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**The 2001 Biennial Report on
the State of the Forest
and
Progress Report on
Forest Sustainability Standards**

Report to the
Joint Standing Committee of the
120th Legislature on
Agriculture, Conservation and Forestry
October 11, 2001



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We help you make informed decisions about Maine's Forests

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

EXECUTIVE SUMMARY

Maine's 17 million acres of forest land cover 90% of the state's land area. Citizens, landowners, and visitors have complex and often conflicting connections to Maine's forests. Over the past decade, we have engaged in an often heated debate over how Maine's forests should be managed. This second biennial report on the State of the Forest provides information and analysis to inform the ongoing debate.

Indicators of forest health suggest that Maine's forests are relatively healthy, and on average are younger and more vigorous than those of neighboring states. Maine's annual forest inventory reports an increase in state wide timber volume since 1990, and higher average volume per acre. The 1999 inventory shows Maine has 37% more timber than the first US Forest Service inventory in 1959. However, Maine's forests continue to have an unbalanced age class structure. Improved silvicultural practices could substantially improve annual growth rates. An average annual state wide growth rate of ½ cord per acre per year is an achievable, long term goal.

An unprecedented amount of forest land changed ownership during the last ten years. Industrial land owners have been the primary sellers of large parcels of forest land, while institutional investors have emerged as the principal buyers of forest land. Ownership of forest land by industrial owners fell from 46% in 1993 to 30% in 1999. Institutional timberland investors now own 15% (2.5 million acres) of commercial forest land in the State.

Public concern regarding these land sales has led to growing pressure for public acquisition of fee and easement interests in higher value forest lands. Conservation easements have become an important tool in conserving the recreational, habitat, and other non timber values on commercial forest land.

Considering both public ownership of forest land and new, large scale conservation easements, nearly 2 million acres of forest land are protected from development.

Independent, third party certification of sustainable forest management is emerging as a new tool to define exemplary forest management, improve current management, and build public confidence in the quality of management in Maine's forests. By the end of 2001, about 58% of the acreage owned by large landowners in Maine will have attained third party certification, either by the Forest Stewardship Council or by the Sustainable Forestry InitiativeSM.

Timber harvest levels have been relatively stable since 1995. Maine landowners harvested 6.1 million cords of wood in 1999 on 532,000 acres. Clearcutting has declined to about 3.5% (18,700 acres) of all harvest activities in 1999. Liquidation harvesting (the practice of purchasing timberland and stripping the timber value followed by prompt resale of the land) is generally viewed as inconsistent with the principles of forest stewardship. The Maine Forest Service estimates that liquidation harvesting occurs on 16,000 to 64,000 acres each year.

The Maine Forest Service, in partnership with the USDA Forest Service, is now in its third year of a new, annual forest inventory. The new inventory system measures 20% of inventory plots annually. The first full inventory cycle will be completed in 2003. This annual inventory, combined with annual assessment of forest sustainability standards, are important new tools for assessing trends in forest conditions and evaluating progress toward sustainable forest management.

The report concludes with a progress report on Criteria and Indicators of Sustainable Forest Management.

TABLE OF CONTENTS

I. Forest Resource and Policy Issues	page 1
A. A Stable Public Forest Policy	page 1
B. Small Non Industrial Private Landowners	page 5
C. Changes in Land Ownership	page 7
D. Certification of Sustainable Forest Management in Maine: Issues and Trends	page 9
E. Annual Forest Inventory	page 12
F. Wood Flow and Timber Supply in Maine	page 14
A Snapshot of Maine's Forest Products Sector	page 14
Woodflow	page 15
Trends in Utilization	page 16
Harvest Trends	page 16
Silvicultural Trends	page 17
Sustainable Timber Supply	page 18
G. Forest Protection: A Fire Prevention Success Story	page 20
H. Forest Health and Monitoring	page 21
I. Maine's Forests and Climate Change	page 24
II. Forest Sustainability Standards	page 26
Criterion 1: Soil Productivity	page 27
Criterion 2: Water Quality, Wetlands, and Riparian Zones	page 29
Criterion 3: Timber Supply and Quality	page 31
Criterion 6: Public Accountability of Forest Owners and Managers	page 33
Glossary	page 35

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**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

PREFACE

Maine's forests are a complex system encompassing over 17 million acres of the state's land area. Maine landowners, citizens, and visitors have equally complex and often conflicting feelings about the state's forests - how they should be used, how they are used, what they mean. These sentiments collide in the public policy arena, leading to an ongoing debate that has sometimes been healthy and at other times divisive. The second of a series of "State of the Forest" reports is intended to enlighten the discussion.

The 118th Legislature established a Forest Resource Assessment Program in the Maine Forest Service to "assess the ability of the State's forests to provide sustainable forest resources and socioeconomic benefits for the people of the State" (12 MRSA §8876). The program has several components:

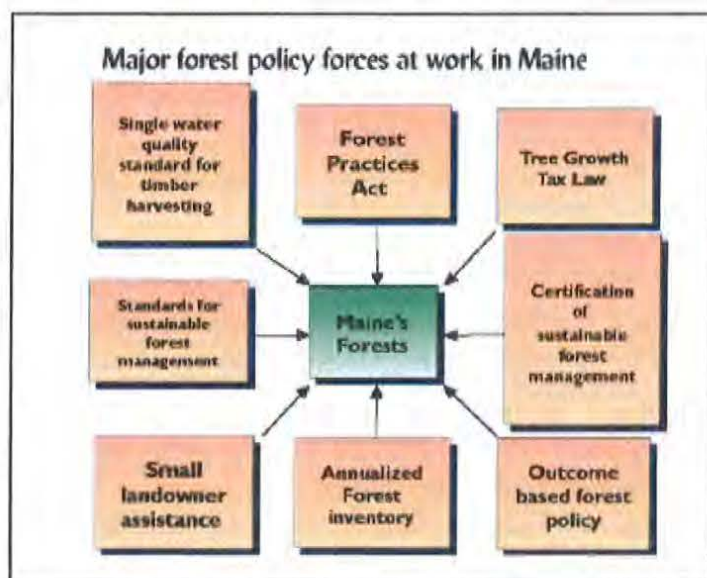
- ◆ An assessment of current status of forest resources using standards of forest sustainability. The standards of forest sustainability are in development by the Maine Forest Service and various stakeholder groups;
- ◆ Assessments of future demand for forest resources and trends in resource utilization;
- ◆ Identification of potential shortfalls in forest resources and policy recommendations necessary to avoid shortfalls;
- ◆ A determination of supply and demand for timber resources using annual forest inventory and timber supply modeling;
- ◆ The biennial report on the state of the State's forests (12 MRSA §8879).

This second biennial report on the state of the forest includes a summary of important forest resource and policy issues, and a progress report on achieving standards of forest sustainability.

I. FOREST RESOURCE AND POLICY ISSUES

A. A STABLE PUBLIC FOREST POLICY

Public concern over stewardship of Maine's forests continues to prompt forest policy debates. Maine recently weathered its third forestry referendum since 1996. The Legislature has faced numerous bills affecting forest management each session since 1994. The frequent changes in large forest ownerships during the past decade have created public uncertainty and have led to numerous calls for increased public acquisition of fee and easement interests in higher value forest lands. Increasing and often conflicting demands upon the forest's resources, the complexity of forest ecosystems, and the public's desire



**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

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.

One consequence of Maine's extensive forest policy debates, both in the Legislature and by referendum, is the creation of an air of uncertainty for landowners and forest industry and confusion on the part of the public. The state should formalize a stable and predictable forest policy to reduce the uncertainty and fear. Some elements of this policy are outlined below.

- **Outcome Based Forest Policy:** During the 1999 Forest Practices Act rulemaking

We have reached the limits of what a prescriptive regulatory framework has to offer.

process, it became clear to both MFS and a number of stakeholders that we have reached the limits of what a prescriptive regulatory framework has to offer. Prescriptive regulation may result in unintended consequences, such as forest fragmentation and premature harvesting to recover equity in a forest investment. MFS has adopted the position that the state should begin to focus more on outcome based forest policy, on the premise that this approach will do more to promote, stimulate and reward excellent forest management while still providing a baseline of regulatory protection for critical public

resources. In support of this premise, the 120th Legislature passed legislation submitted by Governor King to promote and field-test the development of outcome based forest policy.

- **Forest Practices Regulation:** The Legislature has enacted a number of laws to protect public trust resources and public values affected by forest management, including the Forest Practices Act, water quality laws, and laws addressing timber theft, trespass, and fraud.

While these laws set a safety net to guard against the most abusive practices, they do not necessarily encourage good forest management and, on occasion, may actually hinder it. Despite the shortcomings of prescriptive regulation noted above, a well designed regulatory framework constitutes an important pillar of public forest policy.

- **Taxing Forest Land at its Productivity Value:** A commitment to grow healthy, high-quality forests requires a landowner to invest time and money with a very long-term payback. Many landowners express the fear that these commitments will be undercut by changing public policy. In general, policy instability promotes a short-term approach to forest management that contradicts the public policy goal of ensuring long-term, sustainable

**Highlights of 1999 Changes to the
Forest Practices Act**

- All clearcuts over 20 acres must have a silvicultural or wildlife habitat justification, attested to by a professional.
- Require harvest plans for all clearcuts over 20 acres.
- Made harvest plan requirements more stringent.
- Require 60 days pre-harvest notification and field review by MFS for all clearcuts over 75 acres.
- Improved clearcut separation zone requirements.
- Exempted small landowners (under 100 acres total statewide ownership) from most standards.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

forest management. Perhaps the best 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 nearly every year, legislative proposals to substantially change the program are debated, and the 2000 forestry referendum focused specifically on the program. While it can be argued the program has not been changed substantially, the nature of the annual debate combined with actual but modest changes has created an atmosphere of uncertainty. To address the concerns of landowners participating in the TGTL, the Land and Water Resources Council has recommended that the Legislature consider formalizing the state's commitment to the program by fixing the terms under which enrolled lands must be managed at the time of enrollment, essentially creating a binding contract between the state and enrolled landowners.¹

Policy instability promotes a short-term approach to forest management that contradicts the public policy goal of ensuring long-term, sustainable forest management.

- **Incentives for Forest Investments:** The MFS administers the Forest Stewardship Assistance Program and provides technical support for the Stewardship Incentive Program. Both are funded by the USDA Forest Service. These programs help small landowners (those owning less than 5,000 acres statewide) develop management plans and implement stewardship practices on their woodland properties. To date, both programs have helped improve management on over 450,000 acres of Maine forest land. Although the Stewardship Incentive Program has expired, the USDA Forest Service is working with stakeholders and Congress to develop and fund a new landowner assistance program in the 2002 Farm Bill.
- **Independent, Third Party Certification:** Independent, third party certification of sustainable forest management is a rapidly evolving, voluntary, market-driven tool that is changing the face of Maine's forest landscape. Independent third party auditors assess whether the management practices of a landowner are in accordance with specific standards of sustainable forestry. Nearly 3.7 million acres of Maine's forest lands have received third party certification through either Forest Stewardship Council (FSC) or Sustainable Forestry InitiativeSM (SFI). Maine's Bureau of Parks and Lands is currently seeking certification of 493,000 acres of Public Lands. (See the Section D. Certification of Sustainable Forest Management in Maine: Issues and Trends, pg. 9 for a more complete discussion.)

Nearly 3.7 million acres of Maine's forest lands are certified as sustainably managed.

¹ Land and Water Resources Council. 2001. Report on the Use of Incentives to Keep Land in Productive Farming, Fishing and Forestry Use. Presented to Joint Standing Committees on Natural Resources, Taxation, and Agriculture, Conservation and Forestry, pursuant to 1999 PL chapter 776, section 17.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

Including forest land managed by the Maine Department of Conservation - Bureau of Parks and Lands, nearly 2 million acres of Maine forest land are protected from development.

- **Conservation Easements:** In light of recent and ongoing changes in forest land ownership (see Section C. Changes in Land Ownership, pg. 7), large scale conservation easements have become an important tool to stabilize the forest land base and to formalize some public expectations about the present and future management of a significant portion of Maine's working forests. The most basic conservation easement extinguishes the development rights on a property forever, and maintains the property as productive working forest. Some easements set additional conditions or expectations about forest management practices or outcomes in addition to extinguishing development rights.

Forest lands with some form of conservation protection can be summarized as follows:

Forest land protected by law or deed restrictions, timber harvesting is not practiced (Baxter State Park, Big Reed Preserve, etc.)	334,000 acres
Forest land protected from development by fee ownership or conservation easement, some restrictions on timber harvesting (Maine Department of Conservation - Public Reserved Lands, The Nature Conservancy's St. John Project, Land for Maine's Future purchases)	796,000 acres
Forest land protected from development by fee ownership or conservation easement, no restrictions on timber harvesting (Sale of development rights to Department of Conservation - Bureau of Public Lands, New England Forestry Foundation's Pingree Project, and local land trusts or other NGOs.	825,000 acres

- **Balancing a conservation ethic with a consumption ethic:**

In recent years, the public has pressured forest landowners and managers worldwide to improve their management practices and to internalize some costs of providing public benefits, such as recreation and protecting biological diversity. This pressure has led to a sharp reduction in timber harvesting on federal lands and some state lands. Many private landowners have risen to the challenge, as evidenced by the increasing attention to forest certification. As noted in the certification section, this does not come without a cost to the landowner.

Unfortunately, little has been said about the consumption side of the equation. Today the U.S. public consumes more resources than at any time in its history, and also consumes more per capita than almost any other nation. Solid wood and paper use continue to climb, as does the size of the average single family house (usually constructed largely of wood products).



The disconnect between conservation and consumption transfers pressures on forest ecosystems from the federal lands and some industrial lands to small private non industrial lands and to other countries.

Maine is a microcosm of this disconnect. Maine's recent and ongoing debates over forest practices referenda and legislation have not fostered a stable public forest policy. While regulatory programs can prevent specific abusive practices, the more desirable goal of achieving forest management excellence requires a different approach. The key to building public trust in forest management lies in establishing and maintaining a policy framework of publicly accessible and credible accountability measures by which forest landowners and managers demonstrate their commitment to and achievement of an ecologically and economically healthy forest. Further, as

our knowledge base increases, forest landowners and managers should demonstrate a commitment to continuous improvement through education and incorporation of research into practice.

B. SMALL NON INDUSTRIAL PRIVATE LANDOWNERS

The changing face of Maine's NIPF landowners and NIPF lands²

Small non industrial private forest (NIPF) landowners³ control the management of about 5.5 million acres (one-third of Maine's forest land), mostly in the southern and central regions of the state.⁴ Their management decisions affect to a significant degree the present and future condition of the state's forest based economy, including timber supply, as well as the quality of life in rural settings, recreational opportunities, biological diversity, and the many other functions and values of forests.

Maine's small landowners and the lands they own and manage have changed markedly over the last two decades. For example, the average size of privately owned forest parcels declined from about 82 acres in 1982 to about 60 acres in 1993. The number of forest parcels smaller than 50 acres increased by 30 percent during the same period, increasing from 136,800 parcels covering 1.3 million acres to 206,400 parcels covering 1.7 million acres. The biggest losses occurred in parcels of 200 acres to 499 acres and parcels greater than 5,000 acres.

In 1993, there were over 145,000 individual owners of forested parcels between 1 and 9 acres, representing 318,000 acres. Although small in total acreage, these owners represent approximately one-third of Maine's households. (1993 is the most recent data available on small forest ownership. MFS expects these trends in small ownership to continue.)

Individuals 65 and older owned about 2.45 million acres of forest land in 1993, or about 36 percent of the acreage owned by individuals. This represents an increase from about 25

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.

³ Defined as non industrial private landowners owning more than 10 acres and less than 1,000 acres.

⁴ Birch, 1996, op. cit.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

percent of the acreage owned by individuals in 1984. Of the acreage owned by individuals, about 1.6 million acres, or 24 percent, changed hands between 1980 and 1994.

Although the owners of over two-thirds of Maine's forest land cite timber production as the primary or secondary reason for owning their land, they represent only 3 percent of the owners. Half of the owners of Maine's forest land (holding just over 10 percent of the land) own their forest land as part of their residence, for aesthetic enjoyment, or for recreation.

These demographics present both challenges and opportunities.

Over the last several years, MFS has examined its policies and programs affecting NIPF landowners with the goal of improving service to this rapidly changing client base and reducing real or perceived barriers to good management on NIPF lands. Highlights of recent initiatives include:

- Call Before You Cut, a proactive effort to help forest landowners make informed decisions about managing their lands.
- The Woods In Your Back Yard, a forest management guide for homeowners, primarily those owning 1 to 9 acres of woodland. This publication recently won an award from the National Interpretive Association.
- What Do Trees Have To Do With It?, a guidebook to help community planners incorporate forest-friendly policies into their comprehensive plans.
- Simplified the Annual Landowner Report of Timber Harvest for small landowners. MFS is testing a "short form" to reduce the paperwork burden and improve the quality of harvest information from small woodland owners.
- Exempted small landowners (those owning 100 acres or less statewide) from most Forest Practices Act standards. Although small landowners were not creating the problems that the Forest Practices Act was intended to address, many of them perceived the law as another layer of regulation that created a disincentive to manage their forest land.
- Upgraded the Forest Information Center and many MFS information sheets.
- Reviewing and improving the delivery of existing programs.



A forest in Maine can take a life time to grow. Unfortunately, many years of stewardship can be lost in just a few days of poor timber harvesting. You can avoid problems by seeking professional forestry advice before you cut. If you have been contacted by someone to harvest your woodlot, get the facts, and call *before* you cut. The Maine Forest Service can help...but you need to

Call Before You Cut
Department of Conservation
Maine Forest Service
Forest Policy & Management
Division
1-800-367-0223

MFS is also pursuing a number of new initiatives and seeks continuous improvement in its existing programs. For example, MFS has identified women woodlot owners as an important but under served clientele. MFS recently received a Focus Funding grant from the USDA

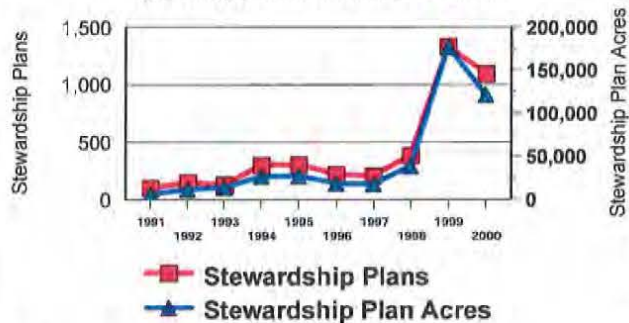
**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

Forest Service to develop a forest management education program for women woodlot owners. MFS will work with New Hampshire Cooperative Extension over the next two years to develop the program. These kinds of efforts will help MFS achieve its goal of promoting informed decisions about the forest as Maine's forest land ownership base continues to diversify.

**Seizing Opportunity
From a Crisis**

The January 1998 ice storms created a window of opportunity for MFS. In the wake of the damage to millions of acres of forest land across a large swath of the state, MFS received from the USDA Forest Service over \$20 million in Ice Storm Recovery grants. Several million dollars were directed to the Forest Stewardship Assistance and Stewardship Incentive Programs, allowing MFS to reach hundreds of NIPF landowners with the message of forest stewardship, create new relationships between these landowners and private consulting foresters, and affect the future management of thousands of acres of NIPF land.

**Maine Forest Stewardship Assistance Program
Accomplishments 1991 - 2000**



Totals 1991 to 2000: 4,211 plans covering 462,135 acres of small, non-industrial forest lands.

C. CHANGES IN LAND OWNERSHIP⁵

Maine has seen an unprecedented amount of forest land change hands during the last ten years, adding to the public's perception of instability and raising questions concerning landowners' long term commitment. Three major patterns in forest land ownership have emerged. First,

Industrial landowners have been the primary sellers of large parcels of forest land since the mid 1980s.

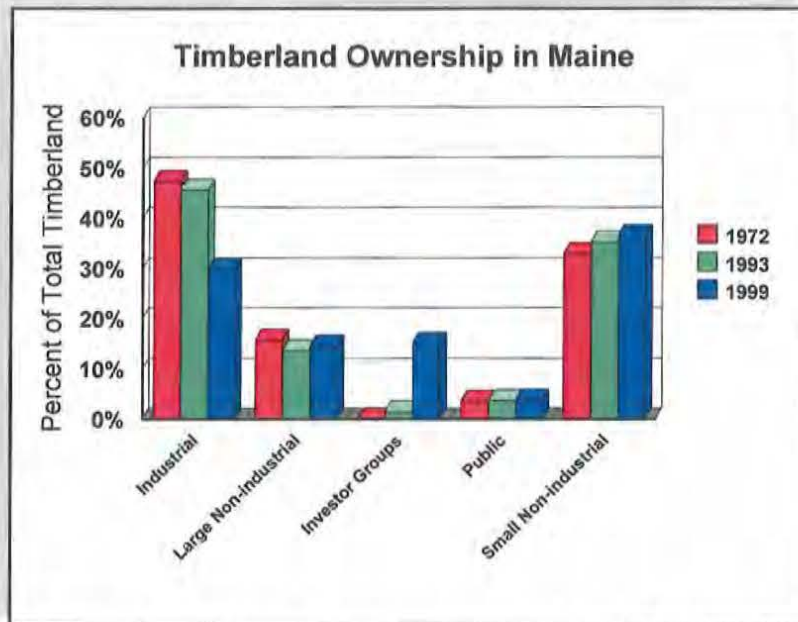
industrial landowners have been the primary sellers of large parcels of forest land since the mid-1980s. Second, institutional investors have emerged as the principal buyers of forest land. Finally, public concern regarding these land sales has prompted the purchase of conservation easements by public and nonprofit agencies as a new land conservation strategy.

As recently as 1993, pulp and paper companies were the predominant group of forest landowners in Maine. Under pressure from the investment community to improve their financial performance, forest products and paper companies that once viewed land ownership as strategic to controlling wood supply have recently sold forest land as nonessential assets. Ownership by industrial land owners in Maine fell from 46% in 1993 (8 million acres) to 30% in 1999 (5 million acres).

⁵ Much of this information is derived from Nadeau, K. 2000. Forestland Ownership in Maine: Recent Trends and Issues. A Report to the Joint Standing Committee on Agriculture, Conservation and Forestry; Second Regular Session of the 119th Legislature.

The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards

Institutional timberland investors are most often financial institutions that hold assets as fiduciaries for the benefit of others. This investor group includes bank trust departments, insurance companies, mutual funds, pension funds, and university endowment funds. Institutional investors now hold over 15% (2.5 million acres) of commercial forest land in Maine.



The trend in Maine mirrors a national trend in the acquisition of timberland by institutional investors. An investment in timberland is a simple real estate investment consisting of three basic elements: bare land, merchantable timber, and pre merchantable trees. The overall return to the investor depends on the performance of the value of each of these components over time. Institutional timberland investors often have a short expected ownership tenure, typically six to fifteen years. The major portion of their expected return on investment lies in the appreciation of asset value and strategic sale of the asset when value is at its highest. The recent purchases by timberland investors, whose goals are to maximize financial returns, prompts concerns whether they are committed to managing sustainably, and whether they will honor non-timber resource values.

An encouraging development is the willingness demonstrated by Maine timberland investors to conserve important recreational and ecological areas by offering undeveloped land for purchase or purchase of conservation easements. An example is the purchase in June 2000 by the State of Maine of land and development rights on 72,000 acres plus 12 miles of Moosehead Lake shoreline. The project will keep the Moosehead shoreline undeveloped, guarantee public access, and maintain 72,000 acres as productive working forest. Negotiations continue between the State and timberland investors for a number of large conservation easements.

D. CERTIFICATION OF SUSTAINABLE FOREST MANAGEMENT IN MAINE: ISSUES AND TRENDS⁶

"Sustainable forest management is an inherent aim of certification. It is the ultimate goal to which certified forests should aspire, but such a goal is reached only through a period of transition, during which management standards are progressively established and fine-tuned. The explicit aim of certification is to improve the quality of forest management so as to reach this goal."⁷

Independent, third party certification of forest management is a rapidly evolving, voluntary, market-driven tool that has the potential to change the face of Maine's forest landscape. Independent third party auditors assess whether the management practices of a landowner are in accordance with specific standards of sustainable forestry. Depending on the system chosen, either the land or the land manager may be certified. The driving factor behind certification in Maine appears to be a desire to satisfy public concerns over forest management as opposed to seeking financial benefit in the marketplace.

Three certification systems have emerged in the Northeast:

- Forest Stewardship Council - is an independent, not for profit organization. Its certification system and standards were developed by representatives from environmental, social, and forest management groups. The system is based on ten principles of sustainable forestry, which are further defined by 56 specific indicators of sustainable forest management. Participants are audited by independent, FSC-accredited third parties against all FSC principles and indicators. FSC is a performance-based system, most indicators emphasize field-level, on-the-ground performance. Public reporting of individual audit results is mandatory.
- Sustainable Forestry InitiativeSM (SFI) - is a program of the American Forest and Paper Association (AF&PA). Participation in SFI is required of all AF&PA members. The SFI system is based on a set of 5 principles and a series of implementation guidelines consisting of 11 objectives and 35 performance measures. Participants can choose between first, second, or third-party verification. Participants selecting the voluntary third-party certification are audited against a mandatory set of "core indicators" in addition to a broader set of other voluntary indicators. The SFI system is more process-based; many indicators emphasize policies, plans, and management procedures. A few are designed to evaluate on-the-ground results. Public reporting of company-specific audit results is not required, although most companies choosing the third-party certification publish a final audit report.
- ISO 14001 - The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies. The ISO develops technical standards for many

⁶ Much of this information derived from Barker, A. 1998. A Review of the Current Forestry Audit Programs in the Northeast: A Report to the Joint Standing Committee on Agriculture, Conservation and Forestry; Second Regular Session of the 118th Maine Legislature.

⁷ Upton, C. And Bass, S. The Forest Certification Handbook. St. Lucie Press, 1996. 219 p.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

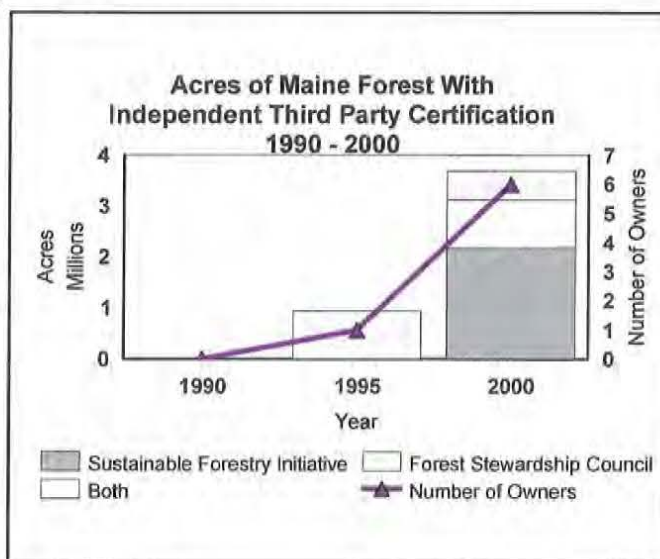
fields. It has more recently developed management systems standards including the ISO 9000 series for quality management systems, and the ISO 14000 series for environmental management systems. The generic Environmental Management System Standard is the ISO 14001. The EMS does not have specific performance requirements; rather, it seeks to improve environmental performance through management planning. Third-party audits are optional; a company may self-declare its compliance with the ISO 14001 EMS standard. Under ISO 14001 standards, a forest operation's management system is certified, not on-the-ground results.

A listing of Maine lands currently certified is shown below. Nearly 58% of all acreage managed by large landowners (landowners who own more than 100,000 acres of forest land) in Maine either has or is anticipated to have attained some form of third party certification by the end of 2001.

Forest Lands in Maine with Third Party Certification for Sustainable Forest Management		
Landowner/Land Manager	Acres Certified	Comments
Seven Islands/Pingree Assoc.	950,000	FSC 1994, SFI 2000
JD Irving	550,000	FSC 1999. Expect entire ownership of 1.55 million acres to achieve SFI certification during 2001.
Plum Creek	905,000	SFI 1999
Mead	550,000	SFI 2000
International Paper	484,000	SFI and ISO 1999. Expect entire ownership of 1.4 million acres to achieve SFI and ISO certification during 2001.
Fraser	240,000	SFI and ISO, 2000
State of Maine - Bureau of Parks and Land	0	Expect 492,000 acres to receive SFI and FSC certification during 2001.

The two major certification systems being used in Maine, FSC and SFI, are both credible systems that are still evolving. Landowners who participate in certification should be recognized for their efforts. It is more important to find ways to encourage more land to be certified under one of the systems than to debate the merits of individual systems.

A major challenge for forest certification systems is to encourage participation by small, non industrial private land owners. The administrative costs of certifying small parcels are very high, and, without some form of private or public assistance, are unlikely to place individual certification within reach of these landowners. One option to resolve this issue involves certifying the land manager, in all



**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

cases to date a consulting forester. The consulting forester bears the cost of certification. This option allows the clients of a certified land manager to enjoy any benefits of certification. A number of consulting foresters have sought independent, third party certification through the FSC certification system. Although the acreage they manage is small relative to larger ownerships, collectively their management can have a significant impact on the future of forestry in Maine. Since much of the land they manage is found in southern Maine, their management can greatly influence public perceptions of forestry. Two firms are currently certified in Maine: Mid-Maine Forestry in Warren, and Two Trees Forestry in Winthrop. A number of other consulting foresters are reportedly seeking certification. The Forest Stewards Guild offers cost-share assistance to consultants seeking FSC certification.

*Approximately
750,000 acres,
owned by 1,800
small private
non-industrial
landowners, are
enrolled in the
American Tree
Farm system in
Maine.*

Another certification option for small private non industrial landowners is through the American Tree Farm system. Approximately 750,000 acres, owned by 1,800 small private non-industrial landowners, are enrolled in the American Tree Farm system in Maine. The Tree Farm System has entered into a mutual recognition agreement with SFI, where SFI recognizes wood delivered from Tree Farms as certified. As part of the agreement, the American Tree Farm System agreed to an independent third party audit of its forest certification process for private non industrial landowners. Tree Farm landowners provide SFI member companies with a source of certified wood from non-industrial forest lands.

Forest products **chain-of-custody certification** is a subset of forest management evaluation programs. The certificate allows landowners and forest products dealers to communicate to consumers that their products originate from well-managed lands, and may be used in the marketplace to command market share or possibly a price premium. At least eight wood processing firms have received chain-of-custody certification in Maine (in addition to the chain of custody granted to certified landowners and land managers).

A number of large U.S. retailers of wood, notably Home Depot, Lowe's, and Kaufman and Broad, have implemented or committed to policies of purchasing only wood produced on certified lands. A number of European firms have made similar commitments. The **Certified Forest Products Council** is an independent, not for profit, voluntary initiative that promotes and facilitates the increased purchase, use and sale of third-party independently certified forest products. Members from Maine include:

A. E. Sampson & Son, Warren, ME
Colombia Forest Products, Presque Isle, ME
E.D. Bessey & Sons, Hinckley, ME
F. A. Smith Lumber, Easton, ME

Maine Woods Company LLC., Portage, ME
Moose Crossing Lumber Co., Ashland, ME
P.M. Kelley, Inc., Ashland, ME
Rock Lumber Co., Portage, ME

The outlook for certification is very good. Competitive pressures are forcing the various programs to establish standards that are credible, visible, and accessible to the public. The long-promised market share and price premiums for certified wood have not developed. However, it appears that Maine landowners are pursuing certification to demonstrate sustainable forest management to the public, rather than as a marketing or price strategy.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

Additional Resources

American Tree Farm System: www.treefarmssystem.org

Certified Forest Products Council: www.certifiedwood.org

"Forest Certification Matrix." Florida Forestry Association. www.floridaforest.org. Follow links to "Landowners" and "All About Certification" or use <http://66.38.154.129/ffa/uploadPDF/Matrix.pdf>

Forest Stewardship Council: www.fscus.org. "FSC Principles and Criteria" can be found at fscus.org/html/standards_policies/principles_criteria/index.html

National Wildlife Federation, Natural Resources Council of Maine, Environmental Advocates. "A Comparison of the American Forest & Paper Association's Sustainable Forestry Initiative and the Forest Stewardship Councils' Certification System." June 2001. www.maineenvironment.org/nwoods/FSC_SFI_comparison.htm. This report compares the formal written standards of the FSC and SFI systems, but does not examine the on-the-ground implementation of either system in Maine .

Sustainable Forestry Initiative: www.afandpa.org. The following publications can be found at www.afandpa.org/forestry/sfi_frame.html

- 2001 SFI Standard
- 2001 SFI Verification Process
- SFI Program Sixth Annual Progress Report

E. ANNUAL FOREST INVENTORY

The USDA Forest Service - Forest Inventory and Analysis, has been the major source of state-level forest inventory information across the U.S. The program provides periodic information on a variety of parameters describing forests and forest use: area and type of forest; species, size, and health of trees; and rates of tree growth, mortality, and removals.

The USDA Forest Service conducted four forest inventories in Maine (1954-58, 1968-1970, 1980-1982, and 1994-1996). These efforts were augmented by additional inventory efforts to address specific issues. Despite this level of monitoring, Maine has faced contentious debates concerning sustainable forest management over the past decade. The long period between inventories has not served Maine's policy discussions well and contributed to a high degree of uncertainty about the state of the forest.

In response to customer needs, the USDA Forest Service - Forest Inventory and Analysis has a new Congressional mandate (Public Law 105-185, The Agricultural Research, Extension, and Education Reform Act of 1998) to change the way they conduct forest inventories nationwide, including:

1. Change from a periodic to an annual forest inventory which measures 20% of all inventory plots in each state each year;
2. Development of consistency in the program across all forest lands;
3. Produce complete state reports at five year intervals.

In 1997, the 118th Maine Legislature authorized the Maine Forest Service to participate with the USDA Forest Service to implement an annual forest inventory (PL 1997 C.720). Maine is the first state in the Northeast to participate in this new inventory process, and is the first

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

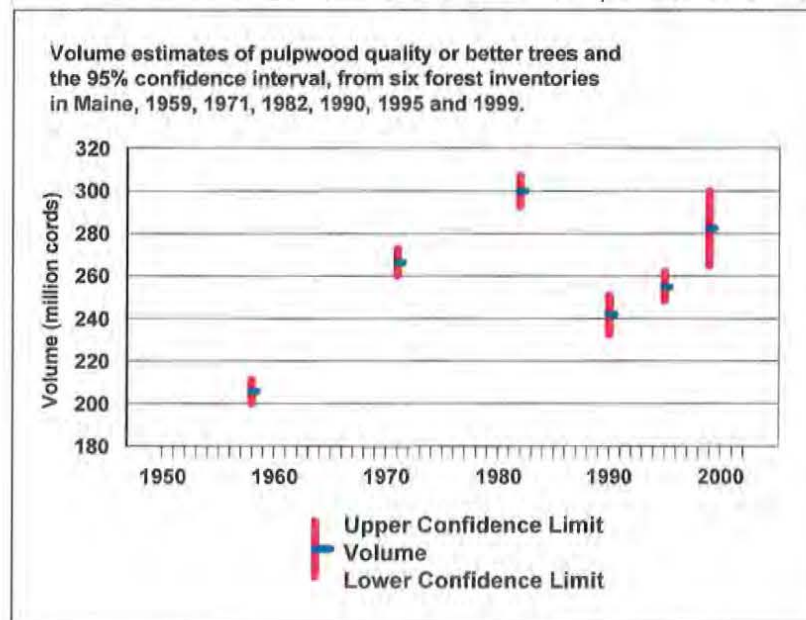
state in the nation to convert to the new national core variables. The annual inventory measures 20% of the inventory plots every year. When the 1999 plots are completely remeasured in the sixth inventory year (2004), Maine will begin the process of a continuous annual inventory system consisting of the most recent five years of inventory data.

Field work under the new inventory system began in April 1999, and will be completed over a five year period. The second field season ended in December, 2000. To date, 1,371 inventory plots have been measured. Analysis of the 1999 survey data was completed in October, 2000. Analysis of the combined first and second year data was on-going when this report was written.

The first annual inventory report, published in October 2000, provides estimates of forest area; number, species, and size of trees; and volume based on the first year's data. The complete report can be obtained from the Maine Forest Service, or can be downloaded at www.state.me.us/doc/mfs/inv_rptp.pdf.

Highlights of the 1999 Annual Inventory of Maine's Forests include:

- In 1999, Maine's forests had an estimated inventory of 282 million cords of wood (trees of pulpwood quality or better). This is an increase from the 1995 inventory.
- The average volume per acre in 1999 (trees of pulpwood quality or better) is estimated at 16.3 cords per acre. This is an increase since 1995.
- There is no significant change in volume since 1995 in any individual species or species group.
- There is no significant change since 1995 in the volume of wood suitable for use by sawmills.
- 94% of softwood trees 5.0" diameter or larger, and 84% of hardwood trees 5.0" diameter or larger are sawlog quality trees.
- 87% of the timberland area is in desirable stocking classes (moderately stocked and fully stocked), essentially unchanged from 1995. Overstocked stands make up 6%, and poorly stocked stands make up 7% of timberland area.
- Maine remains 90% forested, and 97% of the forest land is productive timberland.

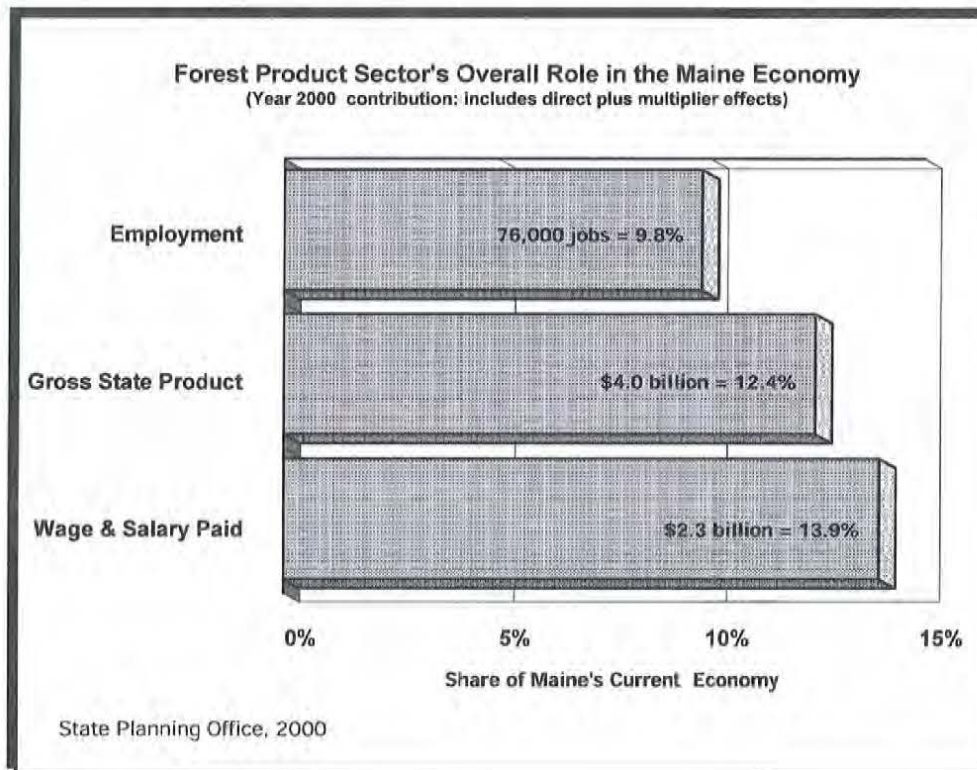


F. WOOD FLOW AND TIMBER SUPPLY IN MAINE

A SNAPSHOT OF MAINE'S FOREST PRODUCTS SECTOR

Maine has 15 major paper mills that have a combined paper-making capacity second only to the state of Wisconsin. The state also has numerous sawmills and specialty wood products mills, as well as a small but high-quality wooden furniture industry.

- ♦ Maine's forest products sector directly provides 30,000 manufacturing jobs - roughly 15,000 jobs each in the paper industry and the lumber and wood products industry (which includes logging).
- ♦ Including direct employment plus multiplier effects, the forest products sector provides 76,000 jobs, 9.8% of current Maine jobs.
- ♦ The forest products sector accounts for \$5.6 billion in sales, or 40% of Maine's total manufacturing sales. Paper accounts for \$4.3 billion (31%), and lumber and wood products \$1.3 billion (9.5%).
- ♦ The forest products sector contributes \$4 billion (12.4%) of Gross State Product and \$2.3 billion (13.9%) of Wages and Salaries paid in Maine. (State Planning Office, 2000)



WOODFLOW

The forest products industry depends on a steady flow of fiber and logs from Maine's forests, as well as from out of state sources.

Wood Fiber Balance

- Maine landowners harvested 6.1 million cords in 1999.
- Maine's pulp and paper industry draws fiber over long distances. Over the past decade, the pulp and paper industry has shifted to using more hardwood than softwood pulp.
- A large sawmill industry in Quebec draws significant volumes of spruce/fir sawlogs from northern Maine. A substantial portion of the chips produced from those sawlogs by Quebec sawmills is sold to Maine pulp mills to manufacture paper.

Exports

- 18% of the total harvest (1.1 million cords) was exported out of state.
- Spruce/fir sawlogs are the biggest export component. In 1999, 815 million board feet of spruce/fir sawlogs were harvested; 60% were processed in Maine, 40% were exported, primarily to Quebec sawmills.
- 21% of hardwood sawlogs harvested in Maine was exported, with Quebec the largest single destination.

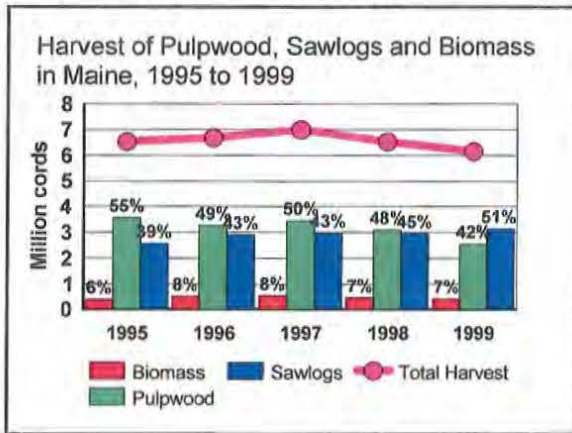
Imports

- Maine is a net importer of wood fiber. Maine's forest products sector consumed 6.3 million cords of wood in 1999. 81% (5.1 million cords) was harvested in Maine, 19% (1.2 million cords) was imported from out of state.
- The sawmill industry consumed 1.4 billion board feet of sawlogs; 17% of the supply was imported from out of state. New Brunswick was the largest single source of imported sawlogs, shipping about 54% of the total sawlog imports to Maine.
- Maine's pulp and paper industry consumed 3 million cords of wood in 1999; 20% of its supply was imported from out of state. Pulpwood imports originated predominantly from New Hampshire and New Brunswick (48% and 30% of pulp imports respectively).

Wood Fiber Balance in Maine, 1999	
	million cords
Wood harvested in Maine	6.137
Wood exported from Maine	-1.068
Wood imported to Maine	1.229
Total processed by Maine Forest Products Industry	6.298

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

TRENDS IN UTILIZATION

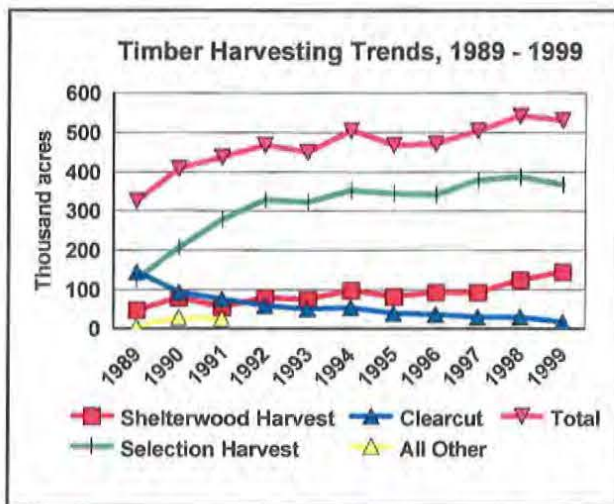
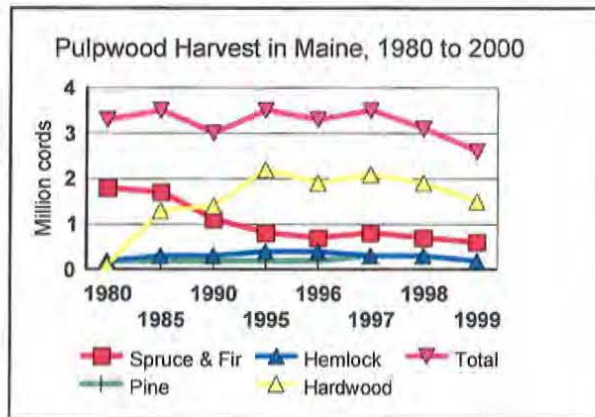


Although overall harvest levels in Maine have been relatively stable since 1995, (ranging from a high of 6.9 million cords in 1997 to a low of 6.1 million cords in 1999), there have been shifts in species utilization and product mix as wood supply and markets change, and as manufacturing technologies improve.

Maine sawmills continue to update manufacturing technologies to remain competitive in a world market. Sawmills are able to recover more lumber from each sawlog. Softwood mills in particular can utilize smaller

diameter sawlogs for 2x4s and dimension lumber. Since 1995, the proportion of Maine's pulpwood harvest has declined, while sawlog harvest grew from 39% of total harvest to just over 50%. In 1999 for the first time, more wood was harvested as sawlogs than pulpwood.

Meanwhile, Maine paper mills have substituted hardwood species for spruce and fir in their supply mix. Maine paper mills are increasingly relying on residual chips from softwood sawmills as part of their supply mix. In 1999, the raw material mix delivered to pulp and paper mills was roughly 27% softwood pulpwood, 45% hardwood pulpwood, and 28% sawmill residual chips.



HARVEST TRENDS

Over the past decade, annual timber harvest in Maine has increased from about 325,000 acres in 1989 to about 532,000 acres in 1999. During the period, clearcutting has dropped dramatically as a harvest method, from 44% of harvest in 1989 to 3.5% in 1999. Most of the clearcutting (82%) is conducted by eleven large landowners (landowners who own more than 100,000 acres).

SILVICULTURAL TRENDS

Improved silvicultural practices can improve the annual growth rates in Maine's forests. An average annual growth rate of a ½ cord per acre per year is an achievable, long term target.

Some land owners in Maine use high yield silvicultural practices in young stands to improve future growth and yield. These practices include pre commercial thinning of young softwood stands, plantation establishment, and control of competing vegetation in young softwood stands by herbicide application. Large landowners account for the majority of these practices.

MFS estimates that in 1999 approximately 4.7% of Maine's timberlands were in high yield silvicultural practices, with the following breakdown:

Precommercial thinning	216,000 acres
Plantation	204,000
Herbicide release	<u>366,000</u>
Total	786,000 acres

Liquidation harvesting

A 1998 study by the Maine Forest Service examined the nature and extent of timber liquidation in Maine.⁸ MFS defined liquidation harvesting as the purchase of timberland, followed by the removal of most or all commercial value in standing timber and prompt resale of the land.

Liquidation harvesting is generally viewed as inconsistent with accepted principles of forest stewardship. It leads to indiscriminate harvesting; it is often a speculative practice that leads to hasty land subdivision (both regulated and unregulated); and it is characterized by disposal of timberland with little regard for its continued use as productive forest land.

The Maine Forest Service concluded that:

- Liquidation harvesting occurs throughout the state, predominantly in organized towns.
- Liquidation harvesting is conducted primarily by a small group of logging contractors or realtors who are in the business of buying land, stripping the timber value, and reselling the bare land.
- 3% to 12% of all timber harvests can be characterized as liquidation harvests, the equivalent of 16,000 to 64,000 acres each year. (In comparison, approximately 5,400 acres of forest land were converted to non-forest uses in 1999.)
- Since liquidation harvests generally retain some stocking of low-quality timber they are not regulated as clearcuts under the Forest Practices Act.

Liquidation harvesting is generally viewed as inconsistent with accepted principles of forest stewardship. MFS estimates that it occurs on 16,000 to 64,000 acres each year.

MFS has found through recent enforcement efforts that liquidation harvesting is occurring on small and medium-sized, non-industrial ownerships. A number of these parcels were purchased during the breakup of larger, industrial ownerships.

⁸ Timber Liquidation in Maine: A report by the Maine Forest Service. 1999. (www.state.me.us/doc/mfs/summary.pdf)

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

The Committee on Agriculture, Conservation and Forestry discussed liquidation harvesting during the first session of the 120th Legislature. The committee did not report out a specific bill or resolve, but it did express its intent to examine the issue and develop a policy to reduce liquidation harvesting in the interim between legislative sessions. MFS will provide information and analysis to the Committee to examine the prevalence of liquidation harvesting and provide a summary of legislation proposed or enacted in other states to address liquidation harvesting.

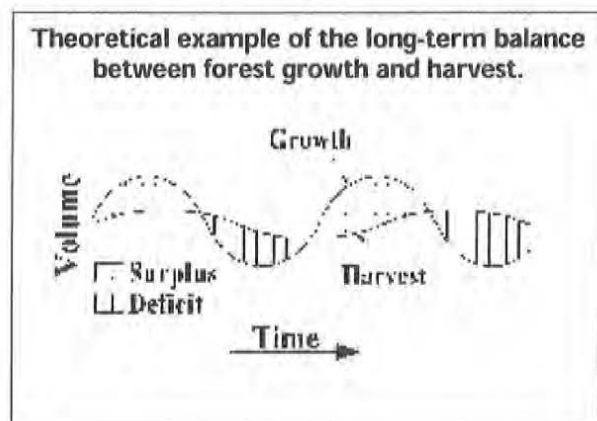
SUSTAINABLE TIMBER SUPPLY

The supply of timber from Maine's forests is influenced by many factors, including the amount of forest land available for harvest, the distribution of different forest cover types, the volume of standing inventory, and rates of timber growth and harvest. Most attempts to assess timber supply over the long term have been based on current inventories (including forest types and acres), expected growth (based on various estimates) and current or predicted harvest levels (demand for forest products).

A basic tenet of sustainable forestry is that current levels of harvesting not exceed or diminish the productive capacity of the forest. When the state's forest is viewed as a whole, "sustainability" in timber supply terms encompasses both the continuing availability of harvestable wood to meet demand, as well as the forest management strategies used to maximize productivity. In its simplest form, sustainability can be expressed as the ratio between growth and harvest volumes, aggregated for the state. Intuitively, when aggregate harvest exceeds aggregate growth, timber supply cannot be sustained for the long term.

However, in reality, both growth and harvest vary annually, from decade to decade, and in even longer cycles, in response to different factors. Aggregate growth (and standing inventory) in particular is subject to forest-wide variables, the most important of which is the age class structure of the forest, which in turn is determined by historical harvesting and land use trends, and pervasive natural disturbances. Maine's forest is far from the theoretical "ideal" forest of equally distributed age classes. Currently, Maine's forest has an unbalanced age class structure with a preponderance of older, slower-growing stands (due in large part to a statewide spruce budworm outbreak in the early part of the 20th century) and an abundance of younger stands (resulting from the 1980s spruce budworm outbreak and resulting harvesting). These younger stands will reach their highest growth rates in the next two to four decades, and maximizing growth rates in these stands will be a major management challenge.

Balancing growth and harvest (i.e., a growth to harvest ratio of one) **on an annual basis is neither attainable nor necessarily desirable.** In periods with an overabundance of old stands, harvest may exceed growth for several years, while in periods when rapidly growing, middle-aged stands predominate, growth may exceed harvest rates. Efforts to bring about a balanced forest structure and "stable" harvest levels will likely moderate, but never entirely eliminate, these cycles. Most importantly, harvest levels may be



**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

sustainable through such cycles when viewed over the long term. "Sustainable" timber supply will hinge on the cumulative actions of forest managers throughout the state, acting in response to a variety of factors. To ensure future sustainability, managers need to ensure that harvesting not only produces needed timber but results in stands capable of growing rapidly to produce future supply.

In 1998 MFS and USDA Forest Service conducted a timber supply analysis to explore the impacts of current forest management and harvest activities on long term timber supply.⁹ The analysis used computer modeling, calibrated with 1995 forest inventory data, to simulate forest growth, harvest levels, and silvicultural practices. The analysis concluded that:

- While inventory levels remain sufficient to support current harvest levels for the 50 year forecast, a long term deficit in the balance between annual growth and harvest should not be considered sustainable.
- ◆ The growth potential of Maine's forests has not been fully realized. The analysis identifies a set of improved management practices in natural forest stands and strategic investments in intensive silviculture that, if broadly implemented over the next two decades, could fully sustain annual harvest levels of 6.0 to 6.5 million cords.

The 1998 timber supply analysis was a first attempt to synthesize a large data set (the new forest inventory data), develop an analytical tool that allows us to explore our knowledge of Maine's forests as a system, identify information gaps, and suggest future lines of analysis. Readers should be reminded that models are only as good as the conceptual models on which they are based and the data used to calibrate the model. MFS continues to improve the simulation model by introducing increasingly better data, available through the new annual forest inventory, and by refining the assumptions upon which the simulation is based. Preliminary results of the new annual forest inventory indicate inventory levels are higher than forecast in the 1998 timber supply analysis.

⁹ Timber Supply Outlook for Maine: 1995 - 2045. Maine Department of Conservation, Maine Forest Service. September 1998. www.state.me.us/doc/mfs/supply.htm

G. FOREST PROTECTION: A Fire Prevention Success Story

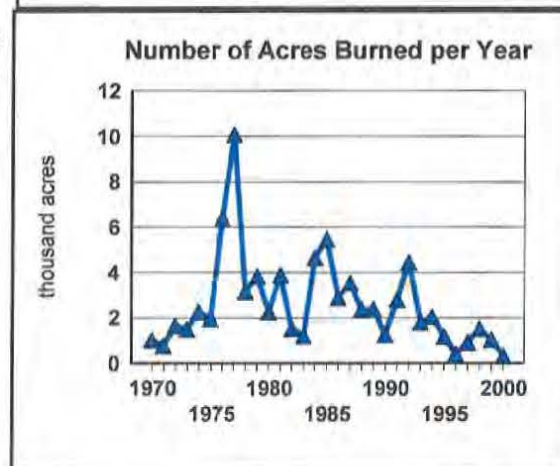
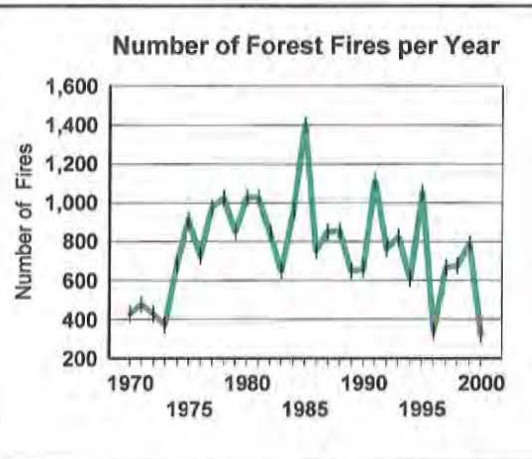
Maine has over 17.6 million acres of forest land to protect. Historically, the state had very large fire losses. However, losses have been reduced from hundreds of thousands of acres per year in the first half of the last century to hundreds of acres per year in the recent decade. This success is not an accident, but rather a directed and planned outcome that has taken decades to achieve. Among the variables contributing to this success are the following:

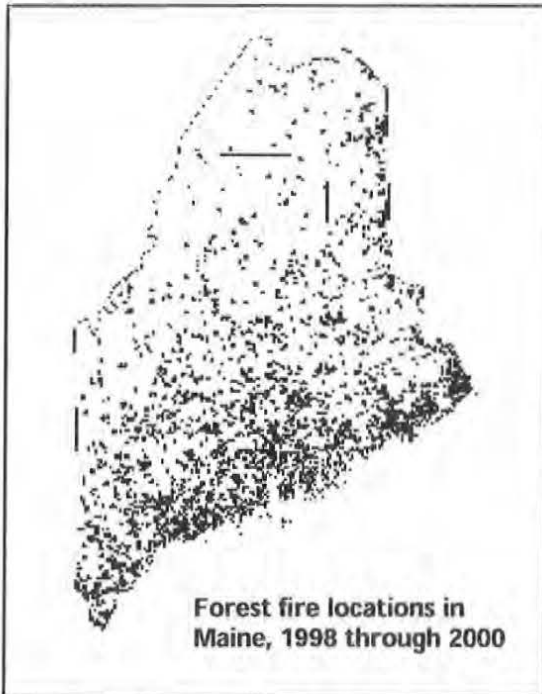
- Strong emphasis on fire prevention, including state control of statewide burning permits
- Proactive media and information campaigns to advise and educate the public
- Effective aerial fire detection network
- Strong planning and preparation by towns, state, and private cooperators
- Modern forest fire equipment
- Training and preparation for fire suppression
- Rapid initial attack
- Effective aerial fire suppression capability for remote areas and locations of high value property
- Statewide radio communication system
- Improved road access
- Mutual aid agreements between states, provinces, and federal agencies
- Well distributed weather stations and an accurate research based fire danger rating system
- Conscientious law enforcement

All of these elements are essential to continue the current successful forest fire protection program. These lessons were learned from large fires of the past, including the well known fires of 1947, which leveled nine towns and caused unsurpassed damages to high value property.

The graphs on the right demonstrate a strong downward trend over the past 30 years in total numbers of fires and acres lost. However, years of extremely dry weather still present major challenges in keeping numbers of fires and acres lost to within established goals of less than 1,000 fires and less than 3,500 acres per year. Recent five-year averages are well below these goals.

Annual loss from forest fires has been reduced from hundreds of thousands of acres in the first half of the 20th century to hundreds of acres per year in recent decades.





As fire danger fluctuates and as the state experiences periods of low fire occurrence and losses, the public and policy makers must remember that a strong, stable fire protection program is the only insurance against losses during periods of extreme fire weather.

Enforcing the State's Natural Resource Protection Laws

Enforcement of timber harvesting related laws has increased in importance and risen in MFS priorities over the last decade. As forest fire control activities have improved in efficiency and effectiveness, MFS staff have devoted more field time and effort to meet the growing demand for enforcement of timber harvesting laws.

Timber theft, timber trespass, and FPA enforcement comprise the major activities of natural resource enforcement. MFS strongly

emphasizes education and preventive measures as a matter of philosophy and policy. Enforcement is used as a last resort to ensure compliance with state laws and rules.

The number of complaints related to timber theft and trespass increased from 85 in 1993 to 325 in 1995. Since that time, the Legislature has closed a number of loopholes and strengthened penalties, giving MFS and District Attorneys the tools to address the issue more effectively. Since then, the number of cases has declined to 263 cases in 2000. MFS believes that the growth in complaints in earlier years was due to increased timber values and increasing landowner and public awareness of the availability of enforcement services.

H. FOREST HEALTH AND MONITORING

Maine's forests are relatively healthy (see sidebar "Indicators of Forest Health", pg. 23), and on average are younger and more vigorous than those of neighboring states. However, the population dynamics and consequent impacts of native and established exotic pests appear to be less predictable than in the past. Ongoing survey and monitoring suggest that complex pest response patterns are heavily influenced by **increasingly frequent extreme weather events**. Winters with warmer low temperature extremes, coupled with more frequent early growing season drought periods, are favoring expansion and intensification of some serious pest species:

- Population levels of browntail moth and balsam woolly adelgid, once held in check at stable endemic levels by natural controls, are expanding.
- An unprecedented outbreak of hemlock looper in the early 1990's appears to be on the verge of recurring.
- Gypsy moth populations are increasing, after having been brought under control by the disease *Entomophaga maimaga*.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

These same weather patterns are intensifying the impact of these pests on host trees. Specifically, trees under water stress are less resistant to pests and slower to recover.

- Spruce mortality in mid coastal Maine, although often attributed to spruce bark beetles, results more from root damage caused by wind throw, lower growth rates associated with physiological maturity and over stocking, and other predisposing conditions.
- Across southern Maine, scattered white pine stands under drought stress exhibit serious decline when exposed to what are normally insignificant insect and disease associations.

Similar climatic patterns are also exacerbating problems associated with new exotic forest pests, including Pine Shoot Beetle, Brown Spruce Longhorned Beetle, Asian Longhorned Beetle, and Hemlock Woolly Adelgid.

With no respite in current climate or world trade patterns, **exotic and invasive pests** will pose an increasing risk to sustaining the natural diversity of native species.

Success in dealing with these threats to forest health will depend on the **availability of forest and pest management tools**. The prognosis is mixed on that score. Public support for restrictions on management practices, with the intent to assure the long-term sustainability of forests, seems to have declined over the past year. An ongoing forest inventory process, conducted by the MFS and the USDA Forest Service, appears to have reassured some of the public. Landowner commitment to 3rd party audits of internal practices, although viewed with some skepticism, is also gaining public confidence.

There will be strong public scrutiny to assure that these processes remain responsive. If the inventory and monitoring efforts generate timely, relevant and unbiased reports on the status of the forest resource, and if those reports suggest that the management practices of private land owners are improving the condition of the forest ecosystems, forest land owners and policy makers should continue to have most of the current silvicultural tools available to maintain and enhance forest health.

However, the public may not extend similar support to the use of pesticides as forest and pest management tools. Many of the public question the wisdom of using pesticides, and forest lands are often held to a higher standard than people apply to their own property. Concerns over environmental contamination, health hazards, and chemical trespass are fueling support for a 10 year **moratorium on the use of pesticides** in the forest. This would seriously weaken Maine's ability to improve forest growth rates or ameliorate the impacts of the forest pests discussed above.

There is increasing discussion regarding the need for new state authority to respond to exotic and invasive pests. In 2000 the MFS for the first time used an Emergency Order to stop the import and distribution of nursery stock infested with hemlock woolly adelgid (HWA). In response to breaches of Maine's HWA quarantine, MFS and Maine Department of Agriculture mounted an aggressive campaign to educate the public and the nursery industry regarding the threat of hemlock woolly adelgid. Media coverage and direct mailings generated more than 450 contacts from the public, resulting in the discovery of 52 infested outplanted nursery trees on 17 sites. Infested stock was also intercepted at several nursery and garden centers. Success in halting the distribution of infested nursery stock was largely due to the ability of the Director

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

of the MFS to enact an Emergency Order to stop all import and plant movement, allowing staff to assess nursery stock before it was scattered across the landscape.

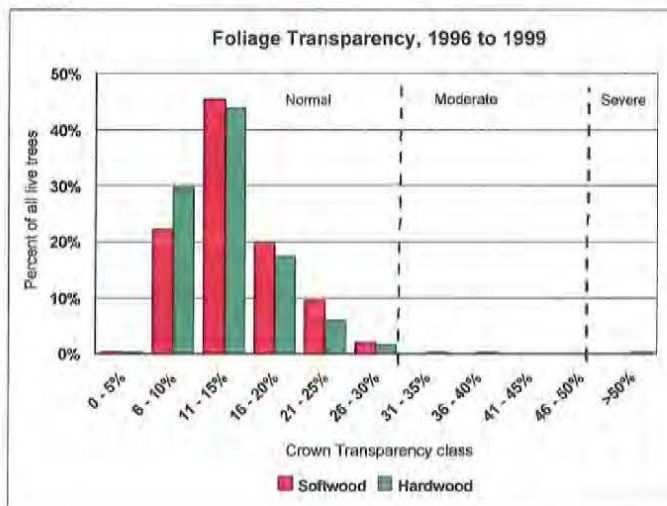
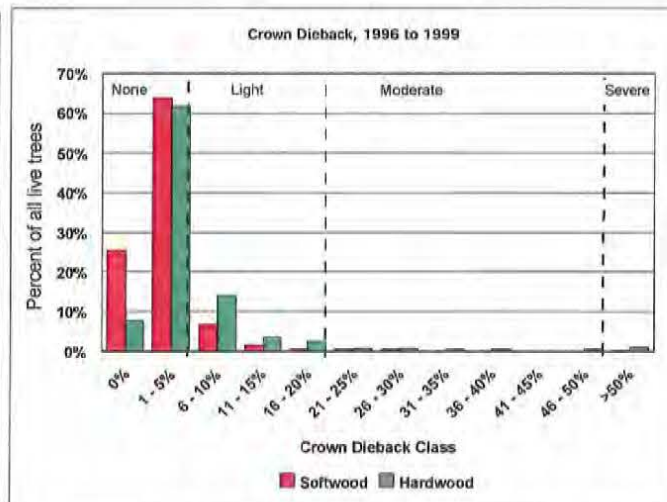
Although MFS has the capability to immediately halt movement of plant material, and the Maine Department of Agriculture has condemnation powers for woody plantings (horticultural plantings, orchard stock), neither MFS nor Department of Agriculture has legal authority to order immediate destruction of infested trees in natural stands. If an exotic pest infests natural forest stands, the specific authority to condemn and destroy infested stands may be critical to our ability to eradicate the infestation.

INDICATORS OF FOREST HEALTH

The Maine Forest Service and the USDA Forest Service maintain a forest health monitoring system to measure, evaluate, and report on forest health. Detection monitoring establishes baseline conditions and detects unusual deviations or events. In detection monitoring, selected indicators of forest health are sampled on a network of permanent plots. Crown dieback and foliage transparency are two of these indicators.

Crown dieback is branch mortality that starts near the end of branches and proceeds toward the trunk, or starts at the top of the tree and proceeds toward the ground. Crown dieback usually occurs in the upper part of the crown and is a symptom of various stresses on a tree, such as drought. **Foliage transparency** is the amount of skylight visible through the live, normally foliated portion of the crown. This is an indicator of the amount of foliage in the crown, a surrogate measure of defoliation.

Data for 1996 through 1999 indicate that 98% of softwood trees and 90% of hardwood trees sampled exhibit little to no crown dieback, and crown transparency is normal for 99% of the sampled trees.



I. MAINE'S FORESTS AND CLIMATE CHANGE

Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise. The National Research Council (2001) concludes that the changes observed over the last several decades are most likely due to human activities, but it could not rule out the possibility that some significant part of these changes are also a reflection of natural variability. Human-induced warming and associated sea level rises are expected to continue through the 21st century.¹⁰

Long-term observations confirm that our climate is now changing at a rapid rate. Over the 20th century, the average annual US temperature has risen by almost 1 degree Fahrenheit and precipitation has increased nationally by 5% to 10%, mostly due to increases in heavy downpours. The science indicates that the warming in the 21st century will be significantly larger than in the 20th century. The rise in temperature will very likely be associated with more extreme precipitation and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. Climate change modeling suggests the following effects on forests:

- Modest warming could result in increased carbon storage in most forest ecosystems in the US. Yet under some warmer modeling scenarios, forests (notably in the Southeast and Northwest) could experience drought-induced losses of carbon, possibly exacerbated by an increased fire disturbance.
- Likely changes in the species composition of the Northeast forests, including migration of sugar maple northward to Canada and replacement of Northeastern maple-beech-birch forests with oak-pine forests.
- Forest productivity is likely to increase in the near term, particularly for hardwoods, due to synergistic fertilization effects between CO₂ and nitrogen oxides. Ozone, however, can suppress these gains. Current ozone levels have likely decreased forest productivity by 10% in Northeast forests and 5% in southern pine plantations.
- Given the fact that middle and high latitude regions appear to be more sensitive to climate changes than other regions, significant impacts in these regions are likely to occur at lower levels of global warming.

Forests play an interesting and important role in the earth's carbon cycle. On one hand, the loss of forests on a global scale to other uses (deforestation) is responsible for up to one-third of carbon emissions to the atmosphere, and ranks second only to the burning of fossil fuels as a source of CO₂ emissions. On the other hand, forests serve as a huge carbon sink: they capture CO₂ from the atmosphere through photosynthesis and store it as carbon in wood and other carbon-based compounds in soil, in understory plants, and in the litter on the forest floor.

¹⁰National Research Council, 2001. Climate Change Science: An Analysis of Some Key Questions. Committee on the Science of Climate Change, Division on Earth and Life Studies. National Academy Press: Washington, DC (prepublication copy).

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

Wood and paper products also play a role in mitigating CO₂ emissions by sequestering carbon. There are currently large stocks of carbon in forests, in wood and paper products in use, and in dumps and landfills. In 1990, 10.6% of the level of US CO₂ emissions was harvested and removed from forests for products. If a substantial portion of this carbon could be prevented from returning to the atmosphere, it could be a notable contribution to mitigating carbon buildup in the atmosphere.¹¹

Large amounts of additional carbon could be stored in U.S. forests, especially on non industrial private ownerships, but also in developed settings, through afforestation (the establishment of forests where the preceding land use was not forest), reforestation and practices to enhance the growth rate of trees in existing forests.¹² In addition to the benefits of carbon sequestration, such actions have the potential to maintain or enhance public trust resources and other public values of forests, such as biological diversity, soil integrity, and water quality.

The private, public, and nonprofit sectors have all undertaken a number of initiatives to promote afforestation, reforestation, and increased forest productivity as a means of offsetting carbon dioxide emissions for a specific industry or firm (e.g., coal-fired power plants), or more generally. The World Resources Institute has cataloged a number of these initiatives on its website (www.wri.org/climate/sequester.html). Many of these initiatives involve reforesting degraded lands.

Maine's forests conceivably could play a role in this emerging market activity, particularly if productivity-increasing actions become cost-competitive. Projects underway elsewhere in the world are estimated to cost between 75 cents and 3 dollars per ton of carbon sequestered. Any large scale actions in Maine would need to compete with often cheaper land and labor in more tropical countries, as well as the inherently higher productivity potential of these lands.

Additional Resources

Carbon Budget of United States Forests, USDA Forest Service Northern Global Change Research Program Research Projects: www.fs.fed.us/ne/global/research/carbon/forcarb.html

International Panel on Climate Change Special Report: Land Use, Land Change, and Forestry: Summary for Policy Makers: www.ipcc.ch/pub/srlulucf-e.pdf

National Assessment Synthesis Team, 2001. Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change, US Global Change Research Program. www.gcric.org/NationalAssessment

¹¹Joyce, L. and R. Birdsey, technical editors. 2000. The Impact of Climate Change on America's Forests: A Technical Document Supporting the 2000 USDA Forest Service RPA Assessment. Gen. Tech. Rep. RMRS-GTR-59. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

¹²Moulton, Robert J. 2000. USDA Forest Service, Southern Research Station. www.rtp.srs.fs.fed.us/econ/research/std44_8.htm

II. FOREST SUSTAINABILITY STANDARDS

The 118th Maine Legislature identified seven criteria of forest sustainability and directed the Maine Forest Service to develop standards (benchmarks) for each criterion by 2003.

The seven criteria, and the schedule for developing the standards are:

- ◆ Criterion 1: Soil productivity (2001)
- ◆ Criterion 2: Water quality, wetlands and riparian zones (1999)
- ◆ Criterion 3: Timber supply and quality (1999)
- ◆ Criterion 4: Aesthetic impacts of timber harvesting (2003)
- ◆ Criterion 5: Biological diversity (2002)
- ◆ Criterion 6: Public accountability of forest owners and managers (1999)
- ◆ Criterion 7: Traditional recreation (2003)

The Maine Forest Service uses the following definition of sustainable forest management, developed by the Maine Council on Sustainable Forest Management¹³:

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.

The **criteria** of sustainable forest management should be viewed as a large scale reflection of public values - the big picture that Maine citizens want to see on Maine's forests. **Indicators** are quantitative or qualitative variables that can be measured or described, and provide the means for measuring these forest conditions and for identifying trends. **Benchmarks** are short term targets for each indicator.

*"Taken together, criteria and indicators provide a mutual understanding and implicit definition of what is meant by sustainable forest management. They are tools for assessing trends in forest conditions, and they provide a framework for describing, monitoring and evaluating progress toward sustainability. It is important to note, however, that the criteria and indicators are not to be used as performance standards for certifying management or products at any level."*¹⁴

MFS developed indicators and benchmarks for Criteria 2, 3 and 6 in 1999. A summary of progress toward achieving those benchmarks begins on page 29. Indicators and benchmarks for Criterion 1 - Soil Productivity were developed by MFS and a technical advisory team in early 2001. The proposed indicators and benchmarks for Soil Productivity are presented on page 27.

¹³Maine Council on Sustainable Forest Management. 1996. Sustaining Maine's Forests: Criteria, Goals, and Benchmarks for Sustainable Forest Management. Maine Department of Conservation, Augusta. 38 pp. + Appendices.

¹⁴(National Association of State Foresters Policy Statement: The Use of Criteria and Indicators in Sustainable Forest Management www.stateforesters.org/positions/C&I.html)

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

Criterion 1: Soil Productivity

The Maine Forest Service and a technical working group developed Indicators for Soil Productivity during the winter of 2001. Members of the technical working group are: Jim Blanck (Maine Forest Service), Sally Butler (USDA Natural Resources Conservation Service), Ivan Fernandez (Dept. of Plant, Soil and Environmental Sciences, University of Maine), Wayne Hoar (USDA Natural Resources Conservation Service), Steve Howell (S. J. Cole, Inc.), Rob Krantz (International Paper), Donald Mansius (Maine Forest Service), David Rocque (State Soil Scientist, Maine Department of Agriculture, Food and Rural Resources), Roger Ryder (Maine Forest

Soils are a key element of and perform many roles in healthy forest ecosystems. Soils store water and nutrients for later use by plants. Soil loss influences the vitality and species composition of forest ecosystems. Soil organic matter is important for water retention, carbon storage, and soil organisms and is an indicator of soil nutrient status. Changes in soil organic matter can affect the vitality of forest ecosystems through diminished regeneration capacity of trees, slower growth rates, and changes in species composition.

The availability of nutrients and water to forest vegetation depends on the physical ability of roots to grow and access nutrients, water and oxygen from the soil. This in turn depends on soil texture and structure and can be altered by soil compaction. The accumulation of biomass as living vegetation, coarse woody debris, peat, and soil carbon is an important contributor to carbon storage and influences the amount of carbon entering the atmosphere.

Forest management activities and timber harvesting can significantly affect soil properties, including soil structure and nutrient cycling. Sustaining healthy, productive forests requires maintaining proper soil structure, texture, organic matter, and adequate nutrient levels.

In recommending the following indicators for soil productivity, the technical working group specifically limited the scope of indicators to soil attributes that can be affected by forest management or timber harvesting. The indicators address soil erosion risk, soil nutrient status, risk of soil compaction, and the ability of soil to store and transport water. Other influences on soil health such as acid rain input or accumulation of heavy metals by atmospheric deposition, while important, are not directly influenced by forest management activities and therefore lie beyond the scope of these indicators.

The proposed indicators rely on data and analysis available through Maine's annual forest inventory. The USDA Forest Service Forest Inventory and Analysis (FIA) has incorporated long established Forest Health Monitoring (FHM) plots in the annual inventory process. The FHM subplots include measurement of soil attributes to determine both soil erosion risk and risk of compaction, and soil sampling for laboratory analysis of soil chemistry and nutrient status. The technical working group felt strongly that initially we should base the proposed indicators on data and analysis that is already available, rather than recommending any new, undeveloped sampling schemes. As a partner in the annual inventory and forest health monitoring process, the MFS retains the option to add new attributes or additional sampling to FHM field procedures (for an additional cost, and subject to operational feasibility) for attributes that MFS might identify as important.

Criterion 1: Soil Productivity

GOAL: Maintain proper soil structure, texture, organic matter, and adequate nutrient levels for forest growth.

Indicator 1.1: Harvested area with soil disturbance (removal of organic matter, exposure of mineral soil, soil erosion, compaction, destruction of soil horizons, or alteration of internal soil hydrology) that alters soil physical properties and degrades soil productivity.

Process Benchmark 1.1: MFS will use soils data from the annual FIA/FHM survey to develop base line information on soil properties on forested sites that have been harvested. These soil attributes are used to determine the extent or potential for soil erosion and soil compaction.

- % Cover of Bare Soil
- % Cover of Leaf & Branch Litter
- % Cover of Ground Vegetation (less than 6 ft. In height)
- Forest Floor Thickness: Forest floor consists of both Litter Layer (undecomposed leaves, twigs, and branches) and decomposed organic soil material.
- Soil Texture
- Slope Length
- Depth to Subsoil Restrictive Layer
- Evidence of Compaction
- % of area with Compaction
- Type of Compaction

Process Benchmark 1.1.a: Recognizing that the relatively small sample size from FIA/FHM soil subplots may not allow analysis at a finer scale than a statewide level, or that it may yield too few harvested plots for meaningful analysis, MFS and a technical working group will examine the base line data, and if necessary, recommend that MFS develop procedures to collect more data.

Indicator 1.2: Harvested area with significant change in soil chemistry that degrades soil productivity.

Process Benchmark 1.2: MFS will utilize data from FIA/FHM soil sampling and soil analysis, as it becomes available, to develop base line information on soil chemistry on forested sites that have been harvested.

Soil analysis includes:

Forest Floor samples: bulk density, water content, total carbon, total nitrogen
Mineral soil samples: bulk density, water content, coarse fragment content (>2 mm), pH, total carbon, total nitrogen, exchangeable cations and sulfur, extractable phosphorus.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

Rationale: FHM already measures soil attributes that can be used as indicators of soil productivity. The attributes and their measurements are part of a national program, with accepted sampling, measurement, and analysis protocols. MFS should use existing processes and data for initial evaluation of sustainable management of soil productivity. If baseline analysis indicates that more detailed evaluations of key attributes are appropriate, MFS should take action to expand sample size or develop more data through FIA/FHM or other appropriate processes.

Criterion 2: Water Quality, Wetlands, and Riparian Zones

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

Several of the water quality indicators refer to a statewide water quality monitoring system. These benchmarks are grouped together below with a single assessment for those indicators.

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**¹⁵.

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

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.

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.

Assessment: In a 1999 report to the 119th Legislature, the MFS recommended the implementation of an in-stream, water quality monitoring system to collect data for temperature, dissolved oxygen, pH, conductivity, phosphorous, sediment loads, biotics, and water flow velocity in headwater streams. The purpose was to establish baseline data for important stream quality parameters in order to monitor trends in the effective use of Best Management Practices (BMPs) in protecting headwater streams from the impacts of timber harvesting operations. The proposal carried an estimated cost of \$1.4 million over a four year period. The project has not received funding. Although the Department of Environmental Protection does maintain a water quality monitoring system, it is broad in scope, and does not provide data specific to the effects of timber harvesting on small, headwater streams.

The Manomet Center for Conservation Sciences and the Cooperative Forest Research Unit of the University of Maine are pursuing a case study approach to examine how buffer strips and riparian zones perform in maintaining water quality and aquatic biodiversity in headwater streams. This research is the most comprehensive study of headwater streams ever undertaken in Maine. It will provide comprehensive data on how harvesting practices along small headwater streams effect water quality. The project is expected to be completed in 2004.

¹⁵As 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).

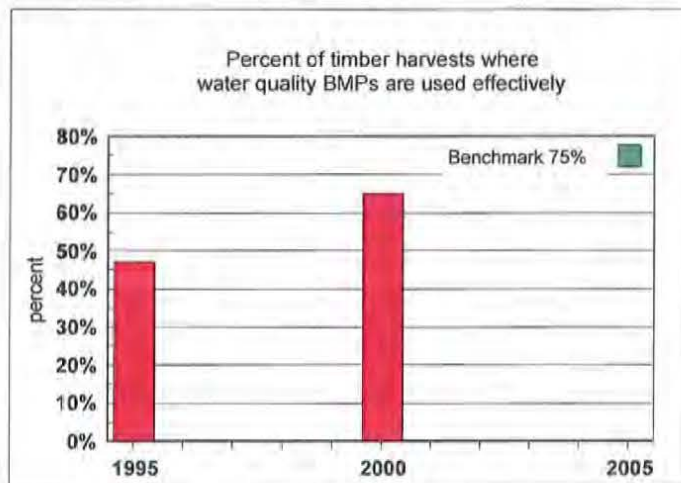
**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

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 percent in 1995 to 75 percent by 2005.¹⁶

Assessment: In March 2000, the Maine Forest Service implemented a statewide system to monitor the use and effectiveness of water quality Best Management Practices on timber harvesting operations. The first annual report won't be available until Spring 2001, when a full year of data is collected and analyzed. However, preliminary analysis of data for 205 timber harvest operations during 2000 indicate a positive trend for this benchmark.

- Water quality BMPs were used effectively on 65% of timber harvests where surface water was present (120 harvest sites).
- 27% of the harvest sites with surface water experienced minor sedimentation to intermittent and first order streams.
- 8% of the harvest sites with surface water experienced major sedimentation events to intermittent and first order streams



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

Proxy Benchmark 2.3.a.1: The number of water quality law violations attributed to forest management operations will show a continuous decline, relative to enforcement effort, from the 1992-96 average of 50 per year.¹⁷

Assessment: Since 1999 the enforcement of water quality laws relative to timber harvesting has become a priority for the Forest Protection Division of the MFS. MFS Rangers include water quality standards as part of their routine inspection of logging jobs. Consequently, MFS has a more comprehensive estimate of the frequency of water quality law violations than was estimated for the period 1992 - 1996. During the 2000, MFS found compliance with water quality regulations on 94% of timber harvest operations. (A total of 1,388 operations were inspected for compliance with water quality standards.)

¹⁶St. Peter, T. 1996. Memo to Forestry Advisory Team, 19 August 1996. 47 percent 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.

¹⁷Michael Mullen and William Galbraith, 1997, personal communications.

Criterion 3: Timber Supply and Quality

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: Ratio of projected growth and harvest, as determined by modeling current management practices and trends in forest development.

Benchmark 3.1.1: The ratio of projected growth and harvest for the statewide forest resource will show improvement from the current ratio of 86 percent by 2005.

Benchmark 3.1.2: The ratio of projected growth and harvest for major geographic & ownership divisions will show improvement from current projected levels by 2005.

Benchmark 3.1.3: The ratio of projected growth and harvest for distinct categories of tree species and quality will show improvement from current projected levels by 2005.

Process Benchmark 3.1.1: The MFS will simulate future forest development using computer modeling and report 50-year projections of growth to harvest ratios every five years. It will base simulations on the latest forest assessment data, harvest activity levels, and projected market demand.

Assessment: Progress on this benchmark can't be assessed until updated growth information becomes available from the annual Forest Inventory in 2003. The MFS is evaluating alternative methods to collect current growth data, rather than waiting for the completion of the first five year inventory cycle in 2003.

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

Benchmark 3.2.1: The number of forest acres available for management and harvest will support projected harvest and growth.

Process Benchmark 3.2.1: MFS will 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.

Assessment: MFS does not yet have a method to determine the number of forest acres where forest management or timber harvesting are limited by regulation, easement or other restrictions.

We are able to report on total number of timberland acres by forest type group. Total timberland acres in Maine were estimated at 17.4 million acres in 1999 (not statistically different from the 1995 estimate of 16.9 million acres).

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: Forest landowners and managers will implement practices to reduce measurable tree mortality by 20 percent by 2009.

Benchmark 3.3.2: State policy will encourage landowners to implement yield-increasing practices that adhere to sustainability principles and are consistent with landowner

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

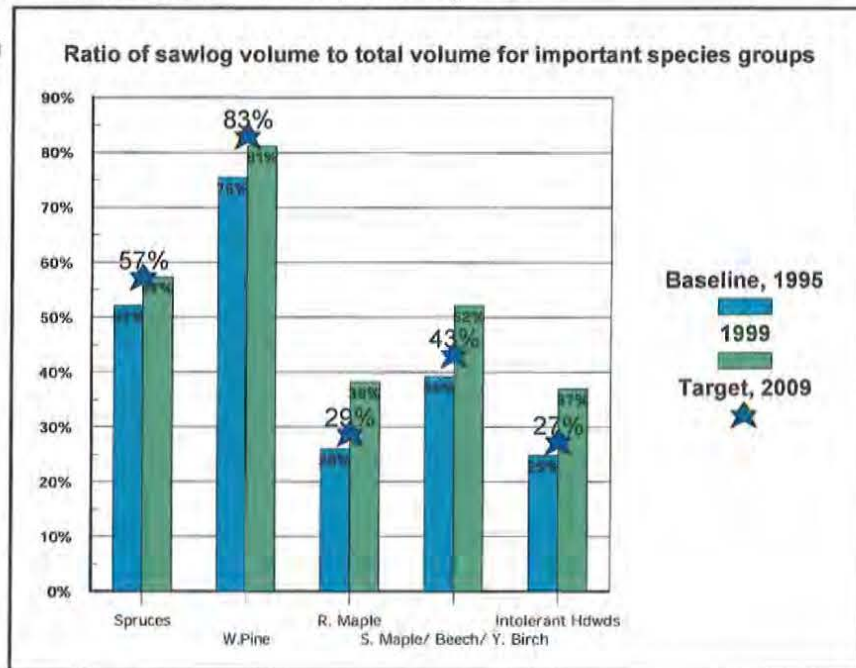
objectives. As a result, growth rates should increase one percent per year until potential sustainable harvest levels increase by 25 percent from those documented in Timber Supply Outlook for Maine: 1995-2045.

Assessment: Progress on this benchmark can't be assessed until updated growth and mortality information becomes available from the annual Forest Inventory 2003.

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 percent by 2009.

Assessment: Data from the first report of the annual forest inventory is sufficient to assess the ratio of saw timber volume to total volume for important species groups, but is not sufficient to examine trends for individual species. Assessment of individual species trends will be possible after the full inventory is completed in 2003. Baseline ratios of saw log volume to total volume (based on the 1995 inventory), the 1999 ratios, and the targets for 2009 are presented in the chart on the right for important species groups.



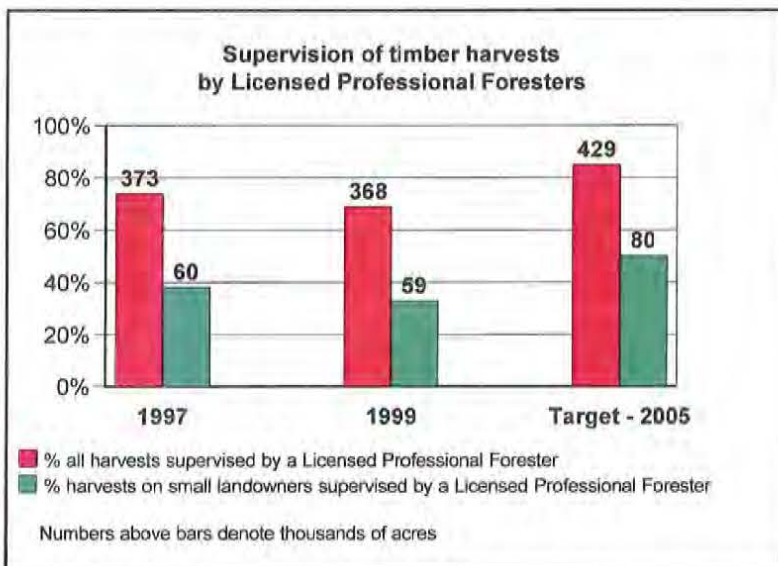
Criterion 6: Public Accountability of Forest Owners and Managers

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 where management planning, harvest layout, silvicultural prescription, and harvest operations are conducted under the direct supervision of a Licensed Professional Forester (LPF).

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

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



Assessment: No significant progress on either of these benchmarks.

In 1999, 69% of all harvested acres were under the direct supervision of a Licensed Professional Forester. On small ownerships, 33% of harvest acres were under the direct supervision of a Licensed Professional Forester, while on large ownerships (>100,000 acres) 92% of harvest acres were under the supervision of a LPF.

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.

Assessment: By 2000, nearly 3.7 million acres on six large landowners have received 3rd party certification of sustainable forest management. (See graph and chart on page 10.)

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

Indicator 6.3: Percent and number of timber harvesters who have received training and certification from the Certified Logging Professional Program (CLP) 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 percent in 1997 to 90 percent by 2005.

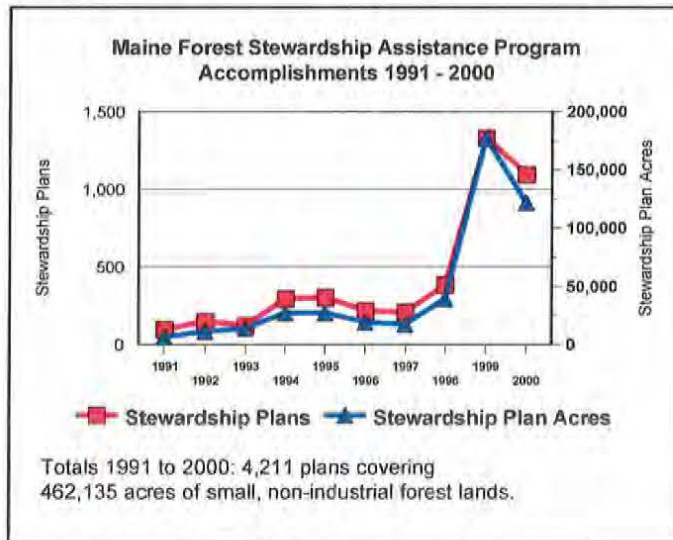
Assessment: Estimates of the number of loggers in Maine vary - a commonly accepted estimate is approximately 3,800 loggers in the state. In reporting progress on this benchmark, we use number of CLP trained loggers, rather than percentage.

Since its inception in 1991, 3,590 loggers (including mechanical harvesters, supervisor/contractors, and conventional loggers) have completed the Certified Logging Professional Program. 2,020 loggers maintained their certification in 2000. CLP of Maine used a \$456,000 Ice Storm Recovery Grant from MFS to develop training materials, train CLP instructors, and provide scholarships to loggers for CLP training and certification.

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.

Assessment: Forest Stewardship Program has expanded to include 462,135 acres on over 4,200 individual parcels of non industrial forest land.



GLOSSARY

As naturally occurs: Condition 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 sub§2).

Benchmark: Intermediate objectives for attaining goals.

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.

Farm and Open Space Tax Law (36 MRSA, §1101-1121): 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 percent 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 (12 MRSA Chapter 805, subchapter III-A: Forest Practices): 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.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

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).

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: Was established by Executive Order of Governor Angus King in April 1995. The Council was charged with four tasks, (1) Define forest sustainability in practical terms feasible for implementation by all landowners, (2) Recommend criteria and goals to ensure a sustainably managed forest, (3) Recommend a methodology for the Department of Conservation to monitor landowner's progress toward achievement of forest sustainability goals, and (4) Review and assess Maine's forest practices rules and regulations for their adequacy in achieving sustainable forest management, and recommend changes where necessary. The Council issued its final report in July 1996, "Sustaining Maine's Forests: Criteria, Goals, and Benchmarks for Sustainable Forest Management."

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

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.

Planting: A technique for the artificial reestablishment of trees on a harvested or non-forested site.

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.

Public trust resources: Natural resources that remain in the public domain, even though they may occur on privately-owned lands. Examples include air, water, fish and wildlife.

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.

**The 2001 biennial report on the State of the Forest and
progress report on Forest Sustainability Standards**

Selection harvest: An uneven-aged silvicultural system that regenerates and maintains a multi-aged structure by removing some trees in all size classes either singly, in small groups, or in strips.

Shelterwood: An even-aged silvicultural system by characterized by the cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated micro-environment. The sequence of harvest treatments can include three types of cuttings: (a) an optional preparatory cut to enhance conditions for seed production, (b) an establishment cut to prepare the seed bed and to create a new age class, and (c) a removal cut to release established regeneration from competition with the overstory. Cutting may be done uniformly throughout the stand, in groups or patches, or in strips.

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.

Stewardship: The administration of land and associated resources in a manner that enables their passing on to future generations in a healthy condition.

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 (36 MRSA §571-584-A.): 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.