting demands upon the forest's resources, the complexity of forest ecosystems, and the public's desire for well-managed forests all point to a need for competent, professional forest management at all levels, and for continuous improvement in knowledge and practice.

While regulatory programs can prevent specific abusive practices, the more desirable goal of achieving forest management excellence requires a different approach. The key to rebuilding public trust in forest management lies in establishing and maintaining a

framework of publicly accessible and credible accountability measures by which forest landowners and managers can demonstrate their commitment to and achievement of an ecologically and economically healthy forest. Further, as our knowledge base increases, forest landowners and managers must demonstrate a commitment to continuous improvement through education and incorporation of research into practice.

Goal: To broaden the practice of sustainable forestry and build public confidence by establishing and maintaining reasonable accountability measures.

Indicator 6.1: Percentage and number of acres harvested under the direct supervision of a Licensed Professional Forester.

Benchmark 6.1.1: The percentage of acres harvested under the direct supervision of a Licensed Professional Forester will increase from 74% (372,579 acres) in 1997 to 85% (estimated 429,000 acres) by 2005.

Benchmark 6.1.2: The percentage and number of acres harvested on small ownerships (under 1,000 acres) under the direct supervision of a Licensed Professional Forester will increase from 38% (60,330 acres) in 1997 to 50% (estimated 80,000 acres) by 2005.

Rationale: The presence of a Licensed Professional Forester on a harvesting operation tends to improve the execution and appearance of a timber harvest through the development and adherence to a management and harvest plan, attention to Best Management Practices, compliance with applicable laws and regulations, and the protection of the landowner's interests.

Indicator 6.2: Number of acres (or number of landowners) under management certified by valid, independent, third party certifiers of sustainable forest management.

Benchmark 6.2.1: The number of acres (or number of landowners) under management certified by valid, independent, third party certifiers of sustainable forest management will increase significantly from the current level.

Rationale: Independent, third party certification systems provide a publicly credible means of assuring that forest management is conducted with consideration of and attention to sustaining all of the critical public values of forests as well as social and economic factors.

Indicator 6.3: Percent and number of timber harvesters who have received training and certification from the Certified Logging Professional Program or an equivalent training system.

Benchmark 6.3.1: The percentage of timber harvesters who have received training and certification from the Certified Logging Professional Program or an equivalent training system will increase from an estimated 58% in 1997 to 90% by 2005.

Rationale: Certified Logging Professionals are trained to work safer, conduct business in an ethical manner, and pay attention to public values during harvest operations. Although not a guarantee, having a CLP logger conduct a harvest can lead to better results on the ground and fewer headaches for the landowner.

Indicator 6.4: Total acres of non industrial forest land with management plans meeting Maine Forest Stewardship Program guidelines.

Benchmark 6.4.1: The number of acres of non industrial forest land with management plans meeting Forest Stewardship Program guidelines will increase from a cumulative total of 1,777 parcels and 162,664 acres in 1997 to 4,000 parcels and 400,000 acres by 2005.

Rationale: The Maine Forest Stewardship Program provides technical and financial assistance to small, non industrial landowners to plan and implement resource management plans on their woodlots. Cost-share practices include: soil and water conservation practices such as road-related BMP implementation; riparian and wetland protection practices; reforestation and tree planting; woodland thinning, pruning and weeding; fisheries and wildlife habitat improvement; forest recreation enhancement. Non industrial landowners with stewardship management plans have given thought to how they will attain their objectives on their woodlot, and have management plans prepared by trained resource professionals. In return, landowners agree to maintain the practices for at least ten years.

GLOSSARY

Advanced regeneration: Trees that have become established naturally under a mature forest canopy and are capable of becoming the next crop after the mature crop is removed.

As naturally occurs: Conditions with essentially the same physical, chemical and biological characteristics as found in situations with similar habitats free of measurable effects of human activity (38 MRSA § 466 subsec. 2).

Benchmark: Intermediate objectives for attaining goals.

Biological control: The use of natural means such as diseases, competitors, or predators to control unwanted pests.

Biological diversity (biodiversity): 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 to global.

BMP (Best Management Practices): Practices designed to be the most effective and practicable means to prevent or minimize environmental degradation, particularly nonpoint source water pollution.

Clearcut: A harvest in which all or almost all of the trees are removed in one cutting.

Commercial thinning: A silviculture treatment that "thins" out an overstocked stand by removing trees that are large enough to be sold as commercial products. It is carried out to improve the health and growth rate of the remaining crop trees.

Criterion: A category of conditions or processes by which sustainable forest management may be assessed. A criterion is characterized by a set of related benchmarks which are monitored periodically to assess change.

Ecological integrity: The completeness of the composition, structure, and processes that are characteristic of the native states of a system. Ecosystems with high ecological integrity continue to express the evolutionary and biogeographic processes that gave rise to the current biota, have a species composition, diversity, and functional organization expected from natural habitats of the region, and are resilient to environmental change and disturbance occurring within their natural range of variability.[13]

Even-aged management: Timber management actions that result in the creation of stands of trees in which the trees are essentially the same age. Regeneration in a particular stand is obtained during a short period at or near the time that a stand has reached the desired age or size for regeneration and is harvested. Cutting methods

[13]Committee of Scientists. 1998. Sustaining the People's Lands: Recommendations for Stewardship of the National Forests and Grasslands into the Next Century. Draft report of the Committee of Scientists to the Secretary of Agriculture, 25 October 1998.

producing even aged stands include clearcutting, patch clearing, strip clearcutting, shelterwood, and seed tree.

Farm and Open Space Tax Law: Provides for the tax valuation of farm land based on the current use value as agricultural land. Provides for incremental reductions in valuation of Open Space land that restrict uses to conserve scenic resources, public recreation opportunities, promote game management, or preserve wildlife habitat. In both cases the municipal tax assessor determines the 100% valuation.

Forest management: Manipulation of the forest to achieve certain objectives, such as timber production, wildlife habitat enhancement, maintaining forest health, or conserving biodiversity.

Forest Practices Act: The Maine Forest Practices Act (FPA) was adopted in 1989 to: 1) ensure adequate regeneration of commercial tree species within five years of completion of any timber harvest, 2) regulate the size and impact of clearcut timber harvesting. The law defines a clearcut, and authorizes the Department of Conservation to develop rules to establish performance standards for clearcuts.

Fragmentation: The process, through cutting or natural processes, of reducing the size and connectivity of stands that compose a forest or landscape. Fragmentation has two negative components for biota: loss of total habitat area, and smaller, more isolated remaining habitat patches.

Herbicide: A pesticide used for killing or controlling the growth of plants.

High-grading: An exploitive logging practice that removes only the best, most accessible, and commercially valuable trees in the stand, often resulting in a poor-quality residual stand.

High-yield forest practices: The management of stands where spacing (stocking), density and species composition are controlled via significant investment in precommercial treatments such as planting or spacing, for the purpose of increasing timber yields to at least 0.8 cords/acre/year (mean annual increment).

Limited Landowner Liability Law: Protects landowners who provide public access to their land from liability for injury to any person using the land for recreational activities.

Liquidation harvesting: The purchase of timberland followed soon thereafter by the removal of most or all commercial value in standing timber, and subsequent attempted resale of harvested land.

Maine Council on Sustainable Forest Management:

Natural regeneration: The establishment of a plant or plant age class from natural seeding, sprouting, suckering, or layering.

Nonpoint source (NPS) pollution: Pollution that enters a water body from an ill-defined or diffuse origin within a watershed and does not result from discernible, confined or discrete sources.

Overmature: In even-aged management, those trees or stands past the mature stage.

Partial cut: A process whereby only part of a stand is removed during each harvest operation. Partial cutting is not considered a regeneration method.

Pesticides: Any substance or mixture of substances intended to prevent, destroy or repel any undesirable animal species, usually an insect. A pesticide may also be any substance or combination of substances intended for use as a plant regulator, defoliant, or desiccant.

Precommercial thinning: Removing some of the trees from a stand that are too small to be sold for timber, to reduce stocking in order to concentrate growth on the remaining trees.

Regeneration: Seedlings or saplings existing in a stand; or the act of establishing young trees naturally or artificially. Renewal of a forest by either natural or artificial means.

Relatively undisturbed: Forested sites with intact soil duff layers that have not experienced harvesting for at least 20 years.

Riparian zone: The land immediately adjacent to a perennial or intermittent body of water. Riparian zones can 1) store water and help reduce flooding; 2) stabilize stream banks and improve water quality by trapping sediment and nutrients; 3) shade streams and help maintain water temperature for fish habitats; 4) provide shelter and food for birds and other animals; 5) support productive forests which can be periodically harvested; and 6) can be used as recreational sites.

Shelterwood: A silvicultural system characterized the gradual removal of the residual stand in a series of partial cuts. The initial harvest removes most of the mature trees, leaving enough trees to serve as a seed source and to provide sufficient shade to produce a new crop.

Silviculture: The art and science of controlling the establishment, growth, composition, health, and quality of forests to meet the diverse needs and values of landowners an society on a sustainable basis.

Spruce budworm: An insect larva that feeds on and in buds and young shoots of spruces and fir trees. An important forest defoliator that can cause extensive damage.

Sustainable forestry: Forest management that enhances and maintains the biological productivity and diversity of Maine's forests, thereby assuring economic and social opportunities for this and future generations. It takes place in a large ecological and social context and achieves a balance between landowners' objectives and society's needs.

Sustained yield: A regular and continuing supply of timber (or other desired goods or services) to the full capacity of the forest and without impairing the capability of the land.

Thinning: A cutting made in an immature stand of trees to reduce stand density primarily to improve growth of the remaining trees, enhance forest health, or recover potential mortality.

Tree Growth Tax Law: Provides for the tax valuation of forest land on the basis of the land's productivity value, rather than on fair market value. The State tax assessor determines tree growth valuation for each forest type on a county basis. Municipalities apply their own tax rate to the tree growth valuation to determine taxes due on the land.

Uneven-aged management: Actions that maintain a forest or stand of trees composed of intermingling trees that differ markedly in age. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

Uneven-aged stand: A stand of trees that contains at least three well-defined age classes intermingled on the same area.