

# MAINE STATE LEGISLATURE

The following document is provided by the  
**LAW AND LEGISLATIVE DIGITAL LIBRARY**  
at the Maine State Law and Legislative Reference Library  
<http://legislature.maine.gov/lawlib>



Reproduced from electronic originals  
(may include minor formatting differences from printed original)

# Land, Timber, and Recreation in Maine's Northwoods: Essays by Lloyd C. Irland

Lloyd C. Irland  
*Faculty Associate*  
*College of Natural Resources, Forestry and Agriculture*

The Irland Group  
RR 2, Box 9200  
Winthrop, ME 04364

Phone: (207)395-2185  
Fax: (207)395-2188

## FOREWORD

Human experience tends to be perceived as taking place in phases. Shakespeare talked of seven ages of man. More recently Erik Erikson has thought of five separate stages in human life. All of these begin to break down, however, when we think of the end of eras. Partially because of the chronological pressure, such times come at the end of centuries. When one adds to the end of a century the concept of an end of a millennium, the sense of change, of difference, of end time can be very powerful, if not overwhelming.

The termination of the nineteenth and the eighteenth centuries were much discussed as to the future. Prior to that, there seems to have been less discussion because literacy was not well advanced. If, as an example, one were to think about the year 1000, perhaps the nearest thing to a new beginning would have been the Viking sorties into North America, and very few people would have known about it, or cared very much if they had known.

With a much larger literate population in the world, the end of the twentieth century, and the end of this millennium, will, no doubt, produce much discussion. That coincident time arrangement will provide many predictors of the future—some of whom will hail the future, while others will decry the end of a past—with an opportunity to offer many prescriptions on how to behave.

Maine faces such a daunting time. The twenty-first century appears to hold a time of vast, kaleidoscopic and perhaps dangerous changes for the Maine biota. The Maine of past time had always met and ameliorated change when it came. To plagiarize myself, “we cut our trees and had them too.”

Perhaps that is all going to change. The population pressure for use of the forest space is growing steadily. Maine is the nearest forest for the northeastern urban megalopolis. Maine has always been thought of by these urban dwellers as a place where one went to be reborn, rejuvenated, reclaimed. Maine was, in the vernacular, “someplace else, something different.” Now the groups who want that experience are larger than ever. The lines of people, on bitter cold nights, waiting to reserve this space in “a wilderness area” provides testimony to this.

While these pressures increase, the need and demand for paper products continues, and although the redevelopment of the World War II experiences in recycling has diminished demand somewhat, or delayed it, still the need for cellulose is great, and will probably become greater. The sawlog market, long thought to be an artifact of a nineteenth century Maine, has had a remarkable growth in recent years as more of the tree is used and in better ways. New markets have been established. The fuelwood market remains a small but important sector of the Maine woodland economy. All of these factors continue while the population pressure on the space grows.

Still Maine has not moved as rapidly in the matters of developing genetically controlled stocks, planting techniques in the difficult areas, and the “control” of harvest techniques, as they modify and change the logging areas. Other areas in Scandinavia, and the American South, and to some degree in the Northwest precede us in these areas of thought and management. To some extent, the Maine traits of stubbornness and individuality may have inhibited thought about the future of the Maine Woods.

We face an uneasy and unknown future. The Land Use Regulation Commission (LURC) is in the process of developing a major plan for dealing with the future of northern Maine. There are so many claimants to different uses that these plans engender mainly protest and unhappiness, although most persons would agree that plans for the future are imperative.

Lloyd Irland and his group of researchers and thinkers deal with these general points in very specific ways every day. They are a sort of intelligence agency for LURC and for us all. Written in a nonthreatening, non-ideological way, these essays allow the reader to think through a variety of alternatives, and to make decisions, or to press for decisions based on serious facts. As we face the new millennium, this book will help us take the proper steps in the proper place and at the proper time.

*David Smith*

# CONTENTS

Tables .....	4
Figures.....	5
1. Preface .....	6
2. Introduction: Maine’s Forest Resource.....	7
3. Five Images of the Maine Forest .....	15
4. Outlook for Maine Wood-Using Industries .....	22
5. Maine’s Forest Resource: Notes on the Concept of Sustainability .....	26
6. Clearcutting as a Management Practice in Maine Forests .....	35
7. Maine’s Forest as Real Estate I: Large Ownerships .....	45
8. Maine’s Forest as Real Estate II: The Subdividers .....	50
9. Outdoor Recreation in the Maine Woods: Issues for the Future .....	57
10. Backpacking and Day Hikes: Resources, Opportunities, and Challenges for Public Ways in Maine .....	65
11. Lessons of Jo-Mary Pond: Reflections on Fish, Wildlife, and Forests .....	69
12. Challenges for the North Maine Woods .....	72
13. References .....	80
14. Sources and Permissions .....	86

## TABLES

1. Maine forest types, 1982 (thousand acres). .....	9
2. Estimated timberland ownership in Maine, 1991 (thousand acres). .....	13
3. Publicly owned lands in Maine, 1993. ....	14
4. Recreation participation rates, Maine residents older than age 18, 1991/1992 season. ....	16
5. Analytical perspectives on Maine's forest resource. ....	18
6. Annual average employment, selected labor market areas, 1992. ....	19
7. Peak and current softwood lumber production. ....	31
8. Indicators of the level of management intensity: The forest resource. ....	32
9. Silvicultural practices—an overview. ....	36
10. Forest practice definitions adopted by the Maine Forest Service under the Forest Practices Act. ....	37
11. Harvest cutting treatments used in maine, 1987 and 1993. ....	38
12. Considerations in setting silvicultural prescriptions. ....	43
13. Recommendations on forest practices. ....	44
14. Maine forest landownership, 1972–1994 (thousand a.). ....	45
15. Case study areas: Population 1980–1987. ....	51
16. Case study areas: socioeconomic indicators compared to entire states. ....	51
17. Case study areas: employment by sector, compared to state (% of total) 1987. ....	51
18. Subdivision activity, 1980–1989. ....	53
19. Characteristics of subdividers and subdivisions, 1980–1989. ....	53
20. Washington County. ....	54
21. Franklin County. ....	55
22. Elements in an assessment of recreation supply. ....	59
23. Peak day attendance, sample of Maine state parks, typical year, late 1980s. ....	61
24. Options for coping with excess demands. ....	62
25. Estimated willingness to pay values updated to 1992. ....	63
26. Regulations affecting forest landowners in the North Woods. ....	77

## FIGURES

1. Unorganized townships, plantations and towns. ....	8
2. Biophysical regions of Maine. Source: McMahon and Bernard (1993). ....	9
3. Balsam fir, trees/acre, 1982. ....	10
4. Red spruce, trees/acre, 1982. ....	10
5. Paper birch, trees/acre, 1982. ....	10
6. Aspen, trees/acre, 1982. ....	10
7. Hemlock, trees/acre, 1982. ....	11
8. White pine, trees/acre, 1982. ....	11
9. Sugar maple, trees/acre, 1982. ....	11
10. Major Maine river basins. ....	12
11. Estimates of Maine forest acreage. ....	12
12. Estimates of Maine spruce-fir growing stock ....	12
13. Maine recreation trends: Backcountry uses, 1976 to 1994. ....	16
14. Maine recreation trends 1976 to 1994. ....	16
15. Number of snowmobiles registered. ....	16
16. Total storage of carbon in forests, 1987, by component. ....	17
17. Total softwood and hardwood product harvest levels in Maine, 1960–1991. ....	20
18. Market pulp—Bleached northern softwood kraft, 1973–1995. ....	22
19. Global demand outlook: Industrial roundwood, 1992–2020. ....	24
20. Timber cut on Western federal lands to fall dramatically. ....	24
21. Canada softwood harvest. ....	24
22. Softwood lumber production, USSR and successor states, 1962–2000. . ....	24
23. Future tropical supplies uncertain. ....	25
24. Maine woodpulp and paper production ....	28
25. Maine lumber production estimates 1954–1993. ....	28
26. Maine as percentage of U.S. softwood lumber production. ....	28
27. Canadian shipments to U.S. as percentage of U.S. consumption. ....	29
28. Maine wood consumption for electricity generation. ....	29
29. Total forest acreage, selected states, 1992 as percentage of original forest area. ....	31
30. Maine case study locations. ....	50
31. Northeast’s land boom of the 1980s: Farmland values, 1981–1994. ....	52
32. Northeast’s land boom of the 1980s: Private housing starts, 1978–1994. ....	52
33. New permit actions by the Maine Land Use Regulation Commission. ....	52
34. Major public ownerships, Maine woods, schematic. ....	58
35. Major private/cooperative recreation management efforts in the Maine woods, schematic. ....	58
36. North Maine woods: Annual visitor days by purpose. Long-term average, 1976–1991. ....	58
37. Private land share of supply, statewide. ....	60
38. Skewness: Individuals’ number of previous visits to Allagash Wilderness Waterway ....	60
39. North Maine Woods visitor days by entrance average, 1976–1991. ....	61
40. Average annual percentage change in use, 1970s to 1990s. ....	65
41. Land acres for recreation by travel region. ....	65
42. Miles of trails available. ....	66
43. Proposed Maine Woods National Park (3.2 million acres). ....	76

## 1. Preface

---

This work is a collection of essays, all of them previously published but for the Introduction. They are about Maine's forests, with a strong focus on the "Maine Woods" in Thoreau's sense—the vast area of unsettled or lightly settled wildlands that stretch across western, northern, and eastern Maine. Much of the state is influenced by these woods—moose have wandered to the backyard of the Governor's residence in Augusta. For some purposes, however, it is difficult to separate the wildlands for statistical treatment.

This work aims to inform the reader about some of the important resource management conditions, issues, and trends in this region. Its focus is mostly on timber and recreational resources, the related economic values, and some of the policy issues related to them. This coverage has its limitations, being light on the fishery, on wildlife, and on air and water and visual quality. Further, it advances no policy recommendations. Policy areas such as taxation, forest protection, public regulation, and public land management are not treated here, but this does not mean that they are unimportant. Perhaps these papers will help Maine citizens better understand part of the context in which these policies have their effect. Additional viewpoints, with regional context, are found in Klyza and Trombulak (1994); Dobbs and Ober (1995); and Irland (in press). The state's Land Use Regulation Commission (1995) has recently offered its perceptions on many of these issues in a draft Revised Comprehensive Land Use Plan.

I would like to thank Barbara Harrity of the Maine Agricultural and Forest Experiment Station for helpful editorial assistance. Most of these papers have been updated, changed in format, or lightly edited to eliminate duplication. We acknowledge with thanks the original publishers (see Chapter 14) for permission to reprint.

## 2. Introduction: Maine's Forest Resource

---

The Maine Woods encompass some 10 million acres of wildlands stretching from the mountains of western Maine to the St. Croix River and the East Line of the State. These woods are unlike any other in the United States. They are primarily in a wild condition, though they have been harvested for products for generations. They lack local government, and the region is only thinly settled. A useful approximation to what Mainers describe as the "Wildlands" today is the jurisdiction of the Land Use Regulation Commission (LURC) (Figure 1). This state agency performs planning and zoning functions for the portion of the state where local government does not exist or is minimally organized. Its jurisdiction closely conforms to the area of the state where larger ownerships predominate (e.g., end paper map of ownerships in USDA Forest Service [1990]).

These woods can be viewed from differing perspectives. They are a natural resource producing multiple products valued by society. They are a financial asset on the balance sheets of private owners and on the tax rolls of the state. They are a site for recreational activities pursued by hundreds of thousands of visitors every year. They are a place of magic and mystery, a place to briefly capture the spiritual enrichment gained from communing with the vistas and the silences, the rushing of the water, birdsong, and evening loon calls. They are a place whose wildness is treasured by those who may never visit it and who do not hunt, fish, hike, or paddle canoes. They are a reserve for the unfettered play of natural forces, habitat for wild things demanding vast undisturbed forests where people stay away.

Some of these values can be measured and some cannot. Each perspective captures something significant about the Maine Woods, yet no one of them is complete. This publication is an extended essay about just a few of these perspectives.

### GEOGRAPHY OF THE MAINE FOREST

Across the state, the forest is shaped in a general way by differences in climate and soils (Kendall [1987] is an excellent illustrated overview). Scientists have developed a set of biophysical forest regions for Maine (Figure 2). These regions reflect differences in elevation, in maritime climate influence, and soils. The mosaic of stands across any portion of Maine's forest landscape has also been determined by its history of land use, fire, wind, logging, and planting and intensive culture.

For a review of major natural areas, see Bennett (1988). For vivid satellite imagery emphasizing connections between forest and sea, see Conkling (1995).

The forests of Maine occupy a broad transition zone between the eastern deciduous forest of the southern and Mid-Atlantic states, and the boreal forests to the north. Species common to the southerly forests, including red and white oak, are found in southern Maine. The spruce-fir, northern hardwoods, and white pine/red pine groups account for most of the state's forest area (Table 1). The maple-beech-birch forest and hemlock and white pine are characteristic of this transitional region. Species from the more northerly boreal forest occupy cooler and wetter sites in a patchwork across the forest landscape. These include red and white spruce, larch, and balsam fir. On the margins of acid bogs in low spots are found black spruce, with an occasional tamarack and white pine.

A set of maps prepared by a USDA Forest Service analyst (Powell 1985) helps us visualize the complexity of Maine's forest today (Figures 3–9). These maps show density of trees of a given species per acre by counties. This gives a more detailed rendering of the picture in the southern portion of the state where the counties are smaller.

In 1982, balsam fir was heavily concentrated in the northerly counties, while red spruce was strongly represented in Somerset, Piscataquis, Hancock, and Knox counties. Paper birch, a species well adapted to flourish in open conditions after fire or land abandonment, is especially abundant in western Maine and along the coast. In western Maine, the tree supports a vigorous industry of specialty manufacturing plants making clothespins, dowels, tongue depressors, and enough toothpicks to make western Maine the nation's capital of the toothpick industry.

The trembling aspen, or "popple," is most abundant in central Maine, though it is widely distributed in the state. It is one of the leading colonizers of abandoned potato fields in "The County."

Hemlock is common in York, Cumberland and Penobscot counties. Hemlock bark was once the source of chemicals for tanning leather, and it provided the basis for a large industry in eastern Maine, which reached a peak during the 1880s to the 1920s. The logs were often left in the woods to rot because hemlock was not considered worth sawing when tall, straight-grained spruce was to be had.



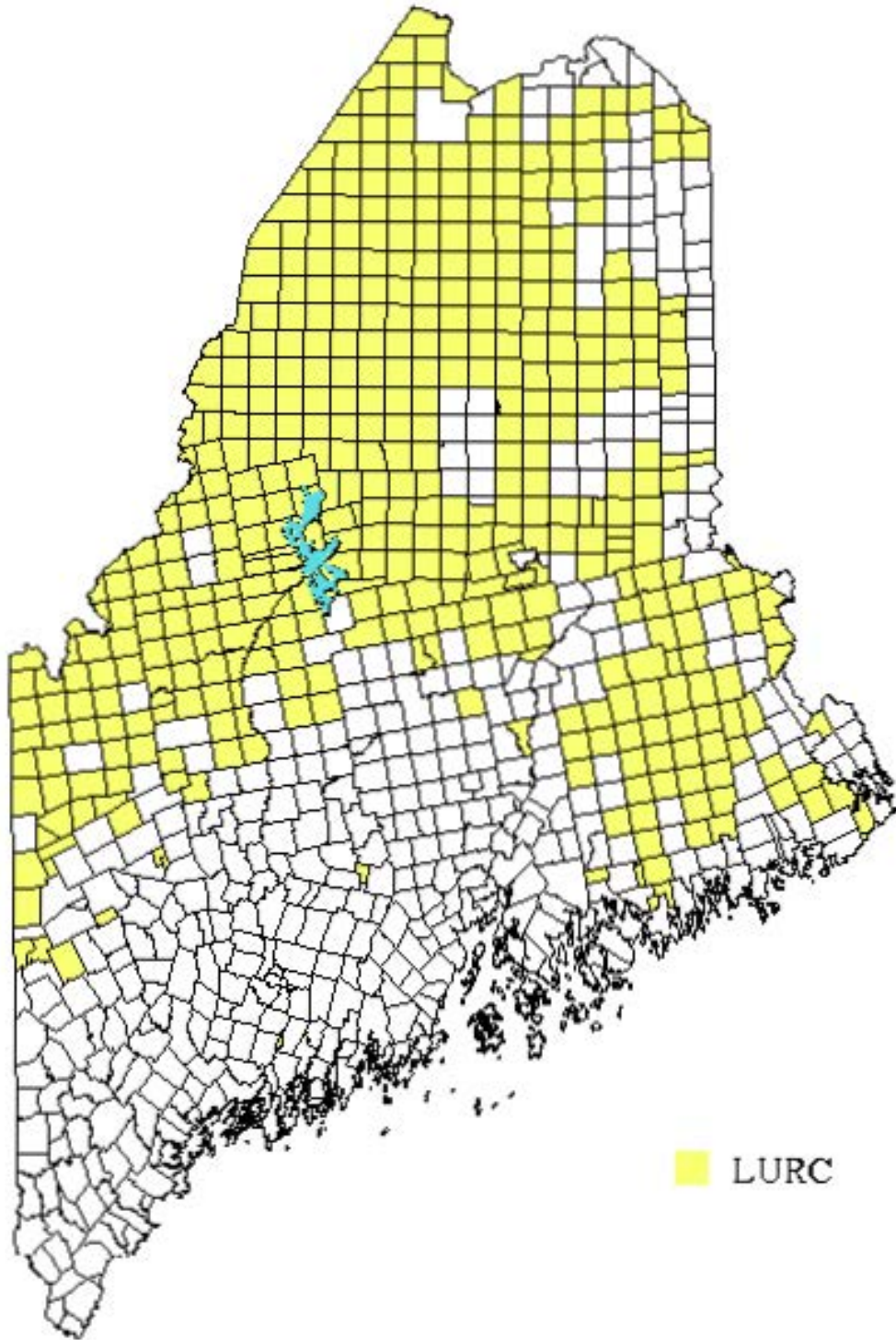


Figure 1. Unorganized townships, plantations and towns.

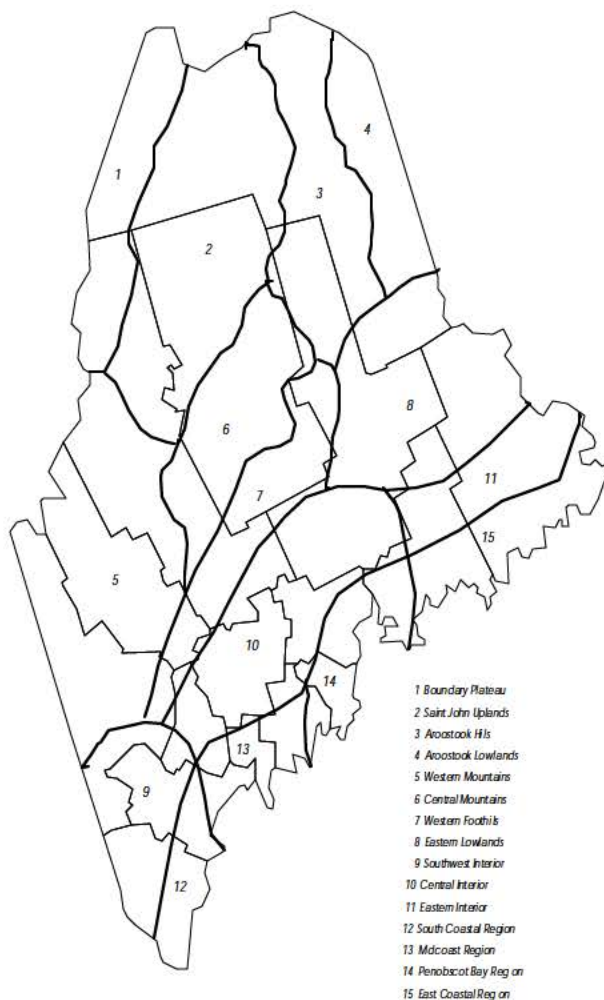


Figure 2. Biophysical regions of Maine. Source: McMahon and Bernard (1993).

Table 1. Maine forest types, 1982 (thousand acres).

Type Group	Largest Type	Total Acreage	Acreage of Largest Type
White/Red Pine*	White Pine	2,203.0	1,031.1
Spruce/Fir	Red Spruce/Balsam Fir	7,770.5	3,321.1
Oak/Hickory**	Northern Red Oak	342.7	209.0
Elm/Ash/Red Maple	Black Ash/Amer. Elm/Red Maple	238.2	166.3
Northern Hardwoods	Sugar Maple/Beech/Yellow Birch	5,000.9	3,134.2
Aspen/Birch	Aspen	1,504.9	1,020.9
<b>Total***</b>		<b>17,060.2</b>	

\* Includes 8,300 acres of pitch pine type.

\*\* Includes 36,200 acres of white pine/northern red oak/white ash type.

\*\*\* Total timberland area is shown in USFS RM-234 in 1991 as 16,987.

Source: Powell and Dickson (1984).

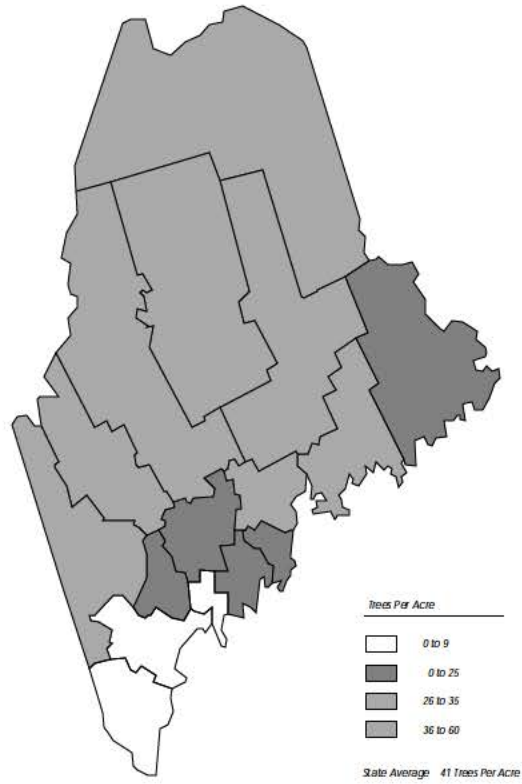


Figure 3. Balsam fir, trees/acre, 1982.

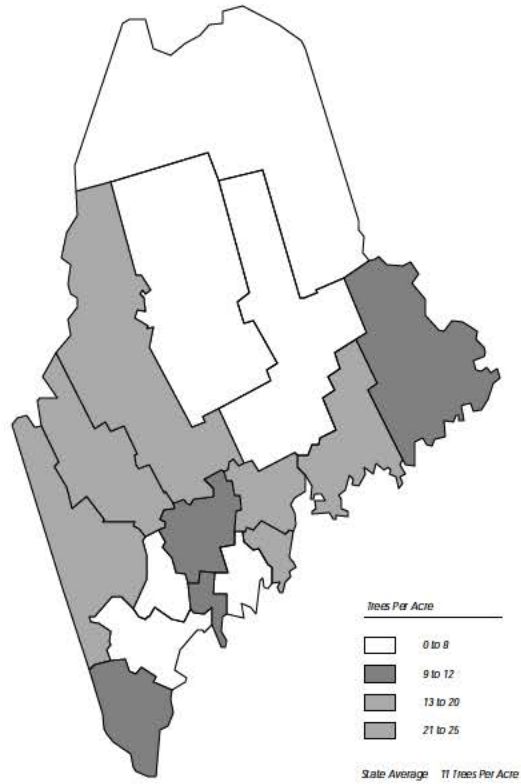


Figure 5. Paper birch, trees/acre, 1982.

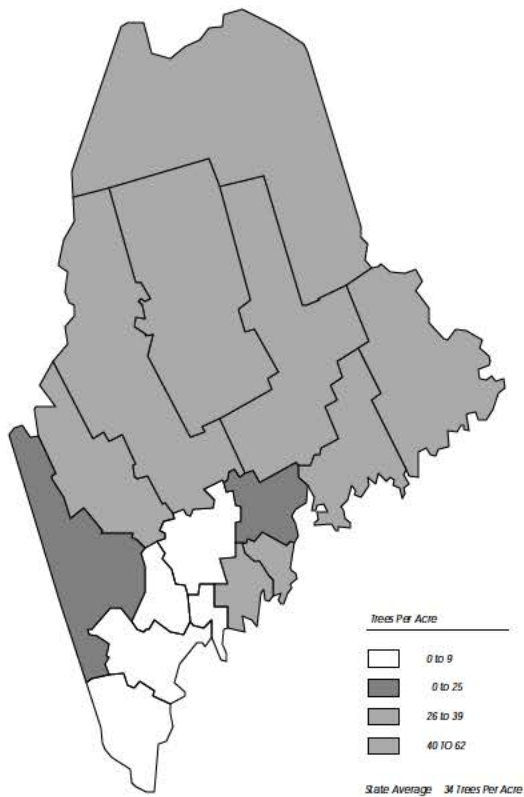


Figure 4. Red spruce, trees/acre, 1982.

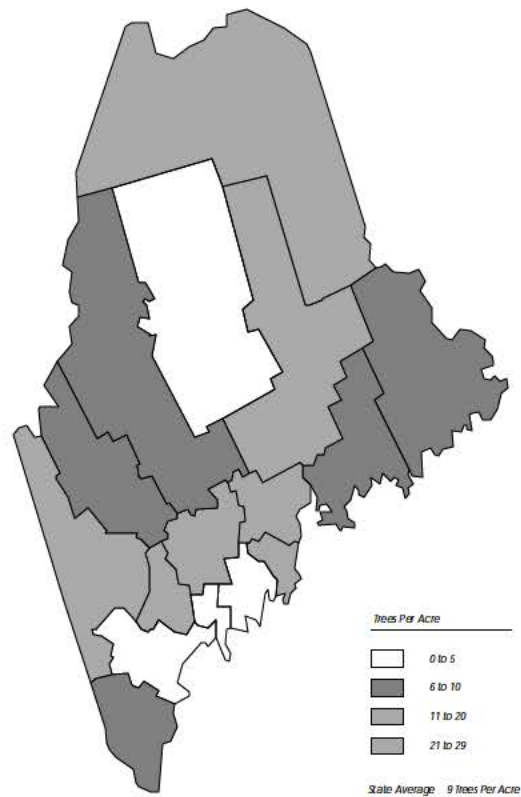


Figure 6. Aspen, trees/acre, 1982.

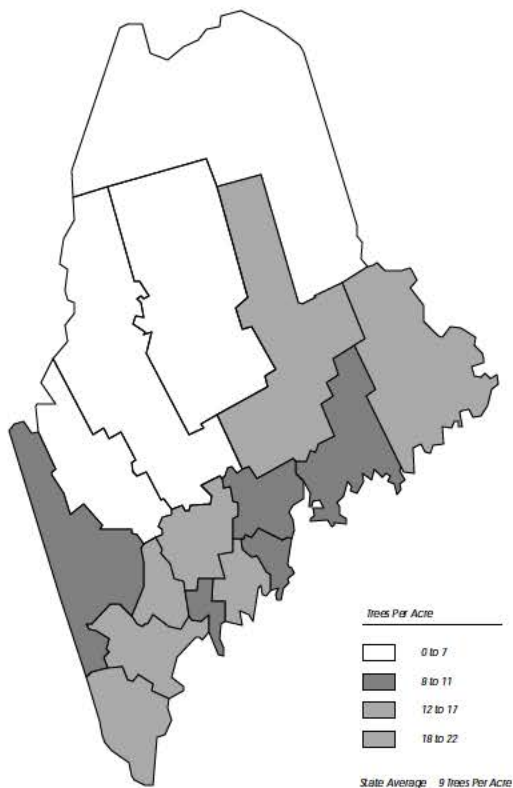


Figure 7. Hemlock, trees/acre, 1982.



Figure 8. White pine, trees/acre, 1982.

White pine is found in dense stands growing on the sandy soils of the old fields of southern Maine. At the time of Maine's peak of lumber production in 1909, a significant proportion of statewide production consisted of second growth pine from this region. In northern Maine, pure pine stands are uncommon. White pine instead grows in mixture with hardwoods, usually overtopping them by a fair margin. Figure 8 shows that in terms of its geographical distribution, white pine is far more characteristic of southern than of northern Maine.

Another fact that at first glance may seem surprising is that there are more sugar maples per acre in northern Maine than in southern Maine. It is hard to say whether this is due to soil, to past cutting, or to other conditions, but along the Quebec border are many sugar houses where the sap is boiled every spring. The paper companies who own much of this land lease the sugaring rights to nearby Quebec producers.

### FORESTS AND RIVERS

Forests and rivers are inseparable in Maine history. The rivers enabled loggers and masting contractors to reach the forest and float the logs out. They also provided water power for the saws

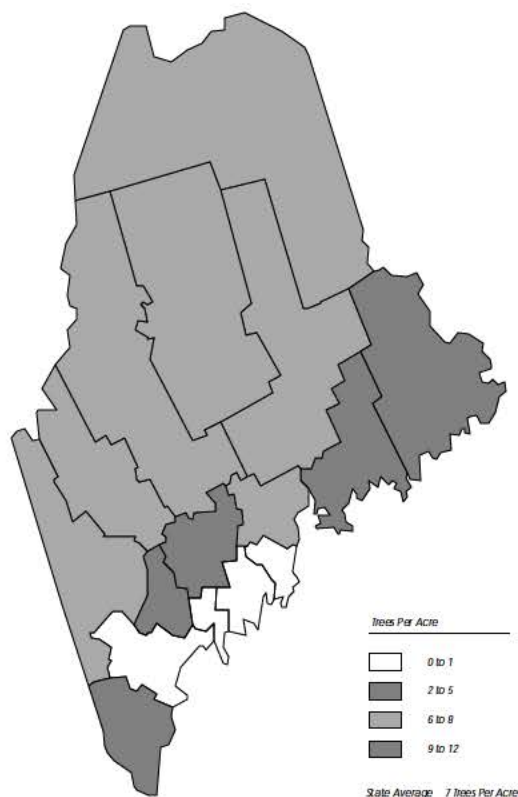
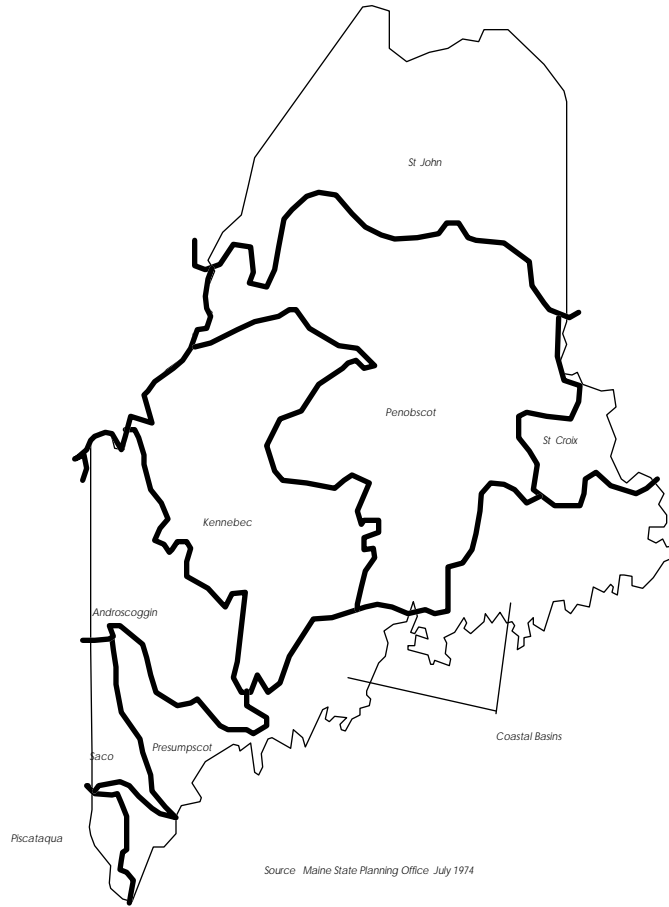


Figure 9. Sugar maple, trees/acre, 1982.



Source: Maine State Planning Office, July 1974

Figure 10. Major Maine river basins.

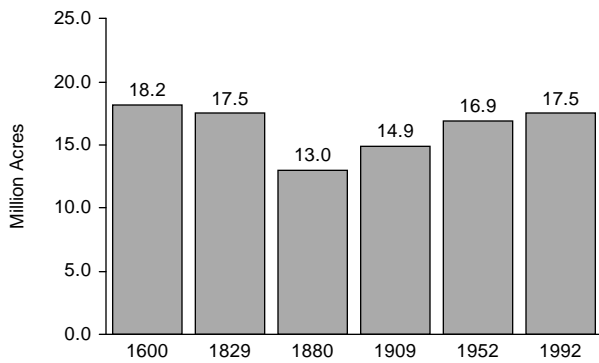


Figure 11. Estimates of Maine forest acreage. Source: Colgan and Irland (1993).

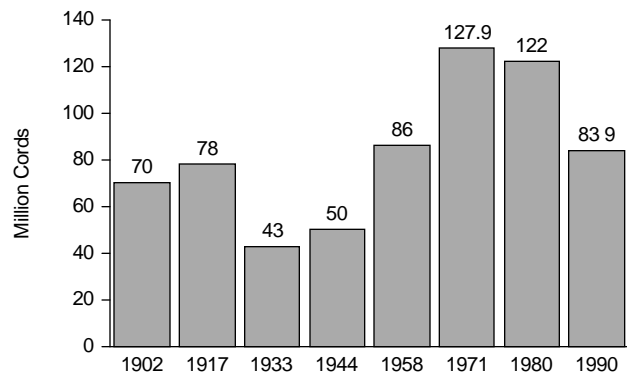


Figure 12. Estimates of Maine spruce-fir growing stock. Source: adapted from Irland (1981:51), Irland et al. (1988:38), and Maine Forest Service (1993:5).

and the means for the schooners to bring the boards, plank, timbers, lath, and shingles to market. Descriptions of the period from 1890 to 1920 always discuss the forest by river basins (Figure 10), ignoring county lines, forest vegetation zones, or other distinctions. Log drives survived on some streams until the 1970s.

### FOREST AREA AND VOLUME CONDITIONS, 1800–1992

Maine's forest area has increased significantly, as farmlands were left to regrow to brush and trees after 1880 (Figure 11). Since then, about 50,000 farms have ceased to exist in Maine. This was due to the more productive farmland elsewhere, to the extraordinary productivity growth in dairying, and to the replacement of horses by tractors, which eliminated the need for large areas of pasture.

Total volumes in the forest are not so easily compared, since measurement standards and species counted have changed greatly over the years. But we can assemble a rough picture of trends for the softwood resource (Figure 12). The high volume in 1971 was probably not sustainable because of the high content of short-lived balsam fir.

### PRIVATE FOREST OWNERSHIP

In the LURC jurisdiction, there were 1,016 parcels of land greater than 500 acres in 1991; these accounted for 8.9 million acres of land (Market Decisions, Inc., and Land and Water Associates 1993). As Table 2 shows, the forest industries own the largest share of Maine's forest land. Also, several groups of family trusts have held forest land in

Table 2. Estimated timberland ownership in Maine, 1991 (thousand acres).

Owner	Acreage	Percent
Federal	59	.3%
State	354	2.1%
County and Municipal	114	.7%
Total Public	527	3.1%
Forest Industry	8,017	47.2%
Other Private*	7,145	42.1%
Farmer	1,299	7.6%
Total Private	16,460	96.9%
All Timberland	16,987	100.0%

Source: Powell, et al. 1993.

\*Includes about two million acres of large family trusts.

Note: This table covers commercial forest land termed "timberland" by USFS and not all forested land or all lands.

Maine, in a few instances since the 1840s. Further detail on private ownership is found in Chapter 7.

In 1932, Austin Wilkins estimated that Maine private forest lands were owned as follows (Wilkins 1932:30):

Size of Ownership	Number of Owners
100–200,000 A.	18
200–500,000 A.	10
500–1,000,000 A.	2
1,000,000 +	2

Wilkins was relying on an earlier estimate by Colby (1917). At that time, only 2.6% of Maine's forest was publicly owned.

### MAINE'S PUBLIC ESTATE

It has been widely observed that Maine has about the lowest amount of public landownership of any forested state in the nation. The history of disposal of the state's public lands in the 19th century has been well treated (Smith 1972; Irland 1986). The history of Maine's present public estate is not so fully documented. But a recent State Planning Office summary permits a statistical depiction. The land areas in this instance are total acres, not just forest acres. The 1.1 million acres of public land noted in Table 3 constitute about 5% of the 20 million acres of land in Maine. It is likely that this source understates the total acreage of municipal forest land, which is not well documented, but may be about 114,000 acres (see Table 2). (See Maine Bureau Parks and Recreation 1994:46–53.)

Maine's public estate has increased in recent years, due to bonding programs for parks, game lands, and general conservation purposes. In addition, the resolution of past legal conflicts over the Public Lots led to a boost in acreage managed by the Bureau of Public Lands from about 65,000 in the mid-1970s to nearly half a million acres today. In response to the land boom of the 1980s, the Legislature created the Land for Maine's Future Board, which acquired roughly 50,000 acres for management by existing agencies. The Board has finished its work and no longer exists. (For larger parcels, see Figure 34 in Chapter 9).

Table 3. Publicly owned lands in Maine, 1993.

Agency	Acreage
<b>Federal Agencies</b>	
USDA Forest Service	58,100
White Mountain Natl. For. USDI — Dept.	45
USDI Fish & Wildlife Service	44,440
USDI National Park Service	
Acadia NP	41,267
Appalachian Trail	30,935
Coast Guard	296
Veterans Administration	510
General Services Admin.	1
<b>Federal Total</b>	<b>188,146</b>
<b>State Agencies</b>	
Department of Conservation	
Public Lands*	456,068
Parks and Recreation	91,403
Forestry	553
Dept. of Inland Fisheries & Wildlife	83,719
Baxter State Park Authority	203,014
Dept. of Transportation	897
Dept. of Agr. Food & Rural Res.	306
University	4,631
<b>State Total</b>	<b>840,591</b>
<b>Nonprofit Organizations</b>	
The Nature Conservancy	19,357
Local and regional land trusts	11,412
National Audubon Society	2,188
Maine Audubon Society	1,300
Other nonprofit	1,605
<b>Nonprofit Total</b>	<b>35,862</b>
<b>Selected Municipal</b>	<b>20,389</b>
<b>Grand Total</b>	<b>1,084,988</b>

Source: Kelly (1993).

\*Does not include small islands and omits unlocated and unlocated public lots held in common and undivided tenure with others.

## OVERVIEW OF THE VOLUME

The first essay examines five views or images of the Maine forest. The volume proceeds with a series of articles focusing on the timber resource, the industry's outlook, cutting practices, and some historical lessons on sustainability. The next set of papers treats the forest as real estate, reviewing forces that have shaped forest ownership and use during the recent land boom and corporate merger wave. A third set of papers reviews outdoor recreation uses of the forest, and the final paper summarizes policy challenges for the future.

### 3. Five Images of the Maine Forest

---

Maine's forests cover almost nine of every ten acres of the state's land area. The extent of forest cover increased significantly from the 1880s to the 1970s as abandoned farmland "went back" to brush (Colgan and Irland 1993; Coolidge 1963; Smith 1972; Land Use Regulation Commission 1976). The largely unsettled woods of western, northern, and eastern Maine are still termed "the wildlands." The forest is interwoven with the Maine identity and sense of place to a degree not readily appreciated. The forest ranges from urban parks like the Deering Oaks to the wooded Camden Hills to the wilderness expanse along the St. John River. As havens for wildlife, as the wellspring for the state's lakes and rivers, and as the visual backdrop for daily life, the forest affects Maine people as it can in few other places. In this essay, I will review five distinct images of the Maine forest.

The forest as a setting for Maine life provides much more than just maple syrup and a place to hunt and ride snowmobiles. Its universal presence in our surroundings and the recurring markers of its role in Maine history give it important, if at times subtle, cultural impact. Because of this importance, it is fitting to begin our discussion with the role of the forest as a cultural resource.

#### MAINE'S FOREST AS A CULTURAL RESOURCE

The history of Maine's forest as a cultural resource has yet to be written, yet even a casual glance reveals many expressions of its impact. Because of its sheer extent, a prominent presence of forest in Maine landscape art would be expected. And this is what we find. It is clear in the paintings from Frederic Church's brooding Mt. Katahdin, to Dahlov Ipcar's Rangeley October, to Neal Welliver's landscapes of cedars and lakes, birches and hills. The forest in these works is no mere stylized backdrop or quickly sketched-in prop behind the important foreground action. The forest, on the contrary, is a central actor, a brooding presence. In Alan Bray's Ghost on Flanders Hill (1982), for example, the forest has reoccupied a hilltop farmstead; the viewer can almost feel the wood on the march. The way the forest is depicted reflects cultural notions of the different periods and illustrates individual styles (Paintings are in Skolnick [1991]; see also, more generally, Beem [1990]).

A key feature of the Maine forest is its general wildness. Wildness is as much a cultural phenomenon as a natural one. The trees of these woods are

second and third growth, and some of them are planted. Yet by and large the North Woods of Maine retain their magical air of wildness, except where large clearcuts are visible from roads or to passing canoeists. Thoreau spoke of the Maine Woods as a wilderness, though he knew that it was mostly privately owned and was scheduled to be cut over for spruce logs. He understood the cultural importance of large expanses of forest and urged that a major reserve be created in the Maine Woods (Thoreau 1987).

The wildness is qualified, however, by the importance of mechanized recreation uses. In the Allagash Wilderness Waterway, visitors arrive by air on Allagash Lake, and the use of motors on canoes is well accepted. Yet these factors would exclude the Waterway from many people's definition of wilderness. Even more unusual, wilderness canoeing on the St. John is managed by a cooperative of private landowners instead of by a public agency (see Chapter 9).

#### MAINE'S FOREST AS A RECREATIONAL RESOURCE

The forest is a key resource in the state's important recreation industry. Even activities such as coastal sight-seeing are related to the forested scenery. But attributing the employment and incomes in tourism to the forest takes some arbitrary assumptions. By one estimate, 62% of the state's recreation spending was forest related (Northeast Forest Alliance 1993). A state survey concluded that recreational spending by Maine residents and nonresidents totalled \$2.75 billion in 1991 (NEFA 1993; Maine Bureau of Parks and Recreation 1994; Clawson and Harrington 1991).

The ready availability of recreational opportunities of many kinds is a key ingredient in Maine's quality of life and of its sense of place. Maine people are active users of the outdoors (Table 4). In a 1986 poll of Maine adult residents, the Department of Conservation found that 72% of respondents had used the woods for recreation at least once in the previous five years (Maine Department of Conservation 1986).

The image of the North Woods as a haven for fly fishing and canoe paddling is misleading. In fact, much of the use of the North Maine Woods area is mechanized, and many of the canoes using the Allagash are motorized. Access by air is common. Efforts to increase the wilderness character of limited areas by limiting snowmobiles, air access,



Table 4. Recreation participation rates, Maine residents older than age 18, 1991/1992 season.

Activity	Percentage Participating
ATV riding	7.1
Bicycling	
Mountain	7.6
Road/trail	25.4
Camping	
Developed	26.7
Primitive	20.6
Canoeing	
Flatwater	30.9
Whitewater	9.1
Freshwater fishing, lakes & ponds	38.3
Backpacking	9.2
Pleasure boating	38.4
Snowmobiling, near home	11.9
Deer hunting	21.9
Freshwater swimming	54.8
Walking for pleasure	57.6

Source: Maine Bureau of Parks and Recreation (1994).

or outboards are bitterly—and usually successfully—resisted.

Most of the backcountry styles of recreation, while recovering recently, show slow growth over the past decade or so. The principal exception is guided rafting trips. In some instances, use levels are below past peaks. Sight-seeing visits to a selection of state parks show a striking downward trend as do snowmobile registrations (Figures 13–15).

The Interstate Highway system, rising incomes in urban areas, and better roads into the backwoods have fostered periodic booms in recreational lot sales. Lots have been carved out of wilderness lakefronts, and properties have been stripped of timber before sale to individual speculators. While the area directly affected has been small, it has had significant impact on the “wildness” of some remote areas, and has created some large and visible clearcuts. How best to regulate this particular recreational industry has been a controversial issue. One statewide group, the Natural Resources Council of Maine, has advocated an outright ban on subdivision and development in the wildlands.

Roads built to remove timber provide access to the remotest corners of the woods. Visitors can now see the forest practices being used—and they do not always approve of what they see. Overcrowding of put-in points and campsites and overfishing of wilderness streams are increasingly common. Using snowmobiles, most remote ponds can be reached for ice fishing. Land use regulators have struggled

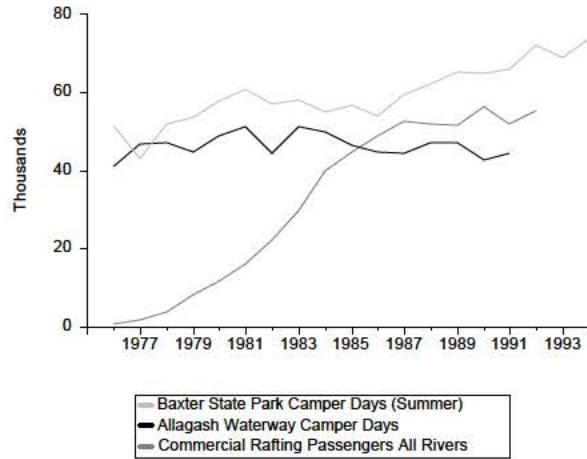


Figure 13. Maine recreation trends: Backcountry uses, 1976 to 1994. Source: Maine Bureau of Parks and Recreation (1994).

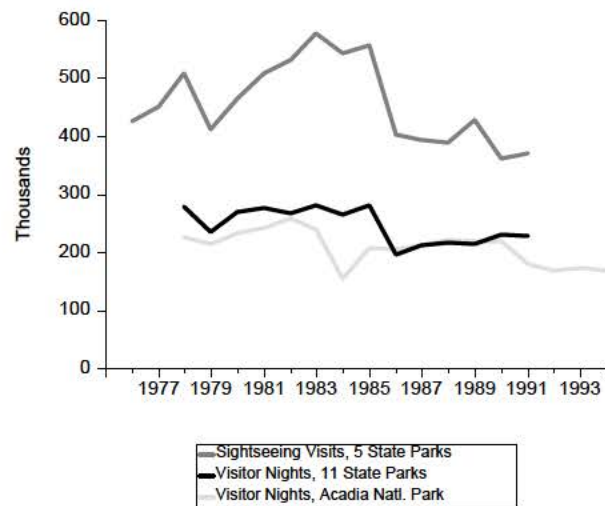


Figure 14. Maine recreation trends 1976 to 1994. Source: Maine Bureau of Parks and Recreation (1994).

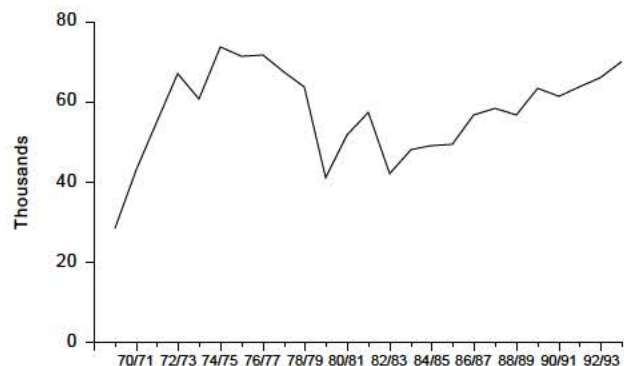


Figure 15. Number of snowmobiles registered. Source: Maine Bureau of Parks and Recreation (1994).

to keep roads away from key wild lakes and ponds in hopes of keeping their wildness intact and their fisheries healthy.

### MAINE'S FOREST AS A BIOLOGICAL RESOURCE

Early visitors to the Maine Woods viewed its forest in terms of a list of individual tree species. There was no concept of forest types, ecosystems, or landscapes.

In the wildlands, the land has remained in forest through several cycles of ownership change and cutting (Marchand 1987; Sedjo 1991). Hunting, habitat trends, and other factors have eliminated several of the prominent wildlife species of this forest, including the timber wolf and the caribou. In the more settled portions of the state, however, a significant acreage of today's woodland is growing on former farmlands. The farms were abandoned because they could not compete with farms in other regions. In these areas, species such as the white-tailed deer, wild turkey, and beaver are returning to prominence. Statewide, Maine's deer kill has fallen slightly since the 1950s, as habitat conditions have shifted away from those favoring deer. In contrast, from the mid-1970s to the early 1990s, the number of active bald eagle nesting sites and young fledged displayed an encouraging uptrend (Maine Department of Inland Fisheries & Wildlife 1994).

A broad functional view of the forest ecosystem is suggested by the distribution of carbon between soil, forest floor, understory, and trees (Figure 16). The trees, soil and forest floor biota, fungi, and bacteria mediate the fixation of carbon and its storage in these forms. The distribution of carbon shows that the trees are in a sense the tip of the iceberg of a complex system. The forest has also

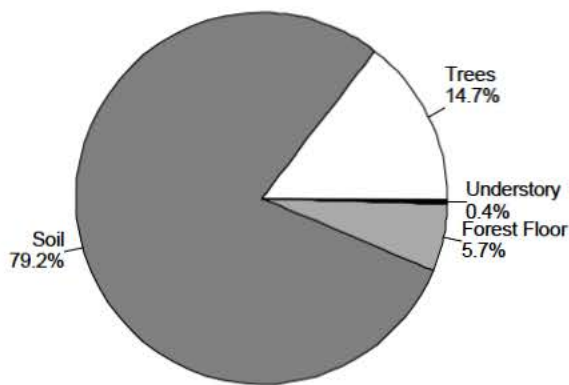


Figure 16. Total storage of carbon in forests, 1987, by component. Source: Birdsey (1992:22).

been exhaustively characterized in terms of wildlife habitat values (Brooks et al. 1986).

Unfortunately, the centuries of farm and industrial activity and foreign trade have brought with them introduced pathogens, insects, and weeds. The white pine blister rust, beech scale/nectria, dutch elm disease, and the gypsy moth have affected the forest's composition and health in varying degree.

In the 1970s, it was discovered that rain and snow in the Northeast had become acidified by industrial pollution. This coincided with the realization that high-elevation stands of spruce were displaying a synchronous decline along the Appalachian Mountain range from North Carolina to Maine. Scientists have attempted to determine whether this decline is due to atmospheric pollutants, to normal stand aging, to a delayed response to the drought of the early 1960s, to all of these factors together, or to yet another factor. No final consensus has been reached. But it is known that alpine ponds from western Maine to the Adirondacks have become acidified, with accompanying loss of fish and other life. Many scientists continue to suspect a role for atmospheric pollutants, but a convincing mechanism or set of mechanisms has yet to be generally accepted. And recently, potential effects of future climate change are receiving detailed attention (Aber et al. 1994).

The forest's recovery over past decades has been accompanied by a gratifying improvement in many wildlife populations. Yet, even as this becomes more clear, concerns for the future of the forest as wildlife habitat are increasing. The level of harvest, and the visible examples of extremely large clearcuts have raised concern that the past period of recovery in many wildlife populations may be over. The concerns over atmospheric pollutants and potential climate change add to the unease of wildlife experts. Considerable study has been devoted to the populations of neotropical migratory birds, which have been in general decline across the East. Research is under way to determine the relationships between forest practices and bird populations on a stand by stand and a regional level (Askins et al. 1990). According to several studies, the right level of forest cutting increases diversity of bird populations (Briggs and Krohn 1993). Research is underway to determine if factors at work in other regions are applicable in the extensive forests of the Northeast. Habitat loss in wintering areas in the US South and in South America and the Caribbean is likely to be a contributing factor. Interest in bird populations reflects a wider upsurge of interest in biological diversity.

Regional assessments show that Maine is not known to be a major "hot spot" for species endangerment (Flather et al. 1994).

Forest scientists are telling us that we need to view the forest as an ecosystem and as a landscape of intermeshed parts. The focus is on ecosystem integrity and on maintaining ecosystem functions. We need to see both the forest and the trees (Hunter 1990; Seymour and Hunter 1992). In the past, we have concerned ourselves with individual tree species, game species, and forest pests. Today, we increasingly view the forest landscape as a habitat for the full variety of its inhabitants. The landscape provides the distinct areas needed by a species for food, shelter, mating grounds, and cover from predators. Also, scientists and land managers now view forest health as a more integrative concept, which monitors the forest with an emphasis on its overall condition instead of just compiling facts about a galaxy of individual pests (USDA Forest Service 1993).

### MAINE'S FOREST AS A TIMBER RESOURCE

Compared to other forest values, we have far more abundant and detailed statistics depicting the Maine Woods as a stockpile and growing resource of timber. Counts of trees by species, size, volume, county, and condition are available at several different measurement years since 1959. (See Ferguson and Longwood 1960, Ferguson and Kingsley 1972, Field 1980, Irland 1986, Powell and Dickson 1984, Sewall Co. 1984, Maine Forest Service 1993.) Less frequent or more informal estimates go all the way back to 1880 (Sargent 1884).

When the first cut of timber was taken from the Maine Woods, forests extended literally beyond what citizens could then imagine, beyond the White Mountains, beyond the Great Lakes, beyond the Plains. Yet labor was scarce. The high-quality pine was used wastefully because only the clear lumber of the trunks had a market value. Logs were topped at the first branches because it was too expensive to chop the limbs from the top logs, when another tall pine with a clear trunk was standing nearby. Several cycles of forest use have come and gone since then, leaving only tag ends of the former virgin forest. A state survey recently found only about 1,500 acres of virgin forest on state land, and only tiny remnants of virgin growth persist on private lands. With new technologies, new products, and new markets, spruce and fir trees cut in the Maine Woods are now used down to 3" tops, and in parts of the state, tops and small trees are chipped, including leaves and branches, to feed biomass boilers.

Successively broader views have been brought to the measurement of Maine's forests. The oldest view simply tallies the amount of pine or spruce. More recently, foresters have measured the forest as pulpwood (Table 5). During the 1970s, experts calculated the total biomass, or weight of living and dead organic material in trunks, tops, and cull trees. Finally, in the 1990s forest scientists began measuring the tonnage of carbon in forests, assessing the forests' role in global carbon cycling.

In late 1993, the Maine Forest Service released results of a "midcycle" inventory, a quick stock taking of the condition of Maine's forest. The results were sobering. The decline in spruce-fir inventory had been predicted, because of the relatively short life of fir trees, the stress of the budworm outbreak of the 1970s and early 1980s, high cutting rates, and the age structure of the forest (see Irland, et al. 1988), but the decline in hardwood was a surprise. Because of the age structure of the forest, and its widespread overstocking, some reduction in total growing stock may not be a bad thing. But the recent inventory results, while not conclusive, are telling us that we should be slowing down to check the road ahead carefully. The USDA Forest Service is completing a new and more detailed survey. The results of that survey must be analyzed with care and interpreted with insight, to give us a basis for state government and landowners to make important policy decisions for the coming century. It is expected that the new data will become fully available in 1996.

While clearcutting is apparently on a downtrend, publicity given to several large and glaring examples continues to keep the issue on the state's policy agenda. There is hardly any aspect of forest cutting and stand management practices that has

Table 5. Analytical perspectives on Maine's forest resource.

Products (1990)		
All Pulpwood Quality		
Trees 5" and larger	241.8	million cords
Biomass (1987)		
Boles (trunks)	374.5	million dry tons
Tops	144.6	million dry tons
Cull trees	82.6	million dry tons
Total	601.8	million dry tons
Carbon Stored in Trees (1987)	354.1	million metric tons

Sources: Maine Forest Service (1993); Cost et al. (1990); Birdsey (1992).

not been controversial (see Chapter 6 and Lansky 1992; Irland Group 1988; Nyland 1992).

### MAINE'S FOREST AS A SECTOR OF THE ECONOMY

Maine's forests provided or facilitated the production of the state's first exportable products. Fur trading helped the Plymouth Colony pay off its debts to its financial backers (Clark 1990). Fuel wood was used to build racks for drying fish (Harrington 1994; Duncan 1992). Oak staves were used to make barrels for shipping the fish (Cronon 1983). Since the days of the early fishing stations, the products and markets have changed, but not the importance of forest in the state's economy.

Forest-based industries have actually increased their share of manufacturing production and employment since 1905:

Share Compared to All Manufacturing:

Year	Production	Employment
1905	30.0%	27.4%
1992	43.5%	29.0%

Source: Maine Commissioner of Industrial and Labor Statistics (1907); Maine Department of Labor (various years).

During this time, manufacturing's share of total employment has declined.

This increase is extraordinary, since the normal course of economic growth is for the share of resource-based industries to gradually shrink as other industries expand, and as productivity in lumbering and papermaking increases. From 1988 to 1991, jobs in the lumber and paper sector suffered proportionately less, as Maine manufacturing lost 10,600 jobs. Even so, lumber and wood plants lost 3100 jobs due to the housing slump and the recession of those years, emphasizing the cycli-

cal nature of this sector. But production grew rapidly. From 1986 to 1991, fully half of the increase in Maine's manufacturing output was due to increases in lumber and paper sales volumes. In 1992, the top 3 employers in manufacturing were paper (16,489), transportation equipment (mostly shipbuilding) (13,067), and lumber and wood (10,794). (Data from Maine Department of Labor various years).

Statewide data mask the importance of forest-based manufacturing jobs to local communities. Since the state does not publish papermill employment for most local areas, the local impact of that industry is obscured. In many smaller communities, lumber and wood products loom large in the economy (Table 6). Unfortunately, as major papermills have shut down unprofitable machines during the current industry recession, local communities have discovered how important these jobs can be to their local prosperity.

In 1992, average annual wages in the paper industry exceeded the state's manufacturing average, while in the more labor-intensive sawmill industry, wages were lower:

	1992 Average Hourly Earnings
Pulp & Paper	\$16.25
All Manufacturing	11.38
Lumber & Wood Products	9.25

Source: Maine Department of Labor 1992.

From the late 1940s to the 1980s, the lumber and paper industries together were able to maintain their employment levels because higher timber harvests offset the effects of rising worker productivity (Irland 1984). From 1960 to 1991, the total harvest nearly doubled, though the increase included types of timber not previously used (Figure 17). At some point, the ability to sustain em-

Table 6. Annual average employment, selected labor market areas, 1992.

	Lumber and Wood	All Manufacturing	Total Employment
Fort Kent-Allagash	400	700	3,360
Bangor	1,400*	4,480	47,810
Belfast	250	1,260	6,560
Farmington	960	4,160	11,830
Patten-Island Falls	400	490	1,420
Norway-South Paris	1,000	1,870	7,310

Source: Maine Department of Labor 1992.

\* Includes Paper and Allied.

ployment by increasing harvests will come to an end. The new Midcycle Survey seems to be telling us that we are at that point already.

The forest has long been a major contributor to the state's and the nation's balance of trade, though the products and the markets have changed. Exports of logs to Canada date back to the opening of the North Woods to river driving after the 1840s (Smith 1972; Judd 1989). The recent increase in exports to European and Asian destinations is much smaller than the established trade to Canada, but has raised public concern as well as opposition from some sawmills.

The social and political atmosphere of the company town continues to be visible in numerous papermill and sawmill towns, with the inherent conflicts this traditionally brings. This is true even where employers have had exemplary records of labor and community relations (Hillard 1990). Although papermill towns enjoy low tax rates and abundant taxable wealth, many citizens resent the low property tax rates the companies pay on their extensive forest holdings. In some smaller communities without mills, much of the tax load has to be carried by the property of a few residents, while 80% or more of the town's land area is paying low Tree Growth Tax rates. State reimbursements were supposed to mitigate this difference, but funding has been inadequate (Maine Office of Policy and Legal Analysis 1988). Finally, in some papermill towns, ongoing productivity improvements have reduced employment at the mills, and the towns have been unable to attract other forms of employment.

Contrary to all expectation then, the forest as an economic sector, especially when considering its

importance for tourism, has maintained its importance to the Maine economy. The forest-based sector has outlasted successive booms in textiles, footwear, electronics, and real estate. It will likely outlast the recent 30-year boom in defense spending and military bases, and may outlast future booms as well. This unusual history may not ensure that Maine can continue to successfully compete for investment capital in future rounds of national investment spending in paper and lumber mills, but it emphasizes that natural resources still count for a great deal in Maine's economy.

### POLICY ISSUES

Maine's forest is a significant cultural asset, a recreational resource, a major sector of the economy, a biological resource, and a timber resource. Threats to the many social values presented by Maine's forests, and competition between these values, periodically raise issues for state and federal policy consideration.

Not only are the issues affecting the forest changing, but the political and institutional forces dealing with forest policies are changing. As an example, a Green Party candidate for governor in the 1994 campaigns ran on a platform advocating major forest policy reform. A primary candidate advocated a major land conservation program for the Maine Woods. Another candidate advocated extending the Appalachian Trail northward to Canada. Once the province of a few interested legislators, industry lobbyists and executives, and state officials, forest policy has been opened up to new political forces and groups. As changes in air pollution, land use, transportation, and international trade clearly affect the forest, it is becoming more difficult to draw the boundaries around the field.

In March 1994, The Northern Forest Lands Council, a federal-state group, issued a report advocating a program for maintaining and enhancing the many values of the forests of the northern New York and northern New England (Northern Forest Lands Council 1994; Binkley and Hagenstein 1989).

The issue of forest practices periodically comes to the Legislature. In 1989, a Forest Practices Act was passed. Regulations were adopted, but the state's funding crisis prevented funding the staff needed for enforcement. In virtually every legislative session, a bill is considered that would ban clearcutting in the wildlands. History shows that policy issues affecting the Maine forest are never finally resolved. Rather, when conditions demand it, the political process generates an uneasy compromise. On each particular topic, this compromise

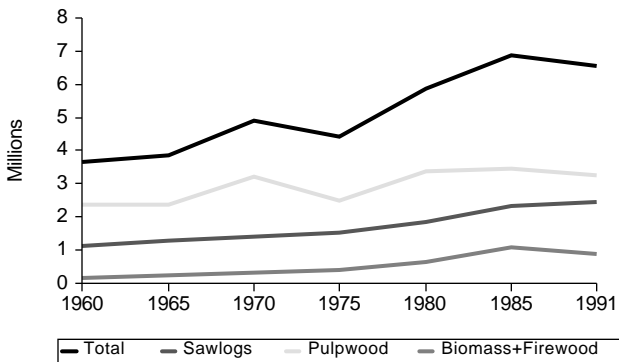


Figure 17. Total softwood and hardwood product harvest levels in Maine, 1960–1991. Source: Maine Forest Service (1993:29).

may persist only briefly, or it may endure for generations. We are now challenged to rebuild many policies anew, to meet the needs of new “ecosystem management” or “landscape management” paradigms (see Chapters 6 and 12).

### OVERVIEW

The five images of Maine’s forest discussed here do not exhaust the possibilities. Yet each represents a critical social value of the resource. The policy problem is not how to choose which should have absolute primacy. The policy problem is grounded in the fact that every one of these perspectives is important, and continues to increase in importance to the state. The Maine forest, and the world that it inhabits, is simply not large enough to enable us to choose one image to the exclusion of others. This fact presents the challenge to the state—acting as trustee for future generations—to sustain the values of Maine’s forests.

## 4. Outlook for Maine Wood-Using Industries

According to legend, Maine was the location for the first sawmill ever operated in the United States. This was a small water-powered mill at South Berwick, believed to have been operating in the 1630s. In addition, the pinnace *Virginia*, launched on the Kennebec in 1608, was the first wooden vessel ever built by Englishmen in New England (Duncan 1992). For years, the forests of the islands and points supplied fuel wood and wood for drying racks, boxes, and barrels for the fish trade. So wood has been a strategic element in Maine's economy since even before permanent English settlements existed here.

There is a risk in treating the wood-based industries too generally. Yet a few words of overall assessment might be useful. In such a broad overview, many general and conclusive statements are required; each could easily fill its own article for adequate explanation.

### THE SITUATION

During the 1980s, a number of major trends shaped Maine's wood-based industries. Perhaps most visible was a major wave of investment in pulpmills. The mill rebuilds of the 1970s were stimulated by the obsolescence of existing mills, by environmental requirements, and by a growing demand for printing and writing papers. The rebuildings of the 1980s were primarily due to continued demand growth, together with an extraordinary boom in the price of pulp. Between the early and the late 1980s, pulp prices roughly doubled. This meant that companies buying a lot of pulp wished to make more themselves; firms selling pulp wished to make more as well. During this period, merger activity in paper companies accelerated, and many Maine mills were expanded and modernized. Between 1989 and 1995, the pulp market has gone through a violent price cycle (Figure 18). It has not been fully appreciated that the competitive outlook for Maine mills looks different at \$500 market pulp than it does at \$850 pulp. Future cycles are likely.

During the recession of the early 1990s, many Maine communities were forcefully reminded of the realities of competition and the importance of manufacturing jobs as individual paper machines have been shut down. The continued erosion of Maine's competitive position in low-wage, low-tech manufacturing has begun to affect particular branches of the wood processing industries as well.

Even as Maine's competitive position in low-wage manufacturing has declined, so has its posi-

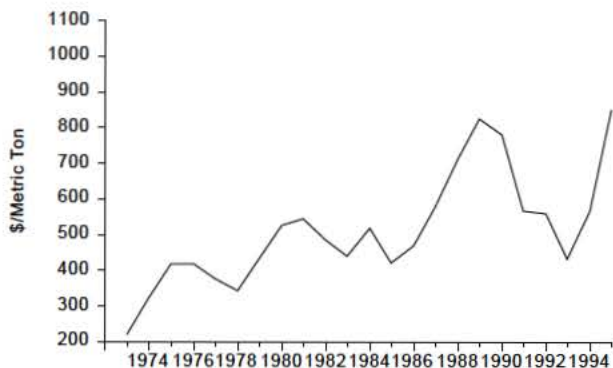


Figure 18. Market pulp—Bleached northern softwood kraft, 1973–1995. Source: Prudential Securities (1995).

tion for capital-intensive heavy industry. The reasons sound like a litany of traditional business complaints, but there is a danger that the social and political polarization created by slow economic growth will make a rational discussion of this situation impossible. Further, policy developments on federal and state levels have not enhanced the state's position as a stable tax and regulatory environment for long-term forest landownership and investment in forest management. For a thorough review, with useful cost comparisons, see Commission to Study the Future of Maine's Paper Industry (1995).

A biomass-using industry was created in the 1980s, positioning Maine as a leader in converting wood into energy. As fuel oil prices have fallen, this has not turned into the economic advantage to consumers it was once hoped to be, but it has cut oil usage and kept some cash in the state. Central Maine Power Company in the late 1980s relied on wood for roughly 20% of its power generation. By the mid-1990s, use of wood-fired electricity was being scaled down again. It has not yet been possible to reap all of the potential benefits for improved forest management, though many positive examples can be found.

Maine's forests have survived yet another land boom—the most recent in a number of periodic waves of speculation and subdivision. This land boom was fostered in part by New England's extraordinary growth between 1975 and 1989. Indications are that subdividing in the wildlands is finally slowing down. The land boom, as symbolized by several large sales of industrial lands, has had the useful effect of jarring our complacency. The per-

manence of the privately owned forest in a generally wild condition can no longer be taken for granted. A major debate over the public policy implications is now underway.

### SUPPLY: CAN THE FOREST MEET THE DEMAND?

The last detailed public reckoning of Maine's forest balance was done in 1981–1982 by the USDA Forest Service. This survey is now (1995) being redone once again. It will be no surprise if the outlook depicted here needs significant revision when that information is available.

Maine's spruce-fir forest, the "black growth" of the North Woods, has undergone significant stress in recent decades. The premium fiber from these species is valued for pulpmaking, especially where strength is important. The lumber is likewise valued for construction uses. From the early 1970s to the mid-1980s, a major spruce budworm outbreak ravaged these forests, killing millions of cords of timber and prompting the premature harvest of many stands (Ireland et al. 1988). An extensive spraying program retarded the damage, but it was recognized that there was no way all the wood could be saved. The outbreak collapsed in the mid-1980s. Most remaining dead stubs have rotted and fallen down, and the forest is recovering its pre-outbreak rate of growth. The spruce-fir forest is a classic example of what foresters call "age class imbalance." This is because many of its stands were regenerated during and after the 1912–1920 budworm outbreak, and cutting pressure on the forest was very low until the 1970s. Fir, which made up a large portion of the stocking, is a short-lived tree, rarely living beyond 60–80 years. So, even in the absence of cutting, the spruce fir forest was going to undergo a decline in volume around the turn of the 21st century.

Projections during the 1980s show that the spruce-fir forest would decline in volume until the 2020–2030 period when young stands created during the 1970s and 1980s will become merchantable (Sewall Co. 1983; Seymour et al. 1985; Seymour and Lemin 1989). Recent projections, recognizing the reduction in softwood harvest in the 1990s and the effects of intensive management, suggest that the decline is nearly over (Maine Forest Products Council 1995). Fortunately, natural regeneration has been aggressive and abundant in many areas, and plantings have on the whole been successful. On the paper company lands, herbicide brush control programs are helping these stands to reach merchantable sizes as soon as possible. But not all of the acres that could benefit have been treated.

Average log sizes have been falling in most of the spruce-fir region and are likely to fall further. Smaller wood will impose higher costs on many users, though all of Maine's competitors face the same problems. Spruce-fir lumber production will decline by the year 2000, though some of this loss can be made up from other species. But closures of major pulp mills due only to timber shortfalls are not likely.

Maine is the nation's largest producer of white pine lumber. Its mills are increasingly modernized and customer-oriented, shipping large portions of their production in value-added form such as panelling and clapboards. Overall, the quality of Maine's pine resource is not high, but log sizes seem to be stable or even increasing as the forest matures. Several of these mills have long been in family ownership and conduct exemplary management on their lands. There are many opportunities to upgrade the quality of the pine resource, and there are many uncertainties about regeneration of young stands, but the supply picture for pine seems secure for the next few decades. In addition, due to declines in ponderosa pine harvests on western federal lands, the demand and prices for eastern pine have improved since 1991.

In hardwoods, the picture is more complex due to the greater number of species and ecological conditions involved. Export markets have boosted demand for quality oak, maple and birch; log buyers are scouring the hills for the rare "bird's-eye" maple. Overall, Maine's hardwood trees are smaller than those of competing states, but the forest includes species highly valued in U.S. markets and in world commerce. Most of the hardwood cut in Maine is used for pulpwood, for firewood, and for biomass fuel. The standing inventories of material suited to these uses can support several decades of harvesting at current rates, though total inventory is likely to decline.

So the supply picture is complex, but the forest appears capable of sustaining present rates of wood consumption over the next two to three decades. There will be shifts in species, size, and quality that will cause cutbacks or rebuilds at some mills. Three cautions cloud this picture, however. The first is that any long-term assessment is vulnerable to unforeseen surprises with each new forest inventory. Also, the ability of this changing forest to support future demands for nontimber forest values—wildlife, fish, and visual values, plus the more elusive qualities of wildness—has not been comprehensively assessed. Finally, and most significantly, there is no straightforward way to ensure that the current harvest level is not exceeded.



**WHAT IS THE DEMAND OUTLOOK?**

For the coming decade or two, what can we say about the outlook? There are a number of forces at work. First, major changes in the worldwide competitive position of the Northeastern U.S. are in prospect. World wood use is expected to continue rising in coming decades, though there is debate about how rapidly (Figure 19). Apsey and Reed (1995) expect that global demand will exceed supplies by 2020 for softwood and hardwood industrial roundwood as well as for fuel wood. They discuss various measures that will balance supply and demand.

Wood production in the U.S. Pacific Northwest is going to decline dramatically from mid-1980s levels (USDA Forest Service 1994), as is Canadian production (Figures 20 and 21). Recent increases in

wood products prices, and changes in public policies, have had complex effects on Canada's supply outlook, which varies materially by province (Natural Resources Canada 1995; Canadian Forestry Service 1994). Export of softwoods from Russia, far from being a potential source of supply, are likely to fall (Figure 22; Apsey and Reed 1995, sec. 13). Finally, production in the tropics will fall as the last available reserves of exploitable tropical forests are cut out in the coming decades (Figure 23).

In pulp and paper, the late 1990s will be good years for some mills and difficult ones for others. In Maine and nearby, we have already seen permanent machine shutdowns, other closings likely to be permanent, and mill complexes languishing on the market for lack of buyers. As markets revive in the late 1990s, the industry will recover, though it may

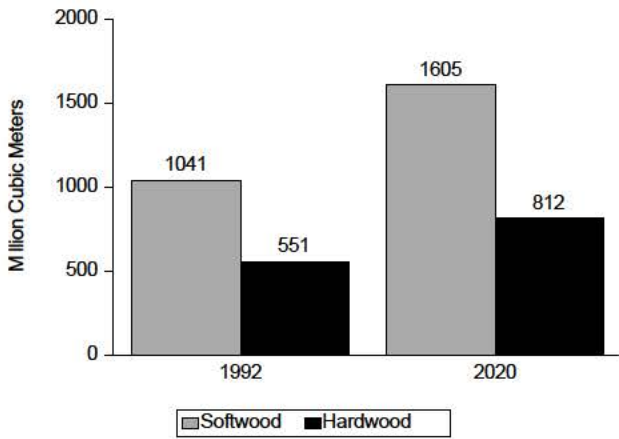


Figure 19. Global demand outlook: Industrial roundwood, 1992–2020. Note: A cubic meter is approximately equal to .42 cords of .221 Mbf of logs. Source: Apsey and Reed (1995:106a, 108).

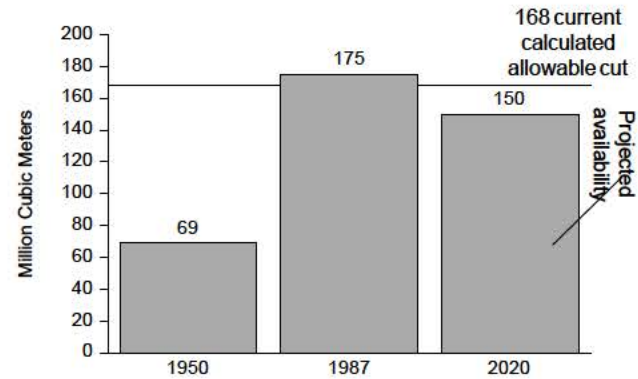


Figure 21. Canada softwood harvest. 1989 is the all time peak to date. Source: Apsey and Reed (1995:26).

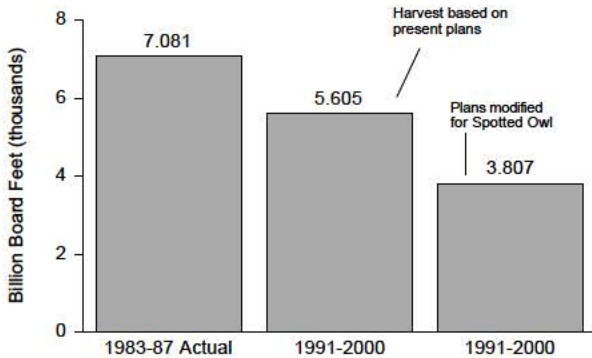


Figure 20. Timber cut on Western federal lands to fall dramatically. Harvest level on all public lands, western Oregon, Washington, and northern California, including state lands. Source: Beuter (1990).

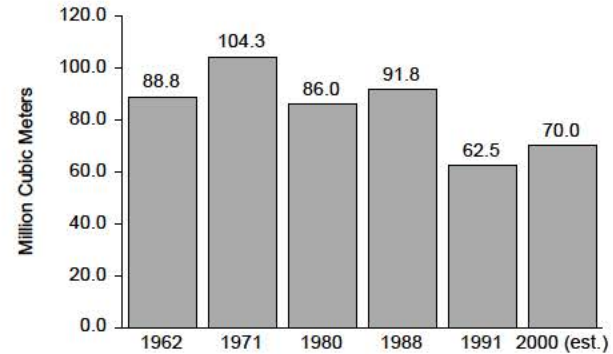


Figure 22. Softwood lumber production, USSR and successor states, 1962–2000. Source: United Nations Food and Agriculture Organization, Forest Products Yearbooks and author estimate.

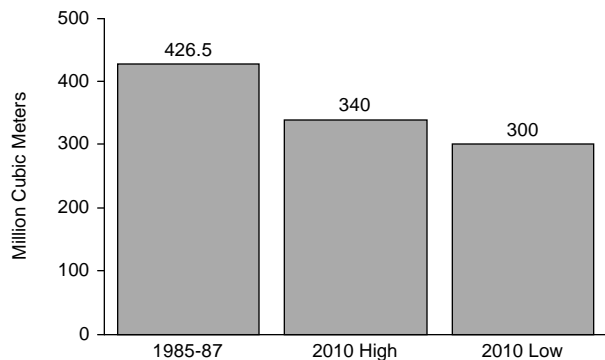


Figure 23. Future tropical supplies uncertain: Industrial wood production in Africa, Asia, South America, Oceania. Source: for 1985–87 data, World Resources Institute (1992); forecast is author estimate.

not have the cash flow for modernization that it has had in the past. The principal competitive threat after the year 2000 comes from paper machines being upgraded to printing and writing grades in large, modern southern mills that now produce commodity, unbleached grades. To a lesser extent, the same is occurring in Canada. Some recycling capacity will probably be built. But high prices for recycled drove out a long-established mill, Statler Tissue, in 1995.

Companies in solid wood products that modernize their production technology and marketing practices should see a bright future in Maine, because of the diminishing competitive supplies. This will not apply to certain lines, such as low-cost furniture, that are vulnerable to substitutes for solid wood or to low-wage competition. Taiwan already supplies about one-third of U.S. furniture imports. For these reasons, we should not be too complacent about the potential for value-added products.

So there will be serious competitive pressures, which Maine is now poorly prepared to face in a world of international competition and \$500.00 pulp. In 20–30 years, however, pulp and paper will still be manufactured here, perhaps by new corporate owners. Our society has made siting of new heavy industrial facilities of all kinds a near impossibility. This means that existing mill sites have a value on the market. An example of this is the modern supercalendered paper mill built in Duluth, Minnesota—on the site of a former steel works.

## REFLECTIONS

Through technological revolutions, through business booms and panics, Maine remains a place where many communities depend heavily upon the land, most clearly in the long-established lumber and paper towns. One thing the recent recession taught us is that jobs, exports, and tax revenues are not obsolete. And manufacturing, as a contributor to those benefits, is also not obsolete. Surely though, nontimber values of many kinds will need to be accommodated more securely than they have in the past.

No one is wise enough to see all of the new forms it will take, but Maine's economy in the early 21st century will continue to depend heavily, as it has these several centuries past, on processing its wood into products for distant markets.

## 5. Maine's Forest Resource: Notes on the Concept of Sustainability

---

Foresters invented the concept of sustained yield of wood products, and it is now a commonplace. This represents one facet of the concept of sustainability as applied to forests—the sustainability of the industrial outputs. The social concern has been that if sustained outputs are not achieved, society's raw materials supplies are impaired, and the economic base of communities and even entire states can be threatened. Results of unsustainable management of this kind have been seen many times.

Today, the concept of sustainability is being applied to the forest ecosystem itself and not only to its flow of raw materials and related benefits. The key goal of sustainability in these terms is to maintain or enhance (sometimes to create anew) forest conditions believed desirable because of wildlife, wildness, visual, or recreational values. Thus, dams built for log driving are now maintained and operated to "sustain" canoeable water over longer periods than existed in nature's wilderness. And specific habitat conditions favorable to scarce wildlife species are to be maintained or created to improve biodiversity and perhaps improve survival chances of threatened or endangered species.

The essence of this concept of sustainability is that it specifies desired conditions over extensive forest landscapes, hence the commonly heard phrase "landscape management." This form of sustainability is far from self-defining when it has to be applied on the ground. At one extreme, it means that the land is to be managed as a national park, else how are purely natural conditions to be sustained? At the other, it may mean applying sophisticated cutting regimes and other manipulations with an eye to creating desired conditions through intensive management. In the intermediate cases, timber cutting is allowed on part of the landscape, but any useful industrial wood that is produced is viewed strictly as a by-product of the management program.

In the Northeast we are only in the beginning of a scientific, professional, and public dialogue on these issues. It's useful to note these complexities as a prelude to setting them aside in order to handle the question from strictly a timber standpoint. The balance of this section reviews the story of Maine's forests, focusing primarily on the softwood resource and the softwood lumber industry. Conclusions from such a limited view need to be seen as preliminary, but including the pulp and paper sector very much complicates presenting the story. Yet given the importance of lumber throughout Maine's his-

tory, and lumber's demand for the larger, higher quality logs, a partial overview along these lines will yield useful insights.

### INHERENT NATURAL VARIABILITY OF THE FOREST

The forest visited by the first European explorers resulted from reestablishment of forest after the latest glaciation and from responses to significant climatic fluctuations since. This forest had only had its present shape for a few thousand years, and it may not yet be in full equilibrium with soils and climate.

Maine's presettlement forest was not a static "climax" forest of "murmuring pines and hemlocks" that never changed. It was formed by disturbance regimes that included intense windstorms, occasional large fires, and in localized areas, activities of the Native Americans. Beaver dams and local erosional forces slowly modified local areas. Kettle bogs and small ponds slowly filled in with peat, forming new stands of larch and spruce where previously there had been open water. In local areas Downeast, upland bogs spread over the landscape, probably engulfing stands of trees. Yet by and large there was probably a certain dynamic stability in all of this.

There is no way to discover for certain just how stable or unstable the presettlement Maine forest actually was. We do know that the forest's composition and health have been significantly altered in many different ways since then, however. For example, cutting patterns since the mid-19th century have materially increased the composition of fir in the north country at the expense of spruce. On the other hand, some types have probably increased due to cutting and farm abandonment. So whatever level of "instability" existed previously, there is little doubt that human activities have increased it, perhaps substantially.

The spruce budworm is a native inhabitant of the region's forests. How its periodic outbreaks may have affected the virgin spruce-fir forest we cannot tell in any detail. But the outbreaks since the turn of the century have inflicted major damage and caused the supply of spruce-fir to fluctuate dramatically. There is reason to believe that the future forest will be less vulnerable, however (Ireland et al. 1988). Another periodic insect infestation is that of the larch sawfly, which from time to time inflicts widespread mortality on larch. There is no reason to imagine that this has not been the case for centuries, if not for thousands of years.

The increase of trade has brought with it forest pests that have inflicted damage not suffered by the presettlement forest. Notable examples include the chestnut blight and the dutch elm disease, which essentially removed chestnut and elm from the forest, the white pine blister rust, which has materially reduced the value of the pine resource, and the gypsy moth, which inflicts more localized damage.

The forests of this century have been visited by periodic declines, often affecting a single species at a time (Millers et al. 1989). In some instances, the underlying causes of these declines have not been fully worked out. So at the level of individual species, there is a fluctuating quality to the condition of the resource.

### ASSESSMENTS OF FOREST CONDITIONS 1829–1990

The conditions of Maine's forests have been reviewed in print ever since the earliest explorers extolled the abundance, quality, and diversity of the timber resources to be found along Maine's coast (e.g., Jackson 1837, 1838). Moses Greenleaf, in his 1829 survey of Maine, noted the forest, its industrial importance, and its tree species. But he did not perceive the forest to be a permanent, or sustainable, resource for the state:

The vast quantity of (Maine's) lumber must diminish before the increasing population, and finally cease, as an article of exportation. Its place will be occupied with fields and pastures, and the products of agriculture must sustain the manufactures which the necessities of the population will require, and both of these must continue the commerce which the lumber trade, and the fisheries, have created Greenleaf (1829: 286).

In the Census of 1880, Charles Sprague Sargent (1884) singled out Maine forest landowners for praise, saying that their management practices had been of a conservative character that maintained productive potential. Without much further research, it is difficult to determine how firmly grounded this assessment might have been in field observations versus self-congratulatory hearsay. Yet it might be premature to dismiss it entirely. With the technology of logging at the time, only large stems could economically be removed, and the hardwoods had hardly been disturbed in the North Woods by that time. So Sargent was observing a relatively benign system of forest exploitation, at least on a comparative scale.

Surely the owners and operators of that period in many cases were still looking for a quick buck

and did not plan to manage for long periods of time. Also, they undoubtedly reduced the quality of the remaining growing stock as they picked out the finest pines, spruce, and maples and left the rest. Yet in terms of volume alone, they did leave residual stands that grew back to merchantable sizes, at times surprisingly fast. Cary's (1896) observations in the mid-1890s documented this, as did many later foresters (Irland 1986).

There was potential for optical illusions in assessing Maine's forest conditions. For example, the statistics on the log drives were one of the only ways to track what was being produced in the forest. The volume of lumber surveyed at Bangor, for example, peaked in 1872, and they stopped counting in 1905. The other log drives showed similar trends. Yet the reasons lumber milling dwindled at Bangor was not that the resource was gone. Surely large diameter sawlogs were scarcer and more costly after 1890, but the major reason was that Great Northern Paper company had purchased much of the watershed, raised Chesuncook Lake with Ripogenus Dam, and turned the log drives aside at Millinocket to manufacture newsprint. Similar developments at Rumford, Winslow, and elsewhere during this period had the same effect. Downstream lumber milling at traditional centers like Machias, Topsham, Hallowell, Bucksport, and Saco withered not from the extinction of the forest as from the diversion of its raw material to other end uses.

At the turn of the century, U.S. Forester Ralph Hosmer assisted the Forest Commissioner in developing estimates of the long-run productivity of the Maine forest. There was a concern that the rapidly growing pulp industry's appetite for logs, small ones in particular, might lead to the overcutting of the state's forests. In a comprehensive assessment published in 1902, Forest Commissioner Edgar Ring presented a river-by-river overview of forest conditions, verified, he said, by landowner records and the work of "expert scalers and explorers." Ring concluded:

...the annual growth is sufficient to warrant the cutting of 637 million feet of spruce timber in the state of Maine without depleting the supply.

It is clearly apparent, therefore, that the forests of the State are amply able, by careful cutting, to meet the needs and requirements of the pulp and saw mills for an indefinite period, unless devastating fires and windstorms occur... (Ring 1902: 6)

He also argued that Greenleaf had been mistaken:

...it is safe to reckon that there will be from eleven to twelve million acres of land in this state that will be lumber producing for all time... Ring 1902: 7).

At the time Ring wrote, in fact, mills were already sawing second growth pine in southern Maine to the tune of millions of feet per year.

Within a decade, however, Ring's caveat about fires and storms was fulfilled, with a vengeance. From 1912 to 1920, a spruce budworm outbreak swept the Maine Woods and killed an estimated 27 million cords of wood, mostly fir that was not included in Ring's earlier estimate of forest volume. Due to the combined effects of cutting, budworm, competition from other regions, and the collapse of demand after 1929, Maine lumber production plunged, not to recover until the 1960s.

As Forest Commissioner Forest H. Colby (1917: xxviiiff) surveyed the scene in the late teens he saw a totally different picture than had Ring. He believed that the depleted growing stock was being overcut and could not support an industry at the then current level for very long. This assessment was made near the peak of the Post-World War I commodity price inflation, and before the full competitive effect of West Coast supplies had been felt in the market. The competing supplies, the Depression, and World War II gave Maine's forests a rest of some two decades before America's postwar boom revived its immense appetite for raw materials. By that time, low-cost sources in the West and Canada would dominate the market until the new economies and technologies of the 1970s brought about a resurgence of lumber production in Maine. Not entirely by accident, this coincided with the coming into merchantability of the softwood forest that recovered from the 1912–20 budworm outbreak.

As much as the pulp and paper boom of the 1890s raised concern for the resource, it was only the beginning of a long, steady increase in pulp and paper production in Maine (Figure 24) (see also, Harper 1949).

Also, not entirely by accident, this boom in sawmill and pulp capacity coincided with a peak in spruce-fir inventory and a new and deeply threatening budworm outbreak. The high level of lumber cut in the late 1970s and early 1980s (Figures 25 and 26) was in part a response to a "use-it-or-lose-it" bargain presented by the budworm. In the state's midcycle inventory published in 1986, Maine became the first eastern state to measure a significant downturn in the inventory of its bread-and-butter species of timber.

This, and a need to refine the budworm spray program, in turn prompted a series of supply-

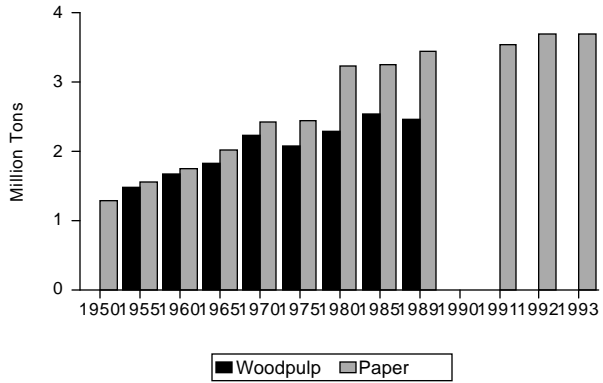


Figure 24. Maine woodpulp and paper production. Source: *Atlas of the Resources of Maine, Supplement Feb. 1987, The Forests of Maine; Current Ind. Rept. MA26A(89)-1 to 1989; and paper 1991–1993 from AFPA. Pulp not available after 1989.*

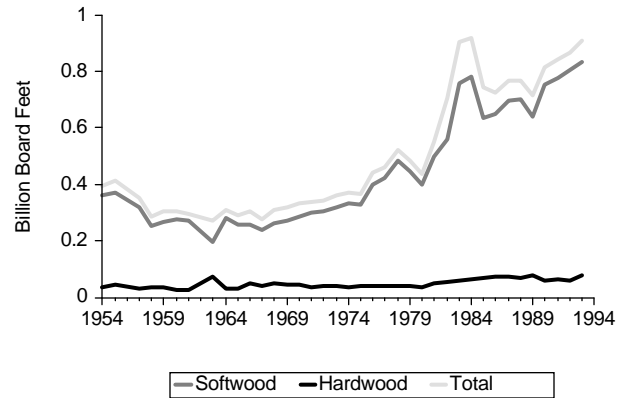


Figure 25. Maine lumber production estimates 1954–1993. Source: Steer (1948), U.S. Department of Commerce, various issues. Data for Total 1980–1981 and Hardwood 1982–1985 are author estimates.

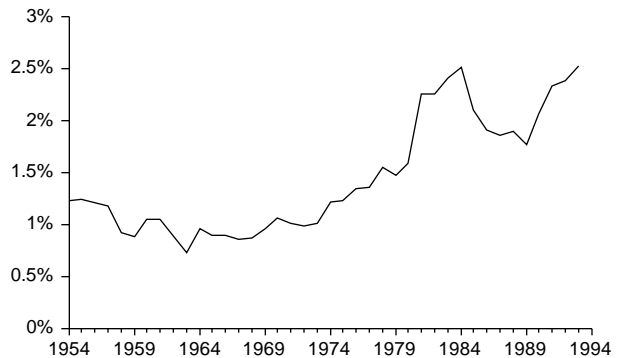


Figure 26. Maine as percentage of U.S. softwood lumber production. Source: Steer (1948), U.S. Department of Commerce, various issues.

demand projections by the state, and proprietary reviews of the situation by the major private landowners. Instead of using “expert scalers and explorers,” these new studies used extensive datasets collected by the USDA Forest Service’s Forest Inventory and Analysis unit and fed the data into complex computer models. The state’s midcycle inventory of the early 1990s employed sophisticated satellite imagery to enable foresters to assemble a low-cost statewide estimate of forest volumes (Maine Forest Service 1993). The results of these exercises brought a whole new terminology into Maine forestry that had previously not even been needed (e.g. Seymour and Lemin 1989).

Competition from other regions was another major factor in preventing the Maine Woods from fully “cutting out” as occurred in so many other states. When the Erie Canal opened in 1825, it rendered the lumber of western New York and the entire Great Lakes available to the eastern seaboard. Albany quickly supplanted Bangor as the leading lumber mart on the East Coast. On the major rivers of the Mid-Atlantic States, loggers cut huge volumes of pine. At its peak, mills in Williamsport, PA, alone cut 300 million feet, about half as much as the entire state of Maine’s softwood cut in 1879. The cutting out of the Lake States pineries was well advanced by 1900, but still not complete until the 1920s. This was also true of the South. In these regions, large, valuable trees were available at low prices on readily loggable ground.

Finally, the opening of the Panama Canal in 1914 trimmed 7,000 miles from the coast-to-coast trip, and finally opened East Coast markets to the fabulous timber wealth of the Pacific Coast. Eureka, Coos Bay, and Vancouver were then essentially on New York’s doorstep, and few people there cared whether Maine would ever saw another board. For half a century, logos of the Pacific Coast lumber firms were on the packs of lumber stacked at Baltimore, New Haven, and Boston.

By the time the logging technologies of railroading and steam yarding had reached their full development, Maine’s competitive position and favorable geographic location had diminished. It would not be until the 1960s and 1970s that the continental lumber demand and supply balance shifted to a point that small stems of eastern spruce and fir were needed. When this occurred, new technologies were developed to saw these small logs at a profit.

Demand pressures on Maine forests were moderated by the rapidly growing supplies of Canadian lumber that increasingly served U.S. lumber needs between 1960 and the mid-1980s (Figure 27). By

the mid-1980s, as Americans were arguing about how—or whether—to conserve our ancient forests, we were consuming large amounts of wood and wood products that were being produced from arguably unsustainable management systems in other countries.

By the 1970s, rising oil prices and higher oil import dependence caused federal and state policy makers to adopt policies to foster the use of domestic energy sources. One result was a huge increase in use of wood for energy (Figure 28). Much of this wood was from sawmill residuals and land-clearing waste, some of which was imported from out of state. In fact, by 1992, Maine was a significant net importer of biomass for energy. Another result was an intense policy debate in the mid 1990s. Because of a regional energy glut, purchased power was available very cheaply, compared to some of the contracts entered into by utilities to purchase electricity from biomass-fueled plants. An intense controversy ensued over whether the plants should be

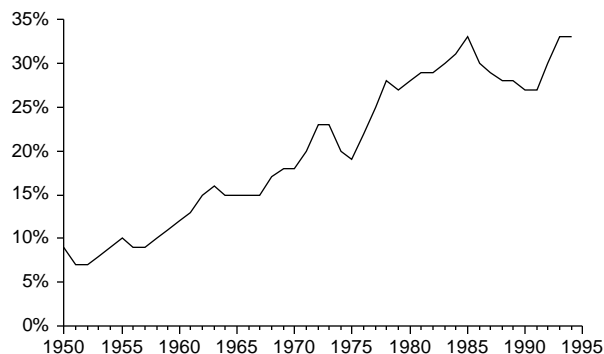


Figure 27. Canadian shipments to U.S. as percentage of U.S. consumption. Source: Adams et al. (1988) and American Forest and Paper Association.

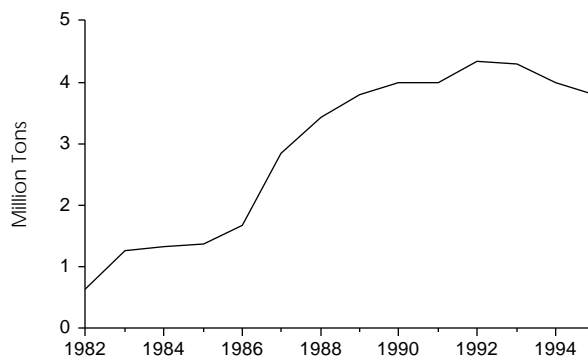


Figure 28. Maine wood consumption for electricity generation. Source: SPO unpub. table and author estimate.

closed to reduce current electric rates, or should be retained for their local economic benefits and as a hedge against future oil price increases. At present, the high-cost wood-fired plants are being closed.

### PRODUCTS RENDERED OBSOLETE BY COMPETITION

We can be more specific in examples of how economic changes eliminated markets for Maine softwoods, thus tending to assist in the sustaining of Maine's forests.

It is difficult to imagine today the extent to which the commerce of the 19th century depended on wood. Goods were packed in wooden barrels or boxes, were moved by wooden schooners to Boston or New York, and then were loaded onto wooden boxcars to be shipped to destinations. At that point, they were unloaded across wooden loading docks into wooden wagons. Perishables would go into a hardwood icebox. Demeritt (1991) has estimated the volumes of Maine wood going into just one field of trade—the export of boxhook and barrel staves to Cuba for the sugar trade. In the years between the Civil War and 1890, jute bags took over the sugar business, virtually ending what had been an important trade for many coastal Maine towns.

In the early 20th century, a “boxboard boom” swept across many Northeastern states. The boxboards were often sawn from knotty second growth pine that could not have been competitive in national markets for clear boards as the virgin pine had been. In Maine about 1900 it was estimated that more than 100 million feet per year were being sawn from second growth in the southern portion of the state (Forest Commissioner 1906). In fact, yield tables for pine for that period are given in terms of “round-edged” material suited to the box market. By the 1940s, the box market was dwindling. The growing production of the cardboard carton, from the kraft paper of the second growth southern pineries, provided a new shipping container that was lighter, more convenient, and more adaptable than the wooden box.

Another story of displacement was the growth of the softwood plywood industry in the 1950s and the waferboard industry in the 1980s. These products offered labor savings in construction for sheathing walls and decking roofs. Their strength and durability recommended them for many other uses. The development of these engineered panels eliminated markets for billions of feet of boards that had been sawn in the East for this purpose (Sinclair 1992). Though a softwood plywood plant operated briefly in Maine, this was a product entirely imported from the West and the South until three

waferboard plants were built here in the early 1980s.

In each of these cases, a Maine product from a local resource was displaced by a product produced elsewhere. The reasons for the displacement were various. The result was, however, that in this forest-rich, lumber-exporting state, Mainers used other products from other places to meet these needs. And the demand on the Maine softwood forest was thereby reduced.

A final story of displacement is in the energy field. While much of the fuel wood used in the state was always hardwood, very likely the replacement of wood heating did also reduce consumption of softwoods to some extent, since softwood was occasionally used. Since softwood fuel was often obtained from mill wastes, this created a waste disposal problem.

### IMPORTANCE OF STABLE LAND USE AND OWNERSHIP

Maine has seen a degree of stability in land-ownership and land use that has been unusual in the United States. A full history of this topic cannot be offered here; a few stylized observations will have to do. Probably more detailed research would modify this overview in significant ways.

In terms of land use, Maine has seen the same waves of change as has the entire Northeast. Yet the trend of urbanization and suburbanization and of leisure lot development has not had the effect here as it has elsewhere. Forest acreage in Maine has increased steadily for a century (Figure 11), peaking in recent years at a level likely to remain roughly stable. A major factor in the increase of forest in the East has been the decline of farming, especially the displacement of horses by tractors. The total acreage of land pastured and hayed for horses 75 years ago across the East was enormous. This was a case, then, of replacing a form of motive power built on a sustainable resource, by a different form using an ultimately exhaustible resource. Yet the area of the forest benefited.

Several large properties that have been in the hands of the same families since the turn of the century and a significant number have been owned by the same families since the 1840s. Within the paper and lumber industries, in most cases the original industrial owners from the turn of the century have been acquired by other larger firms. Even in the recent spate of mergers, acquisitions, and raids, however, little of the land has strayed from industrial ownership. It would be hard to judge the impact on long-term sustainability from mere duration of ownership. There are instances in

which long-term owners have made major policy changes and shifted to less conservative management. Also, many of the examples of subdividing and exploitative management involve properties never owned by either the large established timberland families or by the paper industry. As always, the opportunities of the owners were tightly constrained by operating costs, by market demands, and by the condition of the forest. Yet, there seem to have been extended periods during which the conservative policies of long-term owners have contributed to sustainability of the forest.

### THE BOTTOM LINE

We can take a crude look at sustainability in relative terms. How has Maine sustained its production of, say, lumber, relative to historic peaks, in comparison with other places? To answer this question, we can compare production with some other northern states that produced similar species of timber (Table 7). This comparison ignores land use shifts to farming in the other states (Figure 29) and a whole host of contextual variables, but it shows that softwood lumber production has been sustained impressively well in Maine since the state's (and nation's) 1909 production peak. This is despite the fact that Maine exceeds all except Wisconsin in paper output and all of them in wood energy utilization. On the other hand, the initial volumes in the other states were extremely large and were harvested in a much shorter period than in Maine. Very likely, the surge of output from these other states helped render Maine lumber noncompetitive in the booming Midwestern markets.

Because of the complex of forces discussed here, Maine's production of spruce lumber has only briefly

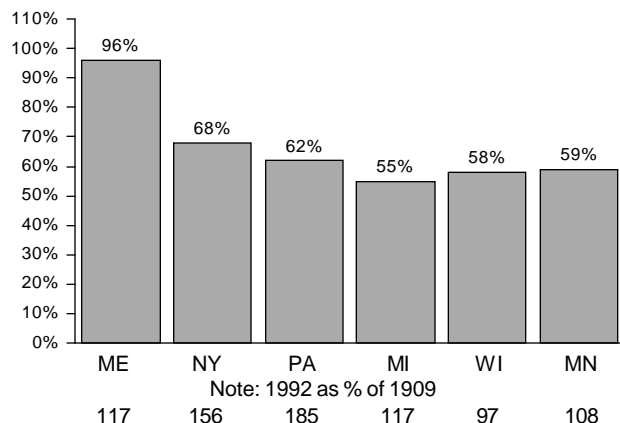


Figure 29. Total forest acreage, selected states, 1992 as percentage of original forest area. Source: Kellog (1969) and Powell et al. (1992).

Table 7. Peak and current softwood lumber production.

	Peak Year	Softwood Peak Output	Softwood Output 1987*	Ratio %
Maine	1909	993	694	70
New York	1869	1,099	53	5
Pennsylvania	1889	1,885	13	1
Michigan	1889	4,203	119	3
Wisconsin	1899	2,847	53	2
Minnesota	1899	2,279	63	3

\* 1987 was also a cyclical peak.

Sources: Steer (1948); U.S. Department of Commerce (1988).

exceeded since 1902 the level that Ring and Hosmer believed was sustainable under the forest acreages, conditions, and merchantability standards of 1902. In terms of conservation, the trend in softwood timber inventory is more complex. The data shown in Figure 12 provide only a gross indication of trends, especially since utilization standards changed so much over the period. The effects of the 1912–20 budworm outbreak are evident, as are the large volumes of “ingrowth” that occurred after 1960 as young trees reached sizes large enough to be counted in the inventories. While the time pattern is plausible, it would be difficult to make these figures prove for a certainty that growing stock volume in 1986 was larger than in 1902.

### REDUCE, REUSE AND RECYCLE

One set of technologies that will affect our forest industry and wood use patterns increasingly in the future is the capacity to reduce our uses, reuse our products, and recycle post-consumer wastes. Jim McNutt et al. (1992) write of the “urban forest” of New York office buildings whose fiber productivity per acre exceeds that of well-managed forests. We have many opportunities to extend the economic usability of our forest (Irland 1984). We have not needed to use them until now. Now it is essential, and we will see many important changes in the coming decade. As a result, Maine's forests may get a much needed rest from rising harvests.

### MEASURING THE SHIFT TO INTENSIVE UTILIZATION

Sustainability presumes some level of management intensity, and the general historical progression is toward higher levels of intensity. We could imagine a number of ways to conceptualize exactly what we mean by intensive management in con-



trast to extensive management. By intensity we mean the amount of labor, technical skill, and capital applied to the average acre to grow wood.

Certainly the distinction is clear enough at the extremes. A property managed on a cut out and get out basis (and we still have some of this) is under the most extensive sort of management. In these instances, capital is turned around promptly, and the returns are primarily from liquidation of the asset. The property is held for so short a time that to call such operations speculation is a misnomer.

A property growing planted and intensively cultured stands of genetically improved trees, or perhaps energy plantations, lies at the other extreme of management intensity. In these cases, a large part of the annual yield may come from intermediate treatments and from salvage. Significant capital investments are made in creating and tending new stands. In the best of instances, management attention and investment are applied to the protection and enhancement of visual, wildlife, and water resources as well.

An effort to fully develop this point would take us far afield. Also, statewide averages would be useless because qualitative distinctions between different management regimes are important and should not be lost in averages, but a number of the relevant criteria can be quickly listed. In many cases these need more specific development to be applied in practice. In applying indicators such as these, the initial condition of a property or region needs to be considered. Table 8 shows that while it is simple to pose a definition of management intensity, to implement it in a meaningful manner involves considering many details.

Experts and observers of forest policy disagree over the degree of sustainability of the most intensive management practices now in use. Part of this disagreement stems from the incomplete state of the science and the relative youth of most of these treatments. We have yet to harvest any sawlogs from genetically improved plantations in Maine, or to grow stands in multiple rotations after biomass harvesting to see how long-term nutrient balances are affected in actual experience.

Also, concerned persons differ in their views of how much intensive management is desirable. To resolve that question is not the purpose of this paper, but we do think that being specific about costs, impacts, and benefits as outlined in Table 8, might help in reaching well-informed conclusions on that subject.

Table 8. Indicators of the level of management intensity: The forest resource.

---

Conditions	
	Age class structure
	Insect and disease conditions
	Condition of roads/trails
	Condition of recreational facilities
	Conditions of waterways — erosion, etc.
	Wildlife habitat
Inputs	
	Intensity of marking and treatment planning
	Intensity of logging supervision
	Fire control/pest management effort/acre
	Forester staff per acre
	Sophistication/currency of forest inventory/GIS
	Investments per treated acre:
	Postharvest treatments and regeneration
	Stand tending
	Monitoring of conditions
	Relative measures of how extensively above treatments are used
	Recordkeeping on harvesting, treatments, and results
Treatment Results	
	Plantation survival
	Growth rates in thinned stands
	Trend in total growing stock volume
	Trend in growing stock quality
	Trend in total forest growth rate
	Trend in nontimber values
Forest Outputs — Level and Trend	
	Annual revenues per acre cut
	Annual total revenues
	Composition of yield and revenues
	Intermediate treatments
	Salvage
	Liquidation of growing stock
	Final harvest
	Nontimber revenues

---

## INTERPRETATION

Maine's forest resource is an example of unplanned sustainability, when viewed from a growing stock volume standpoint alone. The primary forces responsible for this included

- the diversion of the farming frontier westward prior to the Civil War;
- the relatively benign technological and economic constraints that controlled 19th century cutting practices;
- a pattern of landownership that has been stable to a degree unmatched in the rest of the USA;
- the vast supplies of quality timber in the Midwest, South, and on the Pacific

Coast that came to dominate both East Coast and export markets after World War I;

- the elimination of markets for major Maine products by economic and technological changes;
- the collapse of demand due to the Great Depression;
- the country's ability to import large quantities of Canadian lumber and newsprint at favorable costs between 1900 and the early 1990s;
- conservative management of many properties, large and small, over the decades of the current century has helped in significant measure to maintain forest conditions as well as they now stand, but cutting practices have left the forest diminished in quality;
- finally, the intensive management practices put in place over the last 20–40 years have as yet only affected relatively small areas. Their benefits will be felt, if they are continued, in coming decades of the new century.

For the result we should be grateful. It means we still have a mostly wild forest to argue about. All of the latitude for choices has not been consumed, as has occurred in some other regions. Also from a timber standpoint, the quality of the forest has suffered more than the quantity. Turning this around is a major challenge for landowners and for public policy.

Today sustainability means many things beyond timber. To fully assess these many other resource values would be a vast undertaking. For an initial effort, see Maine Environmental Priorities Project (1995, Sec. 9). But we can probably say that wildlife habitat, visual values, and the wildness of parts of the Maine Woods have fared far less well than have the timber values. Because of landowner property rights, incentives, and income opportunities, and a relative lack of public policy interest in such values up to about 1970, this result is what might have been expected.

One thing is for certain. The historical forces portrayed here cannot be taken as evidence that “the market” in its automated wisdom somehow maintained Maine's forests in their present condition in contrast to the wholesale liquidation that occurred in other places. Nor can public policy take any material credit for what has happened. There have been few places where public policy was so passive as in Maine up until about 1970.

Ensuring future sustained yield of timber, and sustainability of nontimber values, poses serious challenges to landowners and government alike. Some landowners have reduced cutting levels in order to ensure their ability to sustain future harvests. A new private initiative by the American Forest and Paper Association (1994) involves a commitment to principles of sustainability. Members of that Association own just above 6 million acres of Maine timberland. Considering the large number of private owners, however, it is far from a sure thing that the private market alone can ensure long-term sustained yield statewide. Unfortunately, no obvious policy solution is evident. The Maine Supreme Judicial Court, in a 1907 Opinion of the Justices, opined that the state has the power to protect the state from forest liquidation (Maine Report 1907). But this was not a holding in an adversary situation, so it may not be legally compelling. In any case, devising a workable regulatory scheme to confront this challenge would be complex indeed.

The King Administration has established a commission on sustainable forestry to develop measures of sustainability and a procedure for monitoring the issue. This group is to report in 1996.

## MEANINGS FOR THE FUTURE

Maine forests now face additional demands for forest services increasingly important to the American public and for styles of management that are more respectful of a broader range of these values. At the same time, timber supply changes in the tropics and in the Pacific Northwest are increasing the value of wood products. This development in turn will drive a wave of innovation in engineered wood products that use more abundant species and may create new forms of wood-using industry in Maine and nearby. As an example, a Quebec firm is producing laminated veneer lumber from aspen. Higher wood prices will mean that more intensive management will be applied and that formal schemes of management will be adopted on a larger acreage.

Early foresters advocated fire control, public land management, less wasteful cutting, tree planting, and sustained yield as preventives for the “timber famine” they foresaw. Some of these measures were actually adopted. Also, the forests proved to be more resilient than many had believed. Because the boll weevil drove many southern families off the land and because tractors replaced horses, it became possible to argue by the 1970s that the timber famine was a myth. Those repeating this argument in the 1990s overlooked the fact that we

had by then become 33% dependent on Canada for our softwood lumber, heavily dependent on the tropics for our hardwood plywood, and about 2/3 dependent on Canada for our newsprint.

For several decades, the timber famine has been out of fashion, but the timber famine is now here, though it has taken an unforeseen form. We now face stark choices about how to use and manage the forest because of the contradictory demands of our society for raw materials and jobs and for the maintenance of biodiversity and more natural conditions. In addition, we are learning of subtle potential threats to this forest coming from an unexpected direction—the sky. As the scientists debate the significance and the potential effects of these threats, public officials, foresters, and land managers continue to grapple with today's problems as best they can.

Contrary to Moses Greenleaf's hopes for Maine society, the state remains an exporter of wood-based materials and is not a community of farms and small manufacturing plants. History has taken a different turn from what seemed likely in 1829. Responding to a host of social and natural forces, history may be taking yet another turn in the Maine Woods right now. If we are to influence that turn in the best ways, we must first clearly understand the forces that have shaped Maine's forests, for good and ill.

## 6. Clearcutting as a Management Practice in Maine Forests

---

Public concerns about the impacts of cutting methods and cultural practices on the forest have increased as the extent of roading and harvesting have become more visible and as the number of visitors to the Maine Woods has increased. One result was the passage of a Forest Practices Act in 1989 that tightened state regulations over cutting practices statewide. The issues involved in understanding forest harvesting and cultural practices are so numerous that a full review is not possible in a short essay. Instead, this chapter focuses on just one controversial practice—clearcutting. It is condensed, with minor revisions and additions, from a report prepared in 1988 by The Irland Group for the Department of Conservation. This chapter treats clearcutting at a stand level, giving little attention to the landscape perspective, which is a vast and complex subject (Aplet et al. 1993; Hunter 1990).

### WHAT IS CLEARCUTTING?

Silvicultural practices are “the various treatments that may be applied to forest stands to maintain and enhance their utility for any purpose” (Smith 1986). Clearcutting is one of a number of silvicultural practices employed to manage forests for timber production.

Clearcuts are the most visually dramatic forest practice used in the Maine Woods, though larger acreages are affected by other cutting methods each year. Especially when carried out in large areas with little or no visual buffering, fresh clearcuts convey a vivid image of a radical and even destructive change in the environment. The image of destruction is reinforced by the ugly appearance of stumps, ruts, crushed oil cans, and slash piles. Shattered pieces of unmerchantable trees convey the additional impression of thoughtlessness and waste. On many areas, leaning and bent residual birches and uncut “wolf trees” lend a forlorn appearance of abandonment. Heavy cuttings in valuable softwood stands are often perceived to result in their replacement by worthless brush. On the other hand, many people see clearcuts as the first step in the wholesale conversion of the landscape to manicured monocultures, managed on short rotations with the heavy use of chemicals. Clearcutting then becomes associated with a much wider concern about a changing wild landscape and its wildlife.

More deeply, however, it is difficult for many observers to square these sights with a caring landowner attitude toward the land, its wildlife, and the future. For many citizens, clearcuts have become a symbol of mismanagement and of lack of

concern for the future and for multiple forest values. This is not surprising at a time when the results of planting, natural regeneration, and release treatments have not yet become visible.

Since clearcutting is such a controversial management practice, it is essential to begin with a clear definition of what clearcutting means. We adopt the following definition:

Clearcutting is the practice of cutting virtually all merchantable trees for the purpose of making a complete harvest, of preparing a stand for regeneration, or both, creating an opening larger than two tree heights in diameter.

This definition emphasizes visible results more than intent. It contains a number of elements. First, it emphasizes the removal of merchantable stems. Trees are left only because they lack value; they are not intended to produce a later harvest nor to supply seed. At its worst, the “loggers choice” commercial clearcut leaves a sparse overstory of culls and unmarketable trees.

As an aid in following the later discussion, Table 9 offers a comparison of the major kinds of forest practices. It is not intended as a set of technical definitions, but only as an aid to using this chapter.

Many silvicultural manuals prescribe removing noncommercial trees, smaller woody stems, and preexisting seedlings to create an entirely blank slate. This fully utilizes available fiber in the stand and prepares for regeneration. This is often done in later, post-harvest treatments and is spoken of as a true silvicultural clearcut. Such later treatments, often called “site preparation,” have been performed in Maine, but are not common.

Second, the definition emphasizes the dual aspect of clearcutting, which is always a harvesting method and often also a regeneration method. In other words, the definition covers cuttings performed for many different purposes. Silviculturists and foresters prefer to view clearcutting as a regeneration method, but members of the public, environmentalists, loggers, and many landowners perceive it as a harvesting method. This duality is real, if only because stands are normally scheduled for regeneration when the mature timber is ready for harvest.

Third, the definition excludes land clearing for other subsequent uses since it refers to preparing for regeneration. While many people are concerned with timber cutting in this context, we see this as a land use and not a silvicultural issue.

Table 9. Silvicultural practices—an overview.

A. Harvest/Regeneration	
Selection	Periodic cutting of individual trees or groups to maintain cover, regenerate desired species, and maintain a multi-aged distribution. Trees are cut in several or all size classes.
Diameter limit or “selective” cuts	Primarily a harvesting method not primarily concerned with creating regeneration. This informal approach may maintain several distinct age classes by periodic partial cuts. Trees are typically cut only in large size classes.
Shelterwood “One cut” 2 or 3-cut Group Strip	Cuts to open overstories to promote regeneration of desired species, with final removal after the new crop is established
Clearcut Patch Strip	Cutting most or all stems to harvest, prepare for regeneration, or both in a unit larger than two tree heights in diameter
Commercial Silvicultural	
B. Intermediate Cuttings	
Thinning	Cuttings designed to improve the spacing of trees to increase value growth.
TSI (Timber Stand Improvement)	Cutting or killing low-grade, low-value trees to improve future value growth. Many foresters restrict the term to noncommercial treatments.
C. Early Stand Treatments	
Site preparation	Treatments designed to affect the composition, density, and freedom to grow of new stands
Crop tree release	
Pre-commercial thin	
Planting	

Fourth, the definition also includes another important practice. Overstory removal cuttings are intended to release established advance regeneration. Many clearcuts in Maine have this effect. It is useful to distinguish this situation, on the basis of silviculture, logging, and aesthetic and environmental effects, from cutting intended to prepare for subsequent establishment of regeneration. Some authors describe overstory removal cutting as the “one-cut shelterwood” method.

Finally, the definition refers to opening size. Many applications of clearcutting in patches or strips blend into group selection or strip shelterwood techniques as the acreage treated becomes smaller. Clearcutting in alternating or progressive strips or in patches has been recommended for many forest types and management objectives. A clearcut smaller than a few acres would be considered a patch clearcut. Removing a group of adjacent trees,

creating an opening up to two tree heights in diameter, would be considered group selection and not a clearcut (some authors would speak of any stand smaller than five acres, where forest type mapping and management prescriptions use this as a minimum treatment size, as a group).

A more specific definition of a clearcut has been adopted by the state to implement the Forest Practices Act (Table 10).

Clearcutting is an important element in several different management regimes—planned sequences of treatments over the life of a stand. This is where treatment intent plays a role. Clearcutting is used in type conversion to replace low-value species with faster-growing or otherwise preferred species. Clearcutting can be used with subsequent natural regeneration from seed or sprouts as well as to prepare sites for planting; it is also commonly used in salvage situations. It is also used in stand reha-

Table 10. Forest practice definitions adopted by the Maine Forest Service under the Forest Practices Act.

**Timber Stand Improvement**

**(Precommercial Silvicultural Activities)** Chemical or mechanical thinning operations, planting, stand conversion or stand improvement provided that no forest products are sold.

**Types of Harvest**

**Partial Harvest.** All harvest systems except clearcut harvests.

**Clearcut Harvest.** "Clearcut" means any timber harvesting on a forested site greater than 5 acres in size which, over a 10-year period results in an average residual basal area of trees over 6 inches in diameter of less than 30 square feet per acre, unless one or both of the following conditions exist: A. If, after harvesting, the average residual basal area of trees over 1 inch in diameter measured at 4.5 feet above the ground is 30 square feet per acre or more, a clear-cut does not occur until the average residual basal area of trees 6 inches or larger measured at 4.5 feet above the ground is less than 10 square feet per acre; or B. After harvesting, the site has a well-distributed stand of trees at least 5 feet in height, that meets the regeneration standards applicable under 12 MRSA, c. 805, sec. 8869, subsection 1.

Source: Maine Forest Service (1993).

bilitation to replace stands of low-value trees that contain insufficient numbers of quality trees to offer management opportunities using other silvicultural practices. Unfortunately, these conditions are common in Maine. Properly prescribed, clearcuts in these stands may be the best remedy for past mismanagement.

Clearcutting is an essential element in intensive management regimes involving the planting of genetically improved seedlings, control of competing vegetation, and stocking level control prior to harvest. Large increases in yields can be obtained using these treatments, which will be important in mitigating the impact of the spruce-fir shortfall (see Seymour 1993).

This chapter will focus on the biological factors underlying silvicultural choices, with minimal attention to the many practical and economic factors that are considered in forestry prescriptions. One reason for this is that there is very little published information available on logging and roading costs in Maine field situations.

Costs are legitimate considerations in silvicultural decisions. Costs are affected by equipment used, wages and workers' compensation costs, hauling distances, and roading costs. Also, the size of trees and volume removed per acre will affect costs. On the other hand, factors such as volume, quality, size, vitality, species, and soil productivity will affect the benefits derived from managing a given stand versus replacing it.

This chapter focuses primarily on clearcutting as an individual management practice. We will not address the many issues raised by succeeding practices such as herbicide release treatments, which are often necessary following clearcuts. Of course,

any harvesting practice can become an abuse when mishandled, when its relation to the full management regime is ignored, or when needed follow-through is not applied.

Clearcutting can be used with long or short subsequent rotations and with mixed or single species subsequent stands (a rotation, or rotation age, is the expected stand age at final harvest). Clearcuts can be carried out with horses and chainsaws or with fully mechanized biomass utilization equipment. Some large modern equipment, because of its size and operating costs, is suited only for clearcutting.

The relative extent of different cutting practices now in use in Maine is shown in Table 11. Commercial clearcutting and diameter limit cutting were the most prominent methods in 1987, but "selection" cutting is shown as the leading method in 1993. Much of the decline in clearcutting is real; but much of the increase in selection is not. Much of the cutting reported as selection is really partial cutting of one sort or another and in some instances is little more than high-grading. Few of these acres are being consciously treated in a manner designed to lead over time to truly all-aged stands. Also, a few owners are leaving just more than 30 sq. ft. of basal area in cull trees to avoid creating clearcuts.

In the balance of this chapter, we set out the silvicultural reasons for employing clearcutting, review what is known of its effects on other resources, and briefly review the accepted ways in which clearcutting can be practiced with due regard for nontimber forest values and for public sensibilities.

Table 11. Harvest cutting treatments used in maine, 1987 and 1993.

	----- 1987 -----		----- 1993 -----	
	Acres Harvested*	Percent of Total	Acres Harvested	Percent of Total
Shelterwood (removal only)	19,395	6%	75,267	17%
Selection	62,020	20%	323,476	72%
Diameter Limit	42,324	14%	N.L.	
Seed Tree	4,056	1%	N.L.	
Silvicultural Clearcut	60,407	20%	51,253	11%
Commercial Clearcut	75,493	25%	N.L.	
Total	301,277	86%	449,996	100%

\* Some minor categories of cuttings omitted from table.

Source: Maine Forest Service (1988), unpub. summary table (note that this is a lower bound, due to under-reporting of treatments on small woodlots); and Maine Forest Service, Silvicultural Report (1993).

Respondents were asked to tabulate their responses in accord with "Standard Terminology," but there will remain some ambiguity in interpreting any data set like this.

N.L. = Not Listed.

## COMMON THEMES FOR MAJOR FOREST TYPES

Several common silvicultural themes occur in the major forest types of Maine, the spruce-fir, northern hardwoods, white pine, and birch-aspen. (A section in the original report deals in more detail with the characteristics of the four types.) First, there is a strong tendency for these stands to be even aged. This is in part due to past cutting, but it is also rooted in the tendency of these stands to originate as advance growth and then to be released by some catastrophe that removes the overstory. This tendency is less strong in northern hardwoods than the other types.

Second, the age to which several species can be grown can be limited by insects or diseases (pathological rotation). The best examples are fir and aspen, whose early removal is often suggested as a means of removing vulnerable trees before their salvage is required by pest damage.

Third, all of these types have a tendency towards a pronounced "brush stage" when opened up too much. Preexisting understories, sprouting stumps, stored seed in the duff, or wind- and bird-carried seeds promptly create a tangle of largely noncommercial vegetation that can hinder establishment of free-to-grow desirable seedlings. The brush stage may contain valuable species, and if so, is not a problem in hardwoods, but the valuable resource of most concern is often the previously established natural regeneration. The brush stage often plays an important ecological role in conserving soil nutrients and also provides habitat diversity. Properly applied vegetation management need not eliminate these ecological values.

Finally, these types share a tendency to develop overabundant natural advance regeneration. As stands grow, they then become overstocked and lose value growth as crowns thin and stems become overcrowded. The classic example is the "dog-hair" fir thicket. Managers must deal promptly with overstocked regeneration to shape vigorous stands in later years, but in general it is better to have superabundant than sparse regeneration.

These biological factors do not dictate any exclusive silvicultural program for Maine forests. Many of the valuable species can be grown successfully under management regimes that include clearcutting, but there are only a few situations in which clearcuts are silviculturally mandatory. Apart from salvage and lack of windfirmness, there are virtually no situations in which biological factors alone—in contrast to existing stocking levels—require openings larger than a few acres. For some species, clearcutting is ill advised. There are strong arguments for using less drastic regeneration cuttings in many situations to attempt to minimize brush stages and take full advantage of whatever advance growth may be present. But costs, management intensity, and local characteristics of individual stands may suggest the use of clearcutting, even when other methods may be biologically applicable.

Clearcutting has two other potential disadvantages, which may be more or less severe depending on local conditions and management objectives. These are matters of degree; the same problems can occur in other cutting methods. First, clearcutting offers little control over the composition of subsequent natural regeneration. In shelterwood treatments, for example, proper practices can increase

the representation of desired species in the subsequent stand. Of course, if planting is planned, this limitation is not important. Second, if used unnecessarily, clearcutting wastes growing stock. The cheapest way to grow wood is on an existing tree. Considering the timber supply situation Maine now faces, an extremely conservative stance on this point would be prudent. Landowners should take steps to ensure the preservation of quality growing stock. Some stands—perhaps many—offer no opportunity for preserving growing stock, but this should not be assumed at the outset. Other practices can also waste growing stock. During the budworm outbreak, efforts to conserve growing stock by partial cutting frequently failed, but in the future our options may be greater.

### CLEARCUTTING IN THE FOREST LANDSCAPE

Forest management practices need to be considered not only on an individual stand basis, but on the basis of their implications for future managed landscapes. From a public perspective, the objective of forest management is to obtain a sustained yield of forest benefits over an entire property or area, not on any single acre. What matters is that the carrying capacity of the landscape as a whole is maintained, recognizing that many species require a number of distinct habitats to complete their life cycle.

Many biologists and land managers believe that a landscape maintained in a diverse mosaic of ages and vegetation conditions will naturally support a high diversity of wildlife and maintain visual and other cultural values of forests. According to University of Maine wildlife ecologist Malcolm Hunter, good wildlife habitat requires creating stands on a variety of size scales, from a few acres to more than a hundred acres. This provides a role for clearcutting in shaping a productive, diverse vegetation mosaic (Hunter 1990; Hagan 1993).

There are said to be towns in which 80% of the softwood has been clearcut; this is not the way to create a diverse mosaic. On the other hand, a few well-planned, scattered, 100- to 200-acre clearcuts over a period of time pose no real threats to overall long-term habitat values. This seems to leave particular wildlife species adapted to old growth and extensive mature forests out of the picture, but meeting the habitat needs of such species is a land use policy issue rather than one of silvicultural practice. That is, it is a policy question of setting a dominant priority for maintaining a specific habitat value over the landscape. Such decisions are often appropriate; they are not in the realm of the more technical considerations covered here.

### ENVIRONMENTAL EFFECTS OF CLEARCUTTING

This chapter addresses effects of clearcutting on forest productivity, water, wildlife, and aesthetic values. In each section, we discuss likely effects, then comment on their actual importance in Maine. Later, we indicate steps to take to minimize environmental damage, to review alternatives to clearcutting, and to discuss its positive use in managing nontimber resources.

#### Forest Productivity

The effect of clearcutting on future timber productivity depends on site-specific factors and on how well the treatment is designed and implemented. In addition, its effects depend critically on the logging and subsequent management practices accompanying it. Forest productivity is a multidimensional concept including annual growth rates, tree quality, species composition, sustainability, and rotation ages. For present purposes we can think of “productivity” as shorthand for sustainable value growth of wood over time.

Clearcutting in large areas may result in regeneration failure if adequate advance growth is lacking or is not preserved. Typically, the desired species are not ones that will disperse seed on the wind for any distance, so post-cut seed dispersal should not be relied upon. Heavy logging equipment and poor skidtrail layout can cause excessive damage to existing natural advance regeneration. High volumes of tops and slash from unused trees can occupy growing space for long periods and interfere with later planting. Clearcutting—with or without planting—often demands follow-through to control competing vegetation and to control stocking. If this is not done, long brush stages will delay restocking of desirable trees and cause diminished future yield for the forest as a whole by lengthening the rotation age (see Simpson 1991).

In the extreme, clearcutting, if accompanied by whole-tree removal on short rotations, can cause nutrient losses sufficient to reduce the productivity of some soils, but such management regimes are not in use in Maine. The whole-tree biomass contains a total nutrient content that is large relative to the available nutrient pool of some soils. Experts agree that whole-tree harvesting increases nutrient loss by a far larger factor than it increases wood yield, but measured evidence of lost subsequent volume growth is scarce. Studies elsewhere do show losses in later growth so there is reason for caution.

Clearcutting not only removes nutrients in the products harvested, it also promotes faster break-



down of the surface soil organic matter, resulting, under some conditions, in loss of nitrogen and nutrients. Of course, other treatments do this in lesser degree. This is an issue of utilization, but it relates to silvicultural treatment. It is often considered desirable to remove all biomass to improve planting conditions. Whether this is wise depends on soil conditions, on how serious the nutrient loss is, and on how long the rotation will be. Conservative practice on vulnerable sites would be to leave tops and branches in place or at least to cut hardwood stands when leaves are off the trees. Retention or enhancement of large woody debris may be a valid management concern on some sites, but it is a separate question from the choice of silvicultural practice.

Clearcuts can reduce site productivity when applied on extremely wet and boggy soils which commonly support spruce-fir, cedar, or black spruce. When such stands are clearcut, the loss of tree cover may cause them to "swamp out" because the draft of the trees on soil moisture is halted. Just how widespread this risk may be in Maine has not been documented. While some see clearcutting as creating a fire or insect and disease hazard, there seem to be no important instances where insect and disease hazard is a major concern, but logging slash occasionally poses a fire risk.

The discussion so far has emphasized possible negative effects on productivity. Certainly clearcutting plays a key role in intensive management regimes now being applied that will significantly increase wood yields compared to the natural forest (Seymour 1992b, 1993). Where potential negative impacts appear serious enough to raise concern, managers can reduce clearcut sizes, shift to other silvicultural methods, or make other adjustments.

### Water Resources

Clearcutting can have a series of effects on water and fish resources. These effects can also occur in lesser degree with other cutting practices. Though few of these have been specifically documented in Maine, there is little doubt that they do occur. Clearcutting, except over a snowpack, disturbs surface soil extensively. Soil disturbance can even be silviculturally desirable when it promotes regeneration of desired species. Additional treatments ("scarification") are at times recommended to expose mineral soil.

Clearcutting up to stream banks has been shown to increase water temperatures when long distances are cleared on the south side of streams. In some instances, the temperature increases can degrade or destroy the streams as habitat for trout.

When the cuts are small, water temperatures quickly return to normal downstream; uncut streamside buffers can avoid this effect.

It has never been convincingly argued that clearcutting as actually practiced has affected runoff sufficiently to increase spring flood peaks on any major Maine stream (Patric 1993). Extensive clearcutting increases the water yield and peak flow of small upstream drainage basins (200–500 acres). This results from a complex web of effects on forest water consumption, snowpack accumulation and melting, and other factors. The effect diminishes in five to ten years as vegetation is re-established. This is well documented and has been shown for shelterwood cuts as well, but with much less effect.

In the watershed experiments at Hubbard Brook, New Hampshire, clearcutting of northern hardwoods led to elevated nutrient loss, which affected the nutrient content of stream water. Levels of nitrogen and other nutrients only briefly reached levels close to or exceeding drinking water standards. This result has not been found for other forest types in other areas. In any case, there was no evidence of a loss of fish productivity for this reason.

Clearcutting up to streams, by affecting flows, temperatures, and nutrient content, will affect the productivity of aquatic insects and hence the food base for the fishery. This can be important even in small headwater streams. Removal of stream bank vegetation is especially harmful since leaves and other organic matter are the most important food source in cold headwater streams.

Beyond this, careless logging practice, which is by no means confined to clearcutting, can involve running machines through brooks and dumping slash in streams. In LURC jurisdiction, it appears that the worst of this sort of logging is being controlled (see Irland and Connors 1994). In most cases, the bulk of the water quality degradation is due to sediment originating on roads, landings, and other areas of disturbed soil. Erosion is determined by how they are located, built, maintained, and "put to bed" after operations are completed. Since shoddy clearcutters are often sloppy road builders, there is potential for confusing the effect of clearcutting with that of road building.

How important are these effects in the field in Maine under actual management practices? Again, there are a few surveys but little real research evidence. Where sound management is practiced, the effects on water quality are modest in intensity and temporary in duration. High-risk situations can be identified in advance and protected.

### Wildlife

Effects of clearcutting on wildlife have to be analyzed using the distinction between individual acres and the overall landscape. It is said that the extensive clearcuts of recent years have favored moose and have injured deer populations. There is no question that wildlife populations are affected by silvicultural practices. Clearcutting effects on wildlife can have a number of dimensions, depending heavily on local conditions and on size and design.

A clearcut clearly reduces habitat for canopy-dwelling species, as well as other species of mature forests. At the same time, it creates habitat for animals that use the habitat resources of the "brush stage" and of young stands. Wildlife use of clearcuts is heavily dependent on the size of the clearcut and varies by species. There are species that will use clearcuts—and subsequent growing stands—over a range of sizes.

When a critical habitat element like a deer-wintering area ("deeryard") is clearcut, it will reduce the habitat value of a large surrounding area. Likewise, careless elimination of cover, riparian areas, and migration corridors can diminish the use and value of the remaining uncut forest. So clearcuts—and to some extent other practices—can have a disproportionately large effect on carrying capacity. Any practices that narrow the range in stand ages over large areas will have an effect. Forest cutting can eliminate specific den trees or nesting sites used by birds or animals, but this commonly occurs in many cutting methods and is not unique to clearcutting.

Numerous studies document these and other effects on an acre-by-acre basis (deGraaf et al. 1992; Deming and Gage 1994). There is little empirical research that actually shows how overall forest carrying capacity changes over time under different cutting practices.

Many observers are concerned that the trend toward intensive conifer management in the North Woods will lead to a gradual conversion of the land to a spruce-fir monoculture, with resulting loss of habitat diversity. This is a concern for the entire forest landscape in contrast to the acre-by-acre questions. Considering the limited amount of intensive management now underway, and the likelihood that such treatments will only be conducted on the more productive soils and close to mills, this is not a likely future.

Forest management practices will undeniably change the Maine forest, but they will not convert it to a spruce monoculture. Current management practices, with inadequate follow-up after logging,

appear to be reducing, not increasing, the spruce-fir area. In southern Maine there are many instances where clearcuts are converting formerly softwood areas to hardwood types.

Wildlife scientists and managers have often suggested that clearcutting is an acceptable management practice in forestry and have used it themselves as a management tool, but they urge that limits be placed on size, location, and dispersion of the cutting units. These limits vary, depending on the animal species and the forest type considered.

### Aesthetic Values

Despite the common feeling that "beauty is in the eye of the beholder," there is a good deal that can be said about the impact of management practices on scenic beauty. Aesthetic values of forests are real forest values just like water, wildlife, and timber.

From an aesthetic viewpoint, clearcutting is more likely to be found acceptable by most recreationists and passersby to the extent that

1. sensible visual screening and stream-side buffering is used;
2. units are small rather than large;
3. cutting is not perceived to be damaging rare and valuable resources (e.g., eagle nesting sites);
4. slash is cleaned up (which can conflict with nutrient conservation, residue management and provision of shading for regeneration);
5. visible efforts are made to design units with the land and with nontimber resources in mind by avoiding straight boundaries;
6. clear benefits from the treatment—growing young trees—are visible; and
7. planned openings improve the view of distant vistas.

In other words, citizen reaction will be affected by many things in addition to strictly aesthetic factors. When sensitive management practices are not followed, public reaction to aesthetic damage will be prompt and intense.

### Mitigative Measures

Careful adherence to a few general prescriptions will usually simultaneously address environmental impacts of clearcutting for productivity, water, wildlife, and aesthetics. The general prescriptions are

1. adequate provision for regeneration;

2. compliance with the spirit of existing regulatory provisions;
3. visual screening, design of cutting unit shapes with the land and in forms that do not clash with the landscape;
4. dispersion of clearcut units in space and time;
5. buffering with uncut or lightly cut areas along streams, lakes, ponds, and marshes, including small headwater streams;
6. sensitivity to obviously significant wildlife habitat elements such as deer-yards;
7. design, construction, and maintenance of bridges, culverts, and roads, to high standards;
8. limiting the size of clearcuts;
9. suitable attention to retention of large woody debris; and
10. due consideration of long-term sustained yield.

There is no reason why reasonable efforts to observe general guidelines like these should add noticeably to the costs of woods operations or compromise the ability of foresters to manage the best soils intensively. In fact, many if not most of these practices are in use to some extent on large properties now, in some cases on a voluntary basis.

### Alternatives to Clearcutting

Beyond mitigative measures, one way to avoid the impacts of clearcutting is to employ alternatives. A comprehensive view of alternative cutting methods is not possible in this brief review, but some commentary is necessary. Clearcutting has often been abused in a variety of ways. Cuts have at times been too large, been designed in ways insensitive to wildlife, water, and aesthetic values, been conducted in ways that destroyed advance growth, and have resulted in erosion and damage to fisheries. Some have advocated that these effects justify turning exclusively to alternatives.

Abuses of clearcutting are highly visible, while abuses of other cutting methods are not. Logging a selection cut on wet soil with poor skidtrail layout can result in as much erosion as clearcutting. Mishandled selection cutting over several rotations can undermine stand productivity and eliminate desirable species. Managing without clearcutting and cutting the same total volume means that more acres must be logged to obtain a given harvest volume, and more roads constructed. Selection cuttings, when poorly managed, often lead to root and stem damage that can sap future productivity.

Insect and disease considerations are also involved. Silvicultural policies that maintain extensive areas in uniform cover of mature trees can provide highly favorable habitat for massive insect outbreaks. The spruce budworm is the best local example.

Before considering what role clearcutting should have in forestry, it is necessary to gain a balanced view of the costs and technical limits of the alternatives and the extent to which the alternatives depend on specific favorable circumstances for their success. In any specific situation, a list of factors, such as those in Table 12, should be considered in choosing a cutting prescription. The many complexities, uncertainties, and judgments involved need to be considered in designing public policy responses to the forest practices issues.

Only occasionally are large clearcuts or over-story removal cuts required by the biological facts. More frequently, clearcutting is required by logging costs, by administrative practicality, and by the absence of sufficient desirable windfirm growing stock to support alternative cutting methods. That is, clearcutting is more often dictated by practical constraints on local situations than by its intrinsic silvicultural desirability. These constraints are often difficult or impossible to overcome.

### Clearcutting for Nontimber Benefits

Clearcutting can play a role in active land management for nontimber benefits. These are currently practiced on only a tiny portion of Maine's forests, but are worth noting because they may increase in importance.

Wildlife habitat can be enhanced by small clearcuts prescribed to achieve specific habitat goals. Small clearcuts are used on the Moosehorn National Wildlife Refuge to maintain woodcock habitat. Clearcuts in aspen are prescribed to maintain aspen cover and to renew age classes used by grouse. In other states, hardwood stands have been bulldozed down to open them up and provide browse and habitat diversity. When reviewing cutting plans, wildlife biologists often suggest adding dispersed patch clearcuts to improve habitat diversity.

Tiny patch cuts are occasionally used to open up important roadside or other vistas. These treatments should not be thought of as clearcuts, since their objective is very local and their purpose is more akin to land use conversion. Their purpose is neither to remove valuable products nor to prepare for regeneration.

Finally, watershed managers often prescribe various forms of progressive strip clearcuts to enhance water yields. To date, there has been no need

Table 12. Considerations in setting silvicultural prescriptions.

---

1.	Existing stand conditions Species composition Size and age distribution Tree health and size of crown Quality and species of overstory Windfirmness
2.	Access, stumpage values, markets and logging costs
3.	Costs of required treatments after the harvest is complete
4.	Season of operations
5.	Type of equipment to be used
6.	Climate and soils
7.	Existing advance regeneration Presence and stocking Species Condition
8.	Damaging agents Provision for wind hazard at stand edges Pests of regeneration Pathological rotations Avoiding regeneration of high-risk species (e.g., fir)
9.	Whether the desired species requires abundant sunlight and exposed soil for germination and seedling establishment
10.	Management objectives Immediate treatment goals for stand harvest regeneration stand improvement insect or disease Long-term objectives for the stand rotation age product objectives likely regime of intermediate treatments likely follow-through immediately following cutting
11.	Regulatory constraints
12.	Multiple use considerations and constraints Wildlife Aesthetics Water quality or quantity; erosion hazard
13.	Whether soil scarification is desirable or undesirable
14.	Practicality of prescription, supervision, recordkeeping, and management

---

to do this in northern New England. In all of these cases, openings created by the prescribed cuts will be smaller—often far smaller—than those used for timber management. Finally, we note some broad recommendations (Table 13).

#### NOTE ON LITERATURE

Since forest practices affect wildlife habitat, forest structure and productivity, soils, water, aesthetic values, and financial returns, the relevant

literature is immense. A useful place to begin is with the bibliographic essay attached to The Irland Group (1988) report on clearcutting. Most materials cited there are not cited here; these citations are for more recent items. No attempt is made to summarize the growing literature on global warming effects, the carbon cycle, or atmospheric deposition effects. Books highly critical of recent practices include Lansky (1992) and Seal (1992). A recent balanced treatment is Kimmins (1992).

Table 13. Recommendations on forest practices.

- 
1. Professionals and landowners should make a commitment to conservative use of clearcutting.
  2. Size of clearcuts should be carefully planned in a landscape context.
  3. Professionals and landowners should commit to cautious use of intensive harvesting and intensive treatments following clearcutting, but also to proper follow-through as needed.
  4. Improved regeneration-conserving harvesting systems should be developed and implemented.
  5. Training of foresters, loggers, and landowners is needed.
  6. Field research on managing mixed stands should be increased.
  7. An expanded state role in documenting trends in management practices and analyzing their effects is needed.\*
  8. A field evaluation of silvicultural practice should be conducted.\*
- 

\*As of Fall 1994, these are being implemented. This table is condensed from Section 5 of The Irland Group (1988).

For those ready for more technical materials, the standard silvicultural text is Smith (1986). Even more technical is Oliver and Larson (1990). A modern appreciation of ecosystem function and process is offered in Aber and Melillo (1991). Useful for intensive harvesting information is Mahendra et al. (1991). For challenging work on partial cutting, see Nyland (1992). For northern hardwoods generally, see Mroz and Reed (1986); for spruce-fir, see Seymour (1992a, 1992b, 1993). There are no recent major works on spruce-fir, but a Midwestern symposium on white pine, though dealing primarily with that region, has interesting papers (Stine and Baughmann 1992). On forest health, an annual Forest Service review is helpful (USDA Forest Service 1993) as are bulletins of the Entomology Division, Maine Forest Service.

A "triad model" that would fit areas of long-rotation naturalistic silviculture and preservation, partial cutting regimes of moderate intensity, and intensive plantation management into one landscape has been proposed by Seymour and Hunter (1992). A major symposium, the Second Munsungan Conference (Field 1994), has considered the implications. Other discussions of ecosystem management include Mladenoff and Pastor (1993), Irland (1994), and Society of American Foresters (1993). On uses of herbicides, see Commission to Study the Use of Herbicides (1990) and McCormack (1994).

Wildlife issues are well treated in Deming and Gage (1994), deGraaf et al. (1992), Hunter (1990),

Maine Cooperative Extension Service (1988), and the recent proceedings of the joint meetings of the New England Society of American Foresters and the Wildlife Society (Bissonette 1986; Briggs et al. 1989; Briggs and Krohn 1993). For habitat data see Brooks et al. (1986). NCASI (1993) included 625 references.

Water issues are summarized in Irland and Connors (1994), and Tellman et al. (1993).

On regulations affecting forestry, see Irland and Connors (1994), Connors (1992), Maine Forest Service (n.d.), and Henley and Ellefson (1986).

Experience has indicated the extraordinary difficulty of compelling landowners to practice good forestry through regulations, though some specific kinds of results can be achieved (Henley and Ellefson 1986; Maine Forest Service 1995).

An overview contrasting Maine with adjacent Canadian provinces is provided in Irland and Maass (1994).

Songbird population trends and effects of cutting and habitat changes have received extensive attention in recent years (Terborgh 1992; Peterjohn and Saver 1994; Askins 1995; Hagan 1993; Lorimer 1995).

## 7. Maine's Forest as Real Estate I: Large Ownerships

### HISTORY OF LARGE LANDOWNERS

Landownership by the major owners has changed over the years, but the total held by the industry has not changed a great deal recently:

Year	Industry Ownership (thousand acres)
1952	6,617
1962	6,521
1977	8,083
1987	8,286
1992	8,017

(Powell et al. 1993).

In some instances, smaller private holders have sold out to industrial owners, the public, or to subdividers. In others, corporations have sold lands that are distant from mills or otherwise not needed for their long-term corporate strategies. In still other cases, corporate ownerships changed hands through mergers. Major examples include the acquisition of the Hudson lands in western Maine by Georgia Pacific in the 1970s, the acquisition of Oxford Paper Co. in Rumford by Boise Cascade in 1976, the acquisition of St. Regis by Champion in the 1980s, and the purchase of Great Northern by Georgia Pacific in 1989 and subsequent sale to Bowater in 1991, and the purchase of Scott's S.D. Warren Division by Sappi, Ltd. in 1994 (Table 14). For a generalized map of private ownerships as of 1993, see R. Kelly's map on page 556 of Judd et al. eds. (1995).

In 1970, ownership of land by the Native American tribes, the Penobscots, Passamaquoddies, and others, was limited. The largest parcel was Indian Township, which was what remained of tribal lands in the state from the 19th century. As a result of complex and controversial land claims settlement in late 1970s (Brodeur 1985), the Passamaquoddy and Penobscot tribes obtained a settlement in a fund of federal dollars, part of which was to be used to acquire land. The lands thus acquired total about 160,000 acres. Part of these lands are federal trust lands (like the reservations in the West), and part are fee simple lands held by the tribes.

### TIMBERLAND OWNERSHIP IN MAINE: WHAT HAPPENED IN THE 1980S?

#### Regional Context

Recent years have seen another in the long series of rural land booms characterizing New

Table 14. Maine forest landownership, 1972–1994 (thousand a.).

Owner	1972	1993
Great Northern <sup>1</sup>	2,250	2,100
International Paper	1,132	976
Seven Islands <sup>2</sup>	—	900
Prentiss & Carlisle <sup>3</sup>	—	900
Georgia-Pacific <sup>4</sup>	435	464
Sappi Ltd. <sup>5</sup>	882	930
James River <sup>6</sup>	762	350
Champion International <sup>7</sup>	751	730
John Hancock <sup>8</sup>	—	tbo
Boise Cascade <sup>9</sup>	—	670
Fraser <sup>10</sup>	182	420
J.D. Irving <sup>11</sup>	400	600
Passamaquoddy, Penobscot Nations <sup>12</sup>	—	160
Kruger	—	109
Dunn Heirs	—	106

<sup>1</sup>Great Northern was a Division of Great Northern Nekoosa until taken over by Georgia-Pacific in 1989. G-P sold the company to Bowater, Inc. in 1992, which operates it under the former GNP name. Ownership changes during G-P ownership were minimal.

<sup>2</sup>Seven Islands manages lands for a series of family trusts, the Heirs of David Pingree.

<sup>3</sup>Prentiss and Carlisle manages lands for a number of family trusts, in addition to its own holdings.

<sup>4</sup>Georgia-Pacific acquired St. Croix Pulpwood Co. in about 1970, then bought the Hudson lands in western Maine in the late 70s. The Hudson lands are now on the market. G-P also holds several hundred thousand acres in New Brunswick.

<sup>5</sup>S. D. Warren acquired lands in Maine in the 1890s; it became a division of Scott much later; its lands and mills in Maine were acquired by Sappi, Ltd. in late 1994.

<sup>6</sup>James River Corp. acquired lands owned by Diamond International from companies controlled by Sir James Goldsmith after Goldsmith broke up the company in the 1980s. Diamond and James River sold portions of the land to John Hancock Timber Resources, to Fraser Inc., and the state.

<sup>7</sup>Champion International acquired the lands and mills of St. Regis Paper Co. in 1984.

<sup>8</sup>John Hancock Timber Resources managed timberland on behalf of institutional investors, primarily pension funds, who are the actual owners.

<sup>9</sup>Boise Cascade acquired Oxford Paper Co. lands in 1976 (295,000 A in Unorganized) and later acquired some of the lands of the Brown Company, which held 223,000 A in Maine in the Unorganized in 1972.

<sup>10</sup>Fraser, Inc., a Canadian forest products firm, acquired lands from Diamond in the 1980s.

<sup>11</sup>J.D. Irving, a New Brunswick firm, began acquiring Maine lands in the 1940s, and later purchased tracts from International Paper Co.

<sup>12</sup>Using federal funds from a land claims settlement, the tribes acquired lands from a number of willing sellers in the early 1980s. These lands are partly held in fee simple by the tribes, and are partly federal trust lands.

Sources: For 1972, Osborn, *The Paper Plantation*, p. 194, based on LURC; 1992–94, LURC datasheet "Major Timberland Owners" dated June 1992; and personal interviews.

England's history. This boom has been profoundly disturbing to recreationists, environmentalists, and others concerned with the future of the region's forests. The boom moved forward on three important fronts. First, it consumed dramatic amounts of land in the region's suburban fringe. Second, it saw rapid construction of condos and subdivisions around the region's ski areas, urban waterfronts, and lakefronts (Dominie and Scudder 1987). Finally, it saw unprecedented subdividing of remote forest and lakeshore. It is this last aspect of the boom that will be discussed here.

The subdividing boom awakened many people to the little noticed fact that most of the North Woods is privately owned. Several things must be understood to grasp the economic realities facing these owners. Only if these points are understood and incorporated into policy can a long-term and sustainable, largely private, wildland heritage of the Maine Woods continue to survive substantially as it has for the past century.

First, the near-term outlook for current cash return on many large properties is not good, though recent price increases for stumpage have been extremely helpful. Second, operating costs are significant and continuously rise. Third, the recent land boom has largely spent its force. Its actual effects on the ground have been modest so far, but we must learn the right lessons for the future.

These forests produce valuable timber of spruce, pine, fir, maple, birch, and other species. Their wood will be in increasing demand as federal timber harvests in the West decline, as Canadian sources increase in cost, and as tropical timber cutting slows down. These forests are the economic base for many nearby communities. In many instances, towns in and near this forest zone rely on them for 50% to 75% of their manufacturing employment. Tourism, hunting, and fishing, being highly seasonal and offering low wages and few fringe benefits, do not compete with these manufacturing industries as keystones of the local economy. It is because of the large and diverse economy of the southern portions of Maine that we often fail to perceive the economic impact of wood-based industry in the Maine Woods.

### Current Cash Returns

It is difficult to generalize about cash revenues from timber management in this region. There is, understandably, little published information to use. Much depends on the initial stocking and species composition of stands and their proximity to markets. In all too many instances, past cutting has depleted large, high-value tree species and left

behind damaged saplings, culls, and noncommercial trees.

When looking at individual stands, revenues are extremely sensitive to species composition. Stands making typical growth rates can grow  $\frac{1}{2}$  cord per acre per year. There are some extremely productive sites that produce 2 cords per acre per year. If this is all in pine of decent quality, annual value growth could be \$100/acre/yr. Some of the hardwoods are valuable enough to yield quite high annual value growth if stands are fully stocked and of good quality.

Few properties, however, are uniformly well stocked and few consist of top-value species. There is a loss of land to roads as well as ongoing loss of trees to disease, windstorm, and insects. Additionally, the current low quality and small size of timber means that much of the revenue in early cuttings is from pulpwood and low-grade wood removed in improvement cuttings. Furthermore, the best growing areas are balanced by liberal amounts of bog and ledge. For these reasons, actual gross revenues per acre over large properties are likely to be in the range of \$8–12/A/yr at best. On many properties, spruce and fir have been the principal sources of revenue, due to their high volumes per acre, their value, and ready markets. In the areas where the spruce budworm outbreak was severe, however, many properties are facing limited harvest potential for these species in the coming decade.

Landowners pay bills out of the gross income for administration, taxes, insurance, and other expenses. In some areas, taxes take a burdensome share of the gross income, but the benefits of ownership must come from the after-tax net, which is a modest annual amount on the typical timber ownership.

In other areas, it is possible to augment returns from rights-of-way and from hunting leases. Recreational leasing, however, is well accepted only in New York and not in northern New England. The user fees shared by North Maine Woods and Great Northern Paper in Maine were highly unpopular initially, and do little more for the owners than cover incremental costs due to recreation. At present, they are not adding much if anything to net returns, though in certain limited examples leases are probably a net benefit. Camplot and recreational leasing are not practical means for augmenting landowner incomes on any scale.

Industrial owners have seen their future timber revenues threatened by budworm losses, but markets for other species have been improving. Strong paper markets have meant that mills have

been extremely busy. A number of companies have expansions underway to meet strong demand for their products. Though they have had strong profits from manufacturing, they still cannot carry woodlands from other sources indefinitely. In some companies, timberlands are operated as profit or cost centers that maintain their own accounts and are rated for profit contribution or cost performance. Typically, their accounts are not adjusted for changes in the market value of the land itself, so they view performance on a cash basis, or on the basis of current net returns relative to estimated asset values.

Not only do these owners face modest net returns from these lands, but they also are making significant investments to bring future production up to its real potential. Maine paper companies, for example, are investing millions each per year in herbicide treatments to restore spruce-fir stands to their former productivity after budworm damage and clearcutting. From 1982 to 1993, the cumulative investment in planting and cultural treatments by Maine landowners was more than \$50 million.

Large areas of Maine timberland are held by families and trusts. These owners do not have the cash flow from mills or the need to feed them wood as do the paper and lumber companies. Family owners have been particularly affected by the removal in 1986 of capital-gains treatment of timber income. On the other hand, for many owners the reductions in estate taxes of recent years has been a benefit. Yet sustaining large family and trust ownerships over the generations is becoming a greater and greater challenge.

Also, significant acreages are owned by individuals, farmers, and families as well as a host of small companies of one kind and another. Many of these are families holding land that was formerly farmed. In some of these locations, local government has been abandoned following depopulation. Nowhere on the fringes of the Maine Woods has there existed adequate planning and regulation of land use and development, for the simple reason that until recently there has been no need.

### **The Land Boom**

The land boom was fostered by a number of underlying economic forces. First, despite a record construction boom, housing prices in southern New England and southern New York reached record highs in the late 1980s. Prices became so high that they largely prevented immigration from responding to the area's low unemployment rates. How

could someone buy a house in the Boston area on an assistant professor's meager pay packet?

Capital gains on existing homes, and rising incomes from two-income families encouraged suburbanites to seek ownership of a piece of the remaining wild backcountry. Many people could invest capital gains from a historic stock market boom. Completion of major interstate highways brought urban populations closer to the wildlands. Growing tourism made more people familiar with the region's beauty. In many areas where logs were previously driven by water, logging roads provided the first ready access to the public for boating, fishing, and hunting.

Greed was undoubtedly a major factor, as land sales outfits touted lots as a surefire investment for buyers. Ads proclaimed—"Last Chance to buy on the Narraguagus River..." As sensational stories appeared in the press about the abuses of major subdividers, regulators bestirred themselves from their inertia. As potential buyers became aware of this, the "Last Chance" pitch became more credible. In a tragic sense, the Last Chance myth became a self-fulfilling part of the land rush. Outdoor publications were natural marketing tools, and their pages filled with ads placed by subdividers.

Land companies and individual operators rushed to meet and feed the demand. These ranged from well-heeled individuals seeing a chance for a quick profit, to locals with a bulldozer, to professional land-marketing outfits traded on the stock exchanges. Bits of the forest were bought and sold as a commodity. For a time, eager buyers pushed money into their hands, but as is always true of speculative bubbles, when a market is glutted with a product nobody really needs, the correction is swift and severe. It only takes word getting around of one or two people trying to resell and taking a beating. Ironically, it was just as the boom was at its peak that widespread interest arose among the organized conservation community and state and federal governments.

In fact, one of the greatest tragedies was how state regulations acted perversely in this land boom. Instead of mitigating harm, all too often they increased it. They induced the creation of lots far too large, and in Maine they even exempted major projects from review entirely. In Maine, thousands of acres have been stripped of all timber and sold to fools in 200-acre pieces. Honest, long-term timber managers were unable to outbid the rapists for these lands.

In work done at The Irland Group for the Northern Forest Lands Study, we attempted to measure the extent of land conversion to subdivi-



sions (USDA Forest Service 1990). The total amount actually converted was small. Much of the conversion was being done by small local subdividers. At the time of our interviews, much of the subdivided land had not yet been developed, and the outlook for it ever being developed was uncertain. So for the number of recreational cottages actually built, a lot of land had been subdivided. On the basis of recent activity, we projected that subdivisions could consume an additional 2% to 4% of the region's forest land between 1990 and 2010. This is a small amount. It is consistent with estimates made by others who have argued that land consumption was being wildly exaggerated.

One thing not found was any significant acreage of industrial land going to development. Even the best known industrial sales, those of the Diamond lands to various buyers, have ended with relatively small amounts going directly into development and subdivision (see Whitney et al. 1994). This is because of the realities of the land market as well as the energetic effort by public agencies and nonprofit groups like The Nature Conservancy to save key properties.

### FORCES AFFECTING INDUSTRIAL OWNERSHIP

The late 1980s, then, confronted industrial land managers with both a potential revenue squeeze and a booming market for recreational subdivisions. To this powerful set of pressures was added the unprecedented turmoil on Wall Street as takeover fever became an epidemic and even began to drive the major market averages. Early in this period, Sir James Goldsmith, a British financier living in France, took over Diamond International, breaking it up for a substantial profit. He later went on to some other financial coups in the paper industry. His move helped highlight the fact that many resource-rich companies offer breakup opportunities because they cannot earn high rates of return on huge inventories of oil, gas, or timber. During this period, the oil industry was undergoing painful restructurings, acquisitions, and spin-offs for the same reasons. Brokerage houses and investment banks were calculating breakup values of companies and designing mergers and breakups, some of which actually happened. Junk bonds were but one of the major financial forces that helped mobilize extraordinary amounts of capital and financial talent for these enterprises.

In the Diamond case, Goldsmith, perhaps acting in a typical European manner, sold the mills and kept the Maine timberland for management. For this reason no alarm bells rang in the conserva-

tion community, although Diamond owned parcels of considerable conservation importance. In about 1987, Goldsmith decided to dispose of a collection of smaller and more isolated tracts not deemed necessary or well suited for long-term timber management. In a few instances, lands of high development value were included. These lands amounted to less than 10% of the ownership. This move aroused instant controversy, despite the fact that no buyer emerged willing to meet Diamond's terms for the entire package. It later became known that Diamond intended to seek buyers for the balance of the property. A major parcel was sold to a Canadian paper company. In a stock deal, James River Corporation, which had bought the Diamond pulp mill, acquired a 25% interest in the remainder with an option to purchase the rest, which was later exercised (Whitney et al. 1994).

During these years, other landowners were trading with the state and with each other to settle the public lots questions, to dispose of remote tracts, or to eliminate troublesome undivided minority interests. A number of these companies were on nationwide programs to eliminate remote lands from their ownerships while trying to acquire lands closer to mills. Frequently, land transactions pursued for these or related purposes became known and increased the unease of observers who perceived a wholesale sellout of industrial timberland going on. In addition, several owners announced intentions to screen their ownerships for lands not essential to timber growing but too valuable to justify retaining for that purpose. Pressure to do this had certainly been enhanced by the takeover boom.

Between the mid-1970s and 1990, a number of major corporate mergers affected the region's timberland ownership. Boise Cascade acquired the old Oxford Paper Company in 1976; since then Boise dramatically increased its timber base in Maine and New Hampshire. Champion International acquired St. Regis in a "white knight" friendly takeover (1984), which has had no noticeable effect on the firm's land management and retention policies. James River Corporation acquired several mills and in at least one instance sold land primarily to other timber firms to finance the deal. Most recently, Great Northern Paper Company, owner for 90 years of some of Maine's scenic wonders around Baxter State Park, was acquired by Georgia-Pacific in a bitterly contested hostile takeover. During the debate, G-P management assured state officials and the public that it had no need or intention to sell lands to developers to finance the transaction. But the immense size of the deal, and the high visibility

of the lands involved, certainly emphasized the fact that landownership is not eternal in the corporate world. Coming as it did on the heels of the release of the Northern Forest Lands Study's draft report, the merger highlighted fears of many that Maine's future was on the line, hostage to Wall Street financiers. The former Great Northern assets in Maine were later sold to Bowater, Inc. and are now operated under their former name.

Will there be more forest industry mega-mergers? Some financial commentators think so. What effect will they have on the North Woods? We can only guess, but recent history suggests to me that we would be wise to reduce the volume of rhetoric on this issue. The corporate ownership shifts so far have largely been between forest industry companies and have not led to massive subdividing.

### OWNERSHIP SHIFTS, LARGE TRACTS

The Northern Forest Lands Council contracted with the James W. Sewall Co. and Market Decisions, Inc., to assemble the best possible record of land transactions in the study region from 1980 to 1991 (see Map in Sewall Co. and Market Decisions [1993] or in USDA Forest Service [1990]). This inventory uncovered 191 transactions involving a total of 6.5 million acres (Sewall Co. and Market Decisions 1993). This total is dominated by the two transactions involving Great Northern (purchase by Georgia-Pacific in 1989; sale to Bowater in 1991). Deleting them leaves 2.2 million acres. Even after deleting Great Northern, Maine dominates the total for the entire Northern Forest Lands Study region.

The analysts classified the Maine transactions according to "tiers of conversion," finding the following results:

	Acres	Lots
Parcelization	148,645	937
Permitting	1,061	26
Subdivision	6,306	6
Conversion	29,941	13

(Sewall Co. and Market Decisions 1993)

In total, 203,000 acres were divided into smaller tracts, of which 149,000 were in Maine. The extremely high turnover of ownership, then, basically left most of the land in large tracts. Only a fraction of the smaller tracts created had been subdivided or developed. This information displays perhaps a comforting picture, but it is still true that significant acreages in large tracts could be offered for future development and that many of the small

tracts are ripe for development when the lot market revives.

### CONCLUSION

Read with care recent history shows us that Sir James Goldsmith did Maine citizens a favor. He hit us over the head with a 2X4...bringing us to a realization that these woods are indeed private property. They are guaranteed to wildness and to no-cost public use only by user perceptions and hallowed customs.

Conservationists and citizens have taken these lands for granted for many years. Responsible environmentalists will take advantage of the renewed visibility of these lands to begin crafting sound, long-term policies for preserving critical public values and access to them. Thankfully, the land boom has subsided. This provides time that is badly needed to plan, debate, and work together for the future. Many of the current owners of these wood-growing lands are, on the whole, willing and even eager to be partners in this process. There is time to correct perversities in public policy, to devise better ways to share costs associated with recreational uses, to secure the conservation of critical parcels of high conservation value, and to attempt what may be feasible in the way of enhancing the financial stability of timberland ownership.

No previous generation of landowners and conservationists has ever faced such complexity of pressures and challenges in so brief a time. Maine has already lost far too much.

## 8. Maine's Forest as Real Estate II: The Subdividers

The corporate sales, restructurings, down-sizings, and acquisitions have significantly altered the landownership picture of the Maine Woods, but have yet to have major impact on the uses of the lands affected. An activity, however, that has had an impact on land use is that of leisure lot subdividing. According to a Maine Times report (1/13/89), the Patten Corporation, probably the largest subdivider, had projects covering 60,000 acres completed or underway statewide by late 1988, near the boom's peak. This chapter reviews case studies of subdividing in two local areas, and summarizes recent research on subdividing within the LURC jurisdiction.

### LOCAL EFFECTS OF THE LAND BOOM: RECREATIONAL LOT SUBDIVIDING IN FRANKLIN AND WASHINGTON COUNTIES

#### Introduction

An unprecedented boom in wildland recreational lot sales occurred in the forested areas of the northeast in the late 1980s. This boom, with its heavy advertising campaigns, drew public attention to the uncertain future of the region's remote lakefronts and forests. A survey of five case study counties in New York, Vermont, New Hampshire, and Maine showed the complexity of the subdivision market. This chapter recounts the results, focusing on Maine. Significant lot demand was for local residential use; forest industry land was not being extensively sold for lots; many of the projects were undertaken by local residents; and few of the lots have been built on to date. The present slackening in the region's lot market provides an opportunity to update state and local policies to deal more effectively with the land use and environmental issues involved. Principal inadequacies include a lack of monitoring of development activity, regulations that create incentives for lots that are too large, and a total lack of even minimal regulations in many smaller communities.

Land use policies must be based on an understanding of what is happening in land markets. In the wooded regions of northern New England and New York, there has been widespread concern over the recent pace of wildland subdividing. This concern motivated the Congress to commission the USDA Forest Service (1990) to study subdividing and other forces affecting the region. The Northern Forest Lands Study was completed in spring 1990.

As part of that study, The Irland Group conducted a detailed field assessment of wildland subdividing. The goal was to understand how the market for rural and wooded land for subdivision works (Irland 1982; Irland Group 1989). A certain level of turnover of ownership of rural land is normal. In 1988 nationwide, 5.7% of rural land parcels and 3.5% of the acreage changed hands. In the Northeast, the rate was higher than the nation for acres, but lower for parcels (Wunderlich 1990).

Within the case study counties, we sought out the towns most affected by subdividing. (In New England, a "town" is a designated unit of land, often six miles square. It may or may not possess local government and may or may not possess a defined town center.) Detailed assessments of the many economic, aesthetic, social, and environmental impacts of wildland subdivisions were not within the scope of the work.

Case study counties were selected to cover the range of conditions experienced (Figure 30). On the basis of our familiarity with the region, we chose areas that were heavily forested and that seemed generally representative of the larger region's social and economic conditions. During the 1980s, the five selected regional case study areas grew in

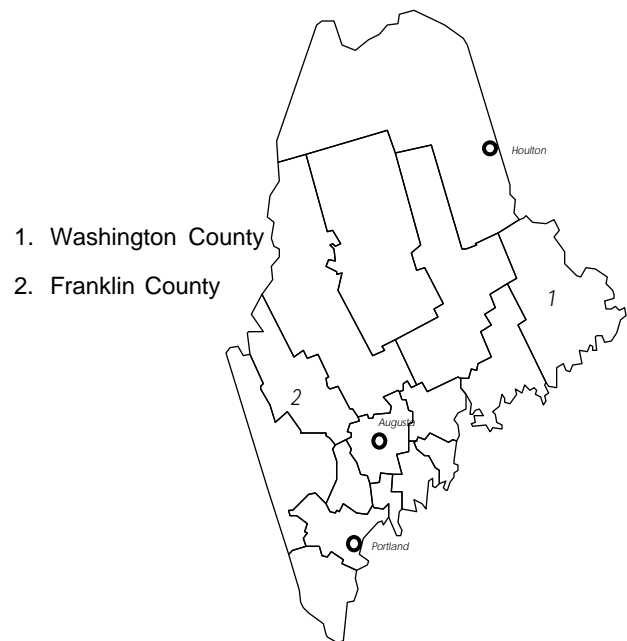


Figure 30. Maine case study locations.

population at slower rates than did their corresponding states. They generally had higher unemployment rates and depended more heavily upon manufacturing than the states as a whole (Tables 15–17).

The Carrabassett Valley region in Franklin County, Maine, is dominated by Sugarloaf USA, a large ski resort. The Appalachian Trail, fishing and kayaking on the Carrabassett River, snowmobiling, and hunting are the major recreational opportunities. The area is heavily forested; several major forest products companies and the Penobscot Indian Nation own substantial timberland holdings. Sawmills and wood products plants in Kingfield, Stratton, and Eustis, as well as a large hotel dating to the early 1900s are major employers. We studied Kingfield, Carrabassett Valley, and Eustis in detail. Between 1980 and 1986, Carrabassett Valley's population grew 21%, while Eustis and Kingfield grew by 13%.

Washington County, Maine, is the nation's easternmost county. The county is remote and heavily forested, with 86% of its total acreage classified as commercial forest land. The largest employer is Georgia-Pacific, employing approximately 1,000 in pulp, paper, and wood products plants. Fishing and blueberry production are also major industries. Washington County is one of Maine's most sparsely populated counties. The county experienced population growth between 1970 and 1980, in contrast to a steady decline between 1900 and 1970. The population declined again after 1980. Towns studied were Beddington, Danforth and Northfield.

### Methods

Data were tabulated to describe the subdivision of rural and forested lands in selected towns from 1980 to 1989. Due to the lack of available data at the county level, work was focused on selected individual towns. Information was compiled on

- total number of subdivisions created per year;
- number of building permits per year;
- area subdivided per year, specifying how much of that area was from commercial forest land;
- location of the subdivisions in town, to determine what types of land are being subdivided (waterfront, remote, road frontage, etc.);
- lot sales;
- extent to which construction had occurred on the lots;

Table 15. Case study areas: Population 1980–1987.

Region	1980	1987	% Change
Washington County	34,963	34,300	- 1.9
Franklin County	27,447	28,600	4.2
Maine	1,125,043	1,187,000	5.5
Coos County	35,014	34,168	- 2.5
New Hampshire	920,479	1,057,000	14.8
Orleans County	23,440	24,095	2.8
Vermont	511,456	541,000	5.8
Essex County	36,176	36,656	1.3
New York	17,558,165	17,825,400	1.5

Table 16. Case study areas: socioeconomic indicators compared to entire states.

Region	Per Capita Income (1986)	Unemployment Rate (1988)	Average Weekly Wage in Mfg. (1987)
Washington County	10,284	10.6 <sup>1</sup>	389.55
Franklin County	10,511	4.7 <sup>2</sup>	450.93
Maine	12,846	4.8	408.69
Coos County	13,114	3.4 <sup>3</sup>	473.16
New Hampshire	16,328	2.5	471.01
Orleans County	10,331	5.3 <sup>4</sup>	302.21
Vermont	13,342	2.9	456.31
Essex County	11,620	5.8	504.29 <sup>5</sup>
New York	16,800	4.1	498.23 <sup>5</sup>

<sup>1</sup>For Calais-Eastport labor market area.

<sup>2</sup>For Farmington labor market area.

<sup>3</sup>For April 1989.

<sup>4</sup>For Newport labor market area.

<sup>5</sup>For 1985

Table 17. Case study areas: employment by sector, compared to state (% of total) 1987

Region	Manufact.	FIRE <sup>1</sup>	Serv.	Gov.
Washington County <sup>2</sup>	23	2.2	18	24
Franklin County <sup>3</sup>	37	3.5	20	15
Maine	20	4.8	21	20
Coos County <sup>4</sup>	34	3.5	26	14 <sup>5</sup>
New Hampshire <sup>4</sup>	27	7.1	25	9 <sup>5</sup>
Orleans County	32	3.5	24	20
Vermont	21	4.9	24	15
Essex County	11	2.4	36	21
New York	15	9.8	27	17

<sup>1</sup>Financial, insurance and real estate.

<sup>2</sup>Calais-Eastport labor market area.

<sup>3</sup>Farmington labor market area.

<sup>4</sup>Figures are for first quarter 1988.

<sup>5</sup>Figures are for local government only.

- descriptions of sellers, purchasers and subdividers of the land; and
- state and local subdivision regulations.

Often, detailed local records of subdivisions did not exist or were in various states of order. Different sources were contacted to supplement official records. Realtors, regional planning commissions, state planning offices, town clerks, planning boards, and tax assessors provided primary data. To understand the conversion process itself and the firms involved, we sampled sales of forest land to subdividers. We then interviewed both buyers and sellers. This provided a far richer understanding of the market than would have been possible on the basis of official records alone.

**The Lot Market and Government Regulations**

The recent boom in forest lot subdivisions is only one of many land booms in New England's history (Irland 1982; Figures 31–33). The current boom has raised concerns in many quarters, especially as nonresidents purchase more and more wildland and as public access to forests and waterways becomes more limited. With the completion of interstate and major secondary highways, the land boom has reached into the remotest parts of the region (Table 18). This increased access is a critically important new development. It invalidates the common view of “we’ve seen this before.” The land booms of previous decades had limited effect on forest areas because limited highway access had the effect of limiting demand. Also, the Northeast's economic boom of the 1980s had seen no counterpart in previous decades.

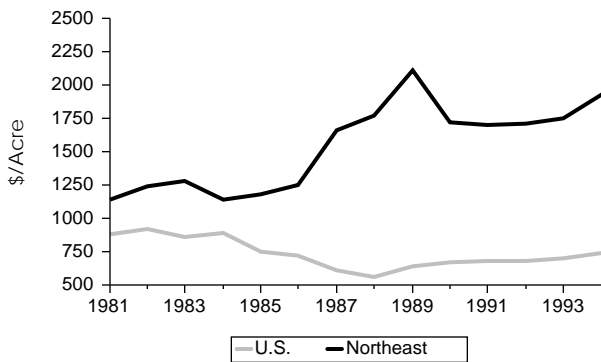


Figure 31. Northeast's land boom of the 1980s: Farmland values, 1981–1994. Source: USDA Economic Research Service. Series used for 1981–1992 was discontinued. 1990–1994 series is average value of farm real estate. U.S. data is for 48 states.

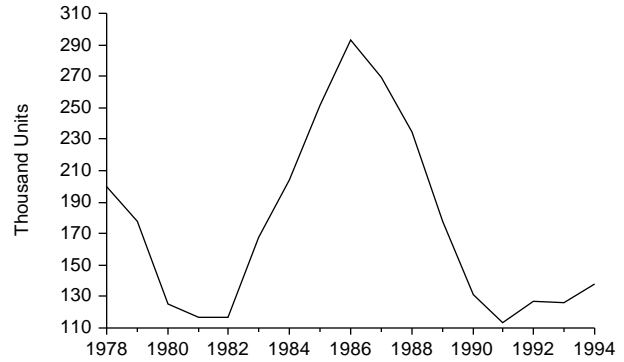


Figure 32. Northeast's land boom of the 1980s: Private housing starts, 1978–1994. Source: U.S. Department of Commerce.

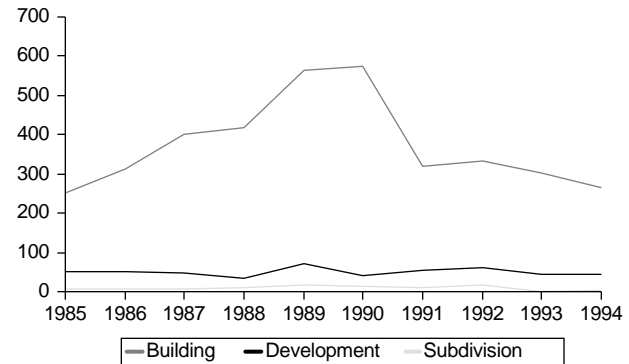


Figure 33. New permit actions by the Maine Land Use Regulation Commission.

As housing prices rose rapidly in urban areas, so too did the demand for rural recreational property. This trend was accelerated by the stock market “crash” of 1987, when investors began diversifying their portfolios to include land as an investment. Also, the Tax Reform Act of 1986 provided an incentive for individuals to sell land in 1986 before the capital gains preference was eliminated. Aggressive marketing efforts by large land development corporations attracted buyers. Finally, growing numbers of households entered age groups likely to purchase lots. Many of these families have two incomes and can pay cash for lots.

States have adopted many regulations controlling subdivisions. Interviews indicated that the state regulations may discourage some small owners from subdividing, but it is not clear that overall subdivision activity has been much affected. As fewer available tracts remain at attractive prices, large land corporations will increasingly be the principal subdividers in the future. Subdivision

Table 18. Subdivision activity, 1980–1989.

	Franklin County	Washington County	Coos County	Orleans County	Essex County
Number of Subdivisions Studied	24	28	129	43	18
Number of Lots	326	532	1,740	318	126
Average Lot Size	10	40*	8	18	9
Percent Sold	57	Most	60	75	56
Peak Year	1988	1986	1987	1987	1989
Average from Commercial Forest Land Subdivided as %	600 0.9%	n/a 6.6%	n/a 1.9%	2,375 10.5%	641 0.6%

\* 60 percent of lots are 40+ acres.

regulation may have caused more acreage to be developed than would have been otherwise, as these regulations encourage larger subdivisions (measured in acres) than may have occurred without regulation, and encourage larger lots than customers say they want.

Detailed regulation of most subdividing and development remains at the local level in most of the towns studied. Few of these towns, however, had even minimal planning and subdivision standards in effect during the early 1980s. The land boom of the mid-1980s has prompted some towns to institute land use regulations. For example, Northfield (Washington County, Maine) instituted Land Use Ordinances, including a Large Lot Review Ordinance in 1987. Kingfield, Maine, enacted a subdivision moratorium in 1988 until an outdated 1973 comprehensive plan could be revised. The new comprehensive plan includes a subdivision ordinance requiring approval of a subdivision plan by the town's planning board.

No level of government is doing an adequate job of monitoring changes in land use, ownership, and

parcel fragmentation. In each state, no single agency is responsible for tracking subdivision and development activity or for proposing policy options to deal with future land booms.

**Subdivision Activity: Specific Results**

News and commentary about the recent land boom, contain a number of impressions about land sales trends in the study area. Impressions that are becoming “common knowledge” may be accurate only in limited instances. The situation is much more complex than it appears at first glance.

**Subdivision activity is not dominated by out-of-state land development companies**

With the exception of Washington County, the case studies showed that small, local owners were more numerous and accounted for more acreage subdivided than did large, out-of-state corporations (Table 19). For these small land owners, the market has “ripened”: the land that they have held for many years is in strong demand and prices have risen high enough to prompt them to sell out or to subdivide their land.

Table 19. Characteristics of subdividers and subdivisions, 1980–1989.

	Franklin County	Washington County	Coos County	Orleans County	Essex County
Kinds of Developers	Local	Local & Land Dev. Corp.	Local	Local	Local
Areas Affected	Road Front.	Lakes	Road Front.	Farmland/ Forest	Road Front/ Forest
Principal Use	Res.	Recr.	Recr.	Recr.	Recr.
Amenity	Skiing	Lakes/Rivers	Lakes; Wilderness	Scenery	Scenery
Hours to Nearest Metro. Area	5½— Boston	6— Boston	3— Montreal	3½— Boston 2½— Montr.	2¼— Montr. 5¼— NY City

In the Carrabassett Valley area, nearly all of the subdivisions were created by people whose residence or business address is in the study area. In Washington County, 10 of the 28 subdivisions studied were undertaken by land sales corporations which operate in Maine and out of state as well. Those ten subdivisions accounted for 80% of the total acres subdivided in the study towns. An additional 13% was subdivided by a Maine company.

**Forest industry land is not being sold on a large scale to subdividers**

In our cases, forest industry land has usually not been available for sale. This has been a major constraint to subdividers. In Washington County, industrial owners of forest land have not been active in the subdivision and sale of land. Only two parcels were sold by an industrial owner and then subdivided during the study period (for a more complete review, see Whitney 1989). Land trades with the State of Maine to consolidate public land ownerships dominated transactions in the early 1980s. Other transactions by industrial owners have been largely limited to sales of small parcels to adjacent owners for personal use. In the town of Carrabassett Valley, neither the paper companies nor the Penobscot Indians have yet been willing to sell their large landholdings to subdividers, even in the face of strong demand generated by Sugarloaf Mountain visitors and fall color tourists.

The importance of forest industry ownerships varies across the region, as indicated by the data for the early 1980s for Forest Survey units (which only roughly coincide with our study areas):

	% of Forest Land
Washington County	59
Western Maine	34

Source: USDA Forest Service (1990:110).

Many large industrial owners have selectively screened their lands to identify potential “highest and best use” tracts for disposal. Some of these may be sold, others may be traded for other timberland or conveyed in easement or other form to public agencies. It appears likely though, that on balance the total landbase of industrial owners will change little.

**Regionally, large lots or “spaghetti lots” do not dominate subdivisions**

Only in Maine did we find large lots. In Washington County, 60% of lots were 40 acres or larger. The average lot size figures for the other study areas were three acres in Franklin County, eight acres in Coos County, eighteen acres in Orleans County, and nine acres in Essex County. “Spaghetti lots” are long, odd-shaped parcels designed to include a maximum of backland together with the minimum required amount of shoreline. These are often wasteful of both land and natural amenities, but they did not appear frequently in the sample towns. Most subdivisions were standard grid designs.

**Subdivisions are affecting small areas**

In three of the five study areas, the total areas subdivided were small relative to the area of the towns (Table 20 and 21). Subdividers reported that the best prospects for subdivisions have already been done. In Washington County the acreages are strikingly large.

In Carrabassett, the effects of the Sugarloaf Mountain resort have been limited to an area near the mountain. In Kingfield and Eustis, less than 10 and 15 miles, respectively, from the Sugarloaf ski resort, demand for subdivided lots is largely local and therefore limited by the small population in those towns. It is generally considered that skiers

Table 20. Washington County.

	Beddington	Danforth	Northfield	Entire Area
Total Acres in Town	19,400	31,806	31,118	82,324
Industrial Forest Ownership	15,546	18,000	17,857	51,403
Public/Conservation	318	32	2	352
Reserved Area Total	15,864	18,032	17,859	52,755
Non-Industrial Private Acreage	3,536	13,774	13,258	30,568
Area Subdivided 1980s	3,303	211	1,924	5,438
Acres Subdivided as % of Town Total	17.0%	0.6%	6.2%	6.6%
Acres Subdivided as % of Non-Industrial Private	93.4%	1.5%	14.5%	17.8%

Table 21. Franklin County.

	Kingfield	Carrabassett Valley	Eustis	Entire Area
Total Acres in Town	24,525	49,430	31,360	105,315
Industrial Forest Ownership	11,400	35,045	16,551	62,996
Public/Conservation	75	3,405	980	4,460
Reserved Area Total	11,475	38,450	17,531	67,456
Non-Industrial Private Acreage	13,050	10,980	13,829	37,859
Area Subdivided 1980s	404	403	172	980
Acres Subdivided as % of Town Total	1.6%	0.8%	0.5%	0.9%
Acres Subdivided as % of Non-Industrial Private	3.1%	3.7%	1.2%	2.6%

prefer to drive less than 30 minutes from a leisure unit to the slopes.

In assessing the impact of past subdividing activity, the question arises as to the correct basis for comparison. When subdivided acres are compared to all forest land, the percentages are small. When compared to the nonindustrial private land, however, these ratios are far higher in a number of areas.

#### **Subdividing does not lead to prompt development**

Our case studies show that wildland subdividing leads to subsequent construction of dwellings very slowly. In Franklin County, only 22% of the 326 lots created in the study period had been built on as of June 1989, and in Washington County there was little construction on the lots created.

#### **Scenic areas and lakefronts sell first, but backland is also active**

Lake frontage is clearly a premium product and is being developed where allowed under regulation. At the same time, however, other forest and farmland is also being subdivided, particularly where water access is nearby. In the Carrabassett Valley, road frontage has been of primary importance. Because of large owner reluctance to sell, few truly remote areas have been subdivided. In sum, while pressure is heavy on water frontage, a great deal of unimpressive upland and pastureland is being subdivided as well.

#### **Primary buyer motives**

On the basis of our interview, personal leisure use and speculation are common buyer motives. Population trends and characteristics suggest that subdivision activity has been largely a response to demand for seasonal, recreational properties rather

than resident housing. The majority of purchasers of subdivision lots in these areas reside in other states, so that the economies of the Boston and New York City areas, as well as other nearby urban areas, play an important role in the wildland lot market.

In the town of Carrabassett Valley in Franklin County, the demand for lots is directly associated with Sugarloaf ski resort. The reorganization of Sugarloaf Mountain Corporation in 1985 brought about unprecedented subdivision activity in that year. In the two Franklin County towns of Kingfield and Eustis, subdivision activity has been largely for year-round residents. Many projects were created as families settled estates or broke up old farms.

Though representing a time before the land boom's peak, data from the USDA Forest Service state landowner surveys are useful (USDA Forest Service 1990). In those surveys, some 10% of the acres were owned by individuals with a primary motive of investment. This information applies to all owners, not just to new lot buyers.

#### **Conclusions**

In the forested portions of northern New York and New England, the wildland lot market has slackened from the pace of the late 1980s, but the results of this experience remain relevant for policy. The rapid pace of subdividing has led to widespread public concern for the future of wildness in these North Woods, as exemplified by major preservation proposals in both Maine and New York (Kellet 1989; Restore North 1994).

In Maine, the wildland lot market responds to local housing needs, as well as to speculative pressures and demands for recreational lots. The market is heavily influenced by the metropolitan areas



to the south. Personal recreational use and speculation are important buyer motives. Patterns of developer activity are complex, and the level of construction on wildland subdivisions has typically been low. In several counties, amounts of land subdivided were significant when compared to private nonindustrial lands. While the regional total acreage subdivided has been very small to date, the environmental and economic implications are significant.

The recent wildland subdividing boom has revealed a number of deficiencies in public policies. First, local subdivision reviews are weak to nonexistent. Second, lot size limitations have often had the perverse effect of causing more land to be subdivided and also of allowing significant projects to escape review altogether. Finally, no state in the study area is doing an adequate job of quantitatively monitoring subdivision activity and land use change. The present slowdown in the pace of lot sales offers an opportunity for these and other deficiencies to be corrected. Additional field research on the lot market and its effects will be needed to design sound policies.

### TRENDS IN LURC JURISDICTION

As part of the update of the Comprehensive Land Use Plan, the Land Use Regulation Commission contracted with Land and Water Associates of Hallowell (1993a, 1993b) to compile file data and assess past development activity in the jurisdiction. This section uses data from a draft report of that work showing development from 1971 to 1991. During these years, there occurred the following agency actions:

Building permits	6,882
Development permits	1,070
Subdivision permits	291
Zones change to development	38

Clearly, a low level of annual activity can add up to important changes over two decades. Much of the activity was by individuals and not by corporations, but it was common practice by developers to buy up subdivisions after individuals had obtained permits, and how extensive this may have been is not known.

The summary showed that most of the activity was by Maine-based residents or companies. In a companion report, it was found that two-thirds of the seasonal homes developed in the jurisdiction in this period were located on water and that the waters involved were usually those with high re-

source values (Land and Water Associates 1993b). So the development that has occurred has strongly affected the wild character of lakes and streams.

While much of the land remains in large ownerships, the subdividing and land sales of the past decades have led to fragmentation of many smaller tracts. In 1971, there were about 5,500 owners of parcels of less than 500 acres in the LURC jurisdiction. In 1991, there were 9,300 owners who held a total of 12,100 lots (Market Decisions, Inc. and Land and Water Associates 1993). A total of 320,000 acres was included in these lots, all ripe for development and many on important waterways. Additional large-lot subdivisions are not regulated, but from 1985 to 1991, a total of 59,800 acres had been subdivided in the 40- to 499-acre size class. In 1989 alone, 86,700 acres were split into lots larger than 500 acres.

These summaries show that subdividing has affected only small amounts of land compared to the extent of the wildlands, but the process has clearly had a disproportionate impact on wildness in particular areas.

### OVERVIEW

Wildland lot subdividing boomed in the Maine Woods during the late 1980s. The dynamics of leisure lot demand and supply, and the role of government policies, were quite different from those affecting the ownership changes for large properties. The land boom triggered public concerns and policy responses that were not always clearly focused on what was actually happening in the woods. As a result, much time was spent arguing over whether there was a problem or not. Studies sponsored by the USDA Forest Service, the Northern Forest Lands Council, and LURC helped clarify how land was being bought, sold, subdivided, and converted. These studies also hinted that inadequate and poorly designed public policies were a part of the problem. When the proposed LURC Comprehensive Plan revisions are adopted, we will see that agency's view of the state of policy. Since the policy mood of the mid-1990s emphasizes regulatory "reform," we can expect extended controversy over state and federal agency roles in land use. The King Administration has established a Task Force on this question, which will be able to review a large number of proposals for improvements (see Dominie and O'Hara 1993; and Maine Office of Policy and Legal Analysis 1994).

## 9. Outdoor Recreation in the Maine Woods: Issues for the Future

Outdoor recreation use of privately owned managed timberland promises to grow in importance in coming years. Yet our ability to accurately assess current and potential supply of these opportunities is limited. The ten million acres of the Maine Woods are largely privately owned and are essentially unsettled. These wildlands provide an excellent case study for exploring this problem. In addition, a long history of successful public-private partnerships for recreation management may provide useful ideas for other parts of the country. There is much that is unusual about the Maine Woods, but many aspects of this experience provide useful lessons and practical ideas that, suitably adapted, can be applied elsewhere.

Because the concept of supply encounters many ambiguities in relation to wildland recreation, this section opens with a definition. Then, it reviews several issues and trends affecting supply. It then closes with a few more general reflections. The demand side of this picture has been thoughtfully reviewed by Hartman (1992).

### SUPPLY: A DEFINITION

Supply is the capacity of an area to provide a given recreation experience at a given time. A single area or water body supplies a number of different experiences. Enhancing supply for one activity may diminish supply or change quality for another. Supply may be difficult to measure, but maintaining a consistent record of trend is essential.

Measurement is ambiguous because of the importance of quality. Quality means many different things, depending on the individual's plans and expectations, trip objectives, type of activity, and perceptions about the "good old days."

One common theme is the search for a unique, memorable experience in a wild setting. The search, for many visitors, often involves an expedition, or travel over some distance for several days. Aldo Leopold wrote that a wilderness should be able to absorb a pack trip of two weeks. Maine expeditions are typically shorter, averaging only about four days even on the St. John River.

Supply has meaning for policy because of its relation to demand levels and trends and to broader policy objectives. For example, there is often a choice as to what recreation experience or experiences should be featured in managing a given area. Within the constraints of any existing policy, judgments as to general supply adequacy may be invoked in reaching such a decision, but the meaning

of "adequate" supply is not always clear. In economic terms, adequacy might be viewed as a situation in which demand and supply meet at some equilibrium price. In actual practice, however, adequacy is often judged on the basis of observed, or assumed, crowding or undercapacity. Also, levels of facility availability can be compared with various proposed standards for availability per thousand population.

In economics, supply has a very specific meaning. It is a schedule depicting the amount of a good that will be provided to the market by suppliers at a range of prices. In Maine, there has been a particular reluctance to use the price mechanism as a management and allocation tool. This has been true in both public and private sectors. For this reason, we have seen little emphasis on the incremental cost of provision and on ways of analyzing recreation supply in relation to user willingness to pay. Thus far, supply has been described using physical proxies. Wouldn't it be intriguing, however, to know the cost schedules applicable to different levels of supply of wilderness backpacking, canoeing, camping, fishing, and hunting in the Maine Woods? The Bureau of Parks and Recreation develops land and facility statistics as part of the periodic State Comprehensive Outdoor Recreation Plan (SCORP) updates (1993 is most recent). For the present, a few brief points about supply in the larger sense can be made. First, in the Maine Woods, virtually all of the land is part of the supply or the backdrop for recreation. Much more is involved than the public ownerships, important as they are (Figures 34 and 35).

Supply and demand shift over time in response to larger social and economic changes:

- the interstate highway system;
- new equipment, such as outboards, recreational vehicles, and aircraft;
- demographics and public preferences;
- monetary exchange rates; and
- promotional programs.

Because of the many forms of dispersed use of the Maine Woods (Figure 36), our standard ways of counting supply are of limited relevance for assessing conditions and trends. Clearly, the relevant dimensions of supply depend on which activity is being measured. In addition to being more difficult to count, dispersed visits are often multipurpose in nature; each visit may incorporate more than one facility, activity, or feature. Certainly it is useful to continue carefully counting the facts about facilities, land acreages, and trail mileages, but serious

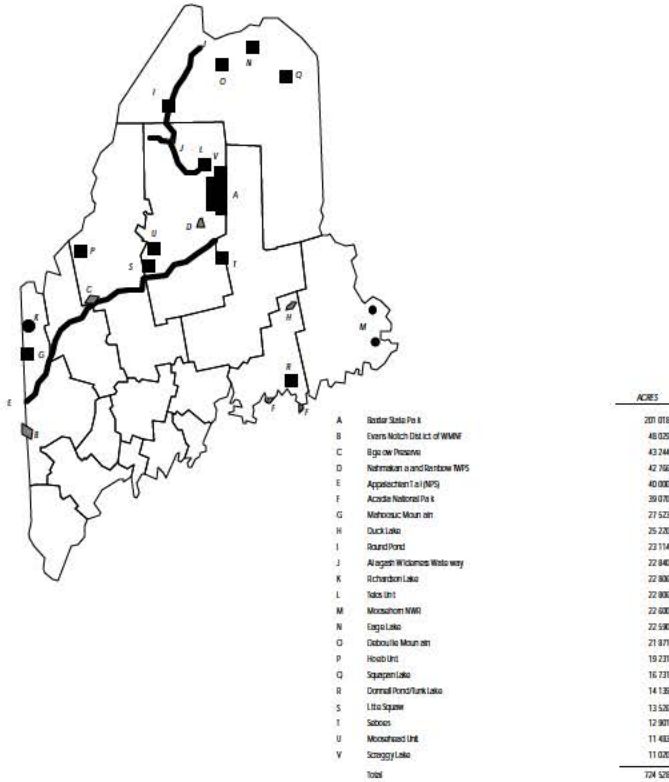


Figure 34. Major public ownerships, Maine woods, schematic. Source: Maine Bureau of Parks and Recreation (1993) and Bureau of Public Lands.

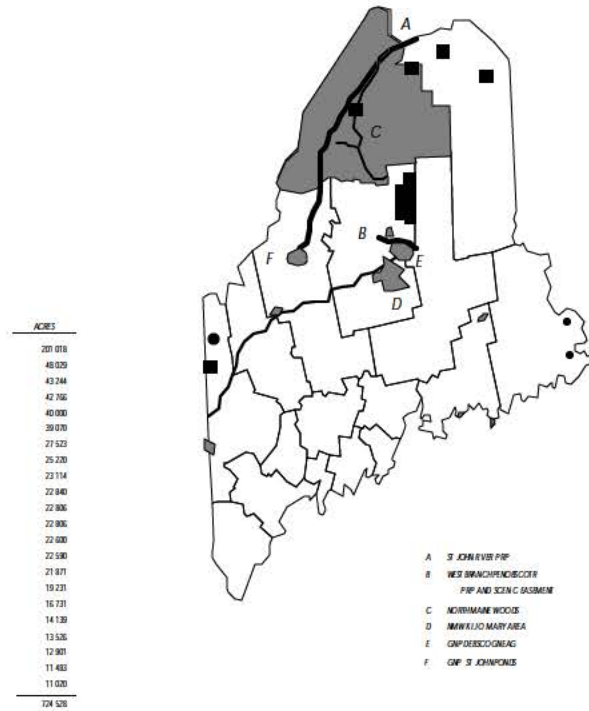


Figure 35. Major private/cooperative recreation management efforts in the Maine woods, schematic. Tribal lands, managed under separate fish and game laws, not shown. Source: Maine Bureau of Parks and Recreation (1993).

research on practical methods of providing a richer and more complete assessment of effective supply for dispersed recreation is needed (see Irland and Rumpf 1980; Hudnut and Golden n.d.; Cordell et al. 1990).

At present, some major dimensions of the Maine Woods visitors' overall experience—the appearance of the landscape, the level of crowding, or noise levels—are not regularly monitored at all, though occasional visitor surveys at individual areas provide some user reactions. Certainly a step in the right direction might include pilot testing some proxies for these values at a sample of key points. In this richer approach to supply, ownership as such loses meaning. Some elements of a more complete supply picture are listed in Table 22.

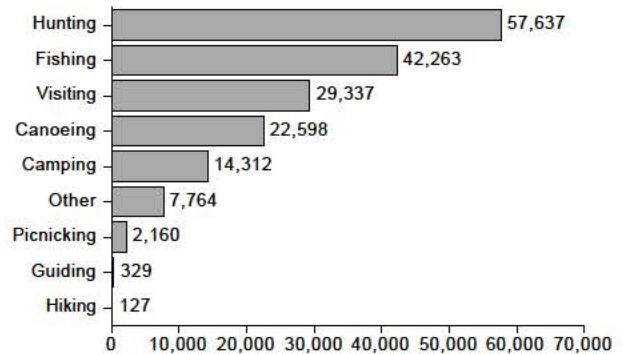


Figure 36. North Maine woods: Annual visitor days by purpose. Long-term average, 1976–1991. Average total visitor days 176,568. Source: North Maine Woods, unpubl. data.

Table 22. Elements in an assessment of recreation supply.

---

A.	Quantitative
	1. Public acres
	2. Easements as on Penobscot River
	3. Regulatory measures
	4. Private lands dedicated to public recreation
	5. Private, available
	6. Privatized — public excluded
	7. Total working landscape
B.	Qualitative
	1. Level of crowding
	2. Noise
	3. Natural/modified appearance of landscape
	a. At destination site
	b. Along travel corridor into Woods
	4. Condition of trails/sites, e.g., trampling, erosion, litter...
	5. Distance/time to reach a given level of quality of experience
	6. Recreation opportunity spectrum
	7. Visibility—air quality

---

It would be hard to deny that the availability of a remote, wild experience in which motorized recreationists are not encountered has declined dramatically. To some people, this simply mirrors the improvements in supply of other forms of recreation. Regardless of the specific activities being pursued, however, we are likely to see an increase in visitor skepticism or outright hostility to timber cutting and to visible evidence of intensive forest management.

While ownership itself is not a critical point in defining supply, Maine's unique mixture of ownerships is a significant factor in defining opportunities and constraints to supply. The Maine Woods' forests are primarily privately owned. The public ownerships can only be reached by floatplane or by travel over privately owned roads. In most instances the private ownerships are scattered in ways reminiscent of the checkerboard ownerships seen in parts of the West. Also, many townships are owned in common and undivided tenancy by several different owners which may have different objectives and policies. All in all, this is a challenging situation for managing backcountry recreation.

### HOW THE WOODS ARE USED

The Maine Woods is essentially a privately owned backcountry, virtually all of it open to recreationists (see Governor's Commission on Outdoor Recreation in Maine 1986). This has contributed to the development of a series of innovative

cooperative enterprises providing recreation experiences and opportunities on privately owned land (Figure 37). These include the following:

**North Maine Woods**—A cooperative formed by major North Woods landowners to manage recreational uses and campsites in a 2.5 million acre region of northwestern Maine. NMW even manages several campsites on public lands.

**Maine Forest Service Campsite Program**—Manages primitive campsites on private lands in much of the region.

**Allagash Wilderness Waterway**—Is managed by the state but is reached over private roads. The Waterway includes a narrow strip owned by the state, and a one-mile buffer within which the state can regulate management practices to protect the riverway.

**West Branch**—Great Northern Paper Co. and the State jointly manage river uses along the West Branch of the Penobscot below Ripogenus Dam.

**High Adventure Camp**—In the past, the Boy Scouts of America managed a High Adventure Camp based on leased private land at Grand Lake Matagamon.

**The Appalachian Trail**—This corridor is now federally owned, but its management involves cooperative work by the state, by adjacent landowners, and by the trail community.

**Snowmobile Clubs**—Numerous snowmobile clubs operate extensive trail systems around the state for their members, relying on working relationships with private landowners.

**Moose River Bow Trip**—A famous canoe trip in western Maine. The lands involved include those of several private owners, major conservation easements, and a major public property.

The region's history of mixed ownership has required the owners to develop habits of cooperation in order to achieve their individual objectives. These habits have led to a number of important programs. In setting priorities for recreation research nationally, high priority should be given to carefully evaluating the effectiveness and cost of these programs, to see in what ways they might be more widely applied.

The mix of uses in the Maine Woods is broad, ranging from sporting camps to guided rafting expeditions. Each use defines a pattern of natural

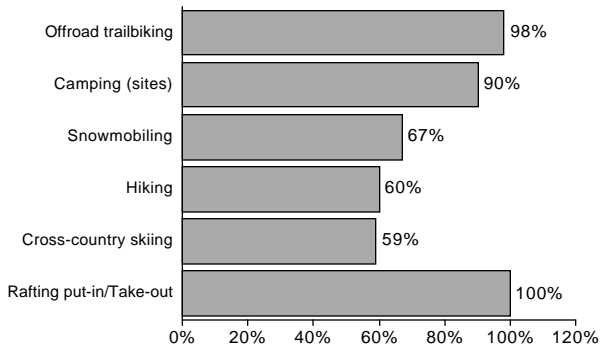


Figure 37. Private land share of supply, statewide. Management is often by private-public agency partnership or contract. Source: Maine Bureau of Parks and Recreation (1994).

resource conditions, facilities, and management programs needed to enable that use to occur or to grow. The differing resource and management needs for these activities prevent summarizing the supply picture in any simple set of statistics or even maps.

Major uses of the Maine Woods share a few other traits that are significant for identifying supply. First, most major uses are highly mechanized and capital intensive. This affects the portions of the Woods likely to be used and facilities needed at the destinations. It may affect ability, if not willingness, to pay. Second, uses are highly skewed in the important dimensions of usage levels per acre or site, of usage over time, and of usage levels by individuals.

### SKEWNESS IN USE PATTERNS: IMPLICATIONS FOR SUPPLY ASSESSMENT

There are three forms of skewness in use patterns that reflect the interaction of supply and demand. Skewness is just unevenness, or deviation from symmetry—statistically, a situation in which the mean and the median diverge, often widely.

The distribution of number of users by frequency of use is highly skewed. Some activities are once in a lifetime or infrequent events. They have long planning times, and bring with them powerful emotional associations. They often occur on the occasion of particularly significant life events, such as the majority of a son or daughter or, as in the case of the canoeists Aldo Leopold met on the Flambeau, a last wilderness voyage before entering military service. Such expeditions are long remembered, with the aid of photo albums and camcorders.

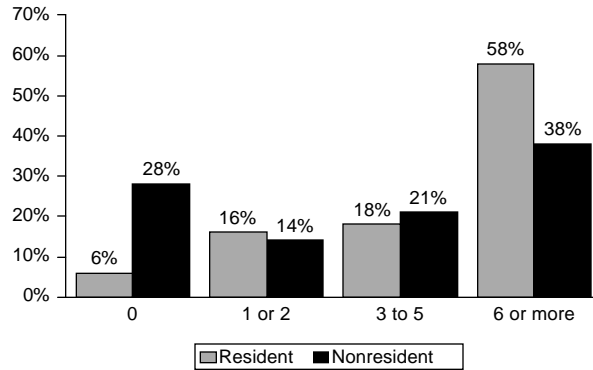


Figure 38. Skewness: Individuals' number of previous visits to Allagash Wilderness Waterway (users queried spring 1990). Source: Zinn (1990:26).

In contrast, most of the user days in the Woods are regular visits, often brief ones, by nearby residents who know what to expect and how to do it. Their styles of recreation and their needs are likely to be very different from the visiting urbanite seeking a memorable experience, an expedition in the wilds. For many of these resident users, the Maine Woods are their neighborhood fishin' hole. For example, in spring 1990, Zinn (1990) found that 28% of nonresident Allagash visitors were on their first visit, but only 6% of the residents (Figure 38).

A key strategic fact is the prevalence of skewness in time—peaking. Concentrated use on peak weekends is probably the most important single source of recreation supply/demand imbalances and use conflicts. Because of the way our society organizes work and play, the bulk of all recreation use of wildlands occurs on some 20 days per year, or perhaps nine days in the growing season. For biological and regulatory reasons, hunting and fishing are often confined to brief periods. For hydrologic reasons, rafting and canoeing are at their best only for brief periods.

In the North Maine Woods area, 39% of total annual nonwinter use occurs during October and November, with the latter by far the biggest month of the year. In Baxter Park, 50% of all visits occur in two months—July and August (Baxter Park Authority 1992). In the state parks statewide, annual usage is dominated by the 25 peak days (Table 23). So supply needs to have a time dimension as well as an acreage or “persons at one time” dimension. Expanding capacity to deal with brief peak loads may make no sense in view of available alternatives.

Table 23. Peak day attendance, sample of Maine state parks, typical year, late 1980s

Activity (no. parks)	Percentage of Annual Visits Occurring on 25 Peak Days
Swimming (15)	61%
Picnicking (34)	53%
Camping (12)	35%
Hiking (6)	56%

Note: Not all of these parks are in the wildlands.  
 Source: Maine Bureau of Parks and Recreation (1994).

Also, the level of use per acre is highly skewed. The number of rafters per river mile at any one time or over an entire year varies by orders of magnitude, from excessive crowding on some rivers to virtual isolation on others. According to a study for the Bureau of Parks and Recreation, “over 70% of the statewide total of 300,000 plus annual user days are concentrated on ten moderate-high use and high use river segments...the lower Kennebec and Penobscot river segments...account for over half of the total recreational use on the study rivers” (Hardy 1985). Because of access, distance, and visitor preferences, use levels for most activities vary in a similar manner.

In Baxter Park, vacancy rates ranged from 6.6% to 46.8% in the ten developed campsites (1991) and from 18.2% to 76.7% in four outlying sites. Fully 59% of all hiking occurred on just two trails. Similarly, the visitation to North Maine Woods, by access point, is highly skewed (Figure 39).

The skewness concept reminds us that two very different kinds of recreation are trying to coexist on the same resource. Wilderness canoeists are seeking a wilderness experience on the same ponds and streams that local residents use every week as their backyard fishing hole. Naturally, styles of recre-

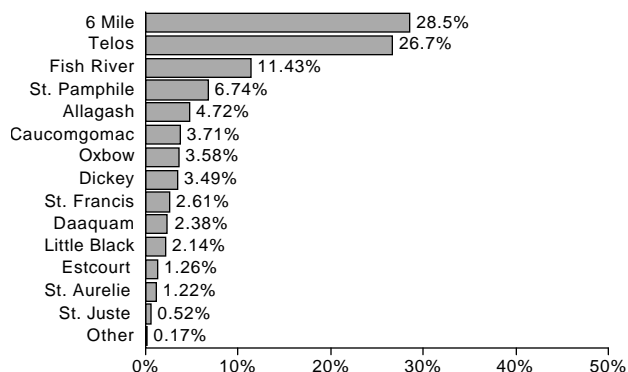


Figure 39. North Maine Woods visitor days by entrance average, 1976-1991. Source: North Maine Woods, unpubl. data.

ation use differ. These styles may exaggerate cultural or other differences between the groups. Differing places of residence do not facilitate the development of improved mutual understanding.

### FORCES AFFECTING SUPPLY

The first force is the development of facilities, such as campsites, boat landings, trails, or information signs. Though much of the use of the Maine Woods is of a dispersed character, very little of it involves campers setting up tents on a totally virgin site. In many areas, such freedom of action is specifically prohibited. Also the rising level of recreational use itself affects supply by reducing opportunities for some forms of recreation and by changing their quality (Manning 1986).

The land market and demand for leisure lots expands supply of individually owned camps and campsites while changing the supply of other opportunities (on the land market, see Irland Group 1989). Ownership change and parcel fragmentation are making long travel corridors, streams, and trails harder to manage.

A major concern is the privatization of spaces and facilities that once served visitors in large numbers and now are owned by individuals and families. As an example, former sporting camps are being “condoized” because these camps are unable to return a profit on their inflated land values; they end up being divided and sold. The condoized units are used by small groups and often stand empty. Doubtless the local spending flows per unit decline from what the former commercial camps generated. More important, the number of visitors supported by a given facility declines. This may in some places have a useful effect in reducing crowding or fishing pressure, but it is clearly a reduction in supply. In southern Maine, commercial campgrounds are being converted to condos and private leisure properties with significant effect on capacity. Large parcel leasing to sporting clubs by paper companies has received a great deal of attention compared to the area affected.

Subdivision of remote lakeshores is another example of privatization. Surely, wildland lakeshores support little shoreside fishing or walking—who likes picking their way through marshes, over boulders, and dri-ki (the local term for masses of driftwood that accumulate on some shores)? Nevertheless, privatization of these shores still affects supply in profound and likely permanent ways.

Spaces and facilities formerly serving the many now serve the few. Yet privatization, properly managed, can help maintain wildness and low use levels. There are places, such as Kennebago Lake in

western Maine, where a form of privatization is helping to maintain quality fisheries that still remain available to many people. We should keep managed, selective privatization in our toolkit as a possible management tool.

Roading of the wildlands for timber management is not yet complete. As it proceeds, it increases supply for many users, while diminishing or modifying opportunities for others. Roading certainly radically changes quality. It is a commonplace that a nearby road eliminates a quality trout fishery and increases hunting and trapping pressure. The Land Use Regulation Commission (LURC) attempts to protect remote ponds through regulation (Land Use Regulation Commission 1983; 1987). Yet as snowmobiles allow year-round access to the deepest portions of the Woods, attempts to manage use pressures become increasingly ineffective. Where efforts to improve fishing in individual ponds succeed, the benefits are lost in a matter of days as fishing pressure escalates when they are opened (see Chapter 11).

One of the critical effects of the land market is shadow conversion, a concept from the farmland preservation field. When a farmer subdivides road frontage, three to five acres may be compromised for future farm use for each acre actually built on. The ratio for some forms of backcountry recreation may be much higher than this. The users for whom remoteness is critical are likely to be highly sensitive to changes in the natural appearance of the landscape, in use levels, and in conflicting uses. One motorized canoe can ruin the feeling of silence on a river for an hour...thereby depleting the experience of the whole day for such users. Other users would not be affected at all. For many users, the sounds of logging and hauling are intrusive. Aldo Leopold's essay "Flambeau" (Leopold 1966) says it all as it described the Wisconsin Department of Natural Resources efforts to restore wildness there. Flambeau was written long before the concept of shadow conversion was invented. There remain many little known places that stay quiet; part of the art of wilderness use is learning where they are.

Even minimal development can have a major effect over a wide area. One lantern by night on the porch of a lakeside camp reduces or eliminates the remote feeling of an entire lake for a viewer on the opposite shoreline. As Herb Hartman (1992) notes, 1,000 lakefront camps have been permitted in the wildlands in recent years. Does anyone really think that their effect on wildness is confined to the two acres on which they each stand? On the other hand, some uses, such as rafting and kayaking on some of our famous rivers, are highly resilient. Recre-

ationists have breathlessly depicted the West Branch below Ripogenus Dam as a "wilderness," despite its

1. managed water flows;
2. traffic jams at put-ins/takeouts;
3. log haul road, trucks, noise and dust;
4. penstocks;
5. power lines;
6. bridges;
7. limited evidence of cutting; and
8. different uses struggling for primacy.

## MANAGING COMPETING USES AND PEAKING

Maine cannot afford many large single-use allocations of land. Instead, officials and user groups must exploit the large gains that may be had from managing competing uses better. They need to give recreationists better information on the multiple ownership/multiple use landscape so they know what to expect. Resort naturalists are used in the Midwest to reach resort guests with information on the outdoors and on forest management. Maps and other informational and promotional materials for users need to be reviewed for these opportunities. The North Maine Woods newsletter is an excellent example. Examples of a few of the possibilities are in Table 24 (see also, Cole et al. 1987; other surveys are found in Lime 1990; Manning 1986; Vanderstoep 1991).

In particular, large gains are available from managing peaking better. This is being done on the Penobscot and Kennebec rivers to manage overuse by rafters on peak weekends. The experience has shown how difficult it can be. Even minor success in spreading usage from the peaks to less busy periods can significantly reduce congestion and improve the quality of the experience.

Table 24. Options for coping with excess demands.

- 
- |    |                                                                                                                                                                                                             |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A. | Cultivate cooperation between single use groups: <ol style="list-style-type: none"> <li>1. Time sharing.</li> <li>2. Technology — quieter motors.</li> <li>3. Exploit natural complementarities.</li> </ol> |
| B. | Inform users on capacity/crowding on a real time basis.                                                                                                                                                     |
| C. | Permit and reservation systems.                                                                                                                                                                             |
| D. | Capacity augmentation or site hardening.                                                                                                                                                                    |
| E. | Selective capacity reduction or access constraint.                                                                                                                                                          |
| F. | Tightly control activities producing excessive shadow conversion effects.                                                                                                                                   |
-

Certainly, costs, access points, and administrative requirements will limit the feasibility of these approaches. The costs in reduced user autonomy are balanced by improvements in quality of the experience for at least some users. Striking the balance in ways that are acceptable to users, however, is far easier said than done. If the Maine Woods symbolize anything, it is probably freedom. Visitors value this freedom highly. Management measures that encroach on visitor freedom will require careful implementation, much explanation, and time to readjust when needed.

### DAVY CROCKETT ECONOMICS

Many recreationists feel that the use of the outdoors ought to be free of charge. This is what I call "Davy Crockett Economics." It is consistent with the associations of freedom that outdoor activities bring with them. It is also, to put it bluntly, fairly self-serving for the users. If wildland uses generated no costs at all, then use fees would not be needed for cost recovery. If use levels were nominal as they were most places a hundred years ago, fees or regulations would not be needed for peak management or to ration access.

The Maine Woods, however, cannot meet all of the public and private needs any more. Conflicts between recreational users and different uses are now common. Conflicts between timber cutting and hauling and recreational uses can be managed, but they are real. And landowner rights to control their property and benefit from its use must also be considered. Finally, providing recreation costs money (Reiling and Anderson 1983), about which another whole paper could (and should) be written. A useful framework for analyzing what recreation in the Maine Woods costs might be a set of consoli-

dated proformas and a business plan. With these proformas, one could see assets and liabilities, costs and revenues, who is paying and who is not. We could develop an approach to estimating the costs of a higher quality program.

There is no reason to subsidize most of the visitors to the Woods. Most have the means to pay. Users of developed sites expect to pay, but may have unrealistic facility expectations. Studies show (Table 25) that users place a high value on backcountry experiences. These values were obtained from a literature review of studies available in 1982. If this value is real, it should be visible in actual willingness to pay. So Davy Crockett economics is obsolete. Instead of keeping rates low for everyone, there are many ways we can give concessionary prices to deserving groups. The pricing mechanism has many uses...but that's also another paper (see Martin 1984).

### POLITICAL AND SOCIAL FACTORS

Recreation policies end up being determined, one at a time, in a political marketplace in which competing interests attempt to devise workable truces over the major issues that divide them. One result is that important, widely shared interests, not advanced by large and vocal lobby groups, get shoved aside. Matters are growing more complex. We now have intense interest in the Maine Woods by local, statewide, and national groups, which are usually interested in only a single use or uses. Many of these groups believe they hold vested property rights in some status quo or some opportunity. Often they can be extremely intolerant. On the one hand, noisy opposition has been raised to developing an ORV trail at Mount Blue State Park. On the other, the snowmobile lobby successfully pressed for admission to Baxter Park—they could not stand being kept out of one percent of the state.

In these political struggles, participants are all too eager to put a black hat on the other person's head. There is no willingness to recognize that we are often choosing between competing goods, not between good and evil. This trend in our political culture bodes ill for the kinds of measures needed in the Maine Woods.

### REFLECTIONS

A substantial recreation enterprise is ongoing in the Maine Woods on millions of acres of private land and intermingled public land. This enterprise is managed by a series of private, private-public, and public programs.

Table 25. Estimated willingness to pay values updated to 1992.

	\$/Activity Day 1982 (mean)	1992 Value
Wilderness	13–23 (18)	26
Nonmotorized boating	6–33 (20)	29
Hiking	8–26 (17)	25
Coldwater fishing	8–26 (17)	25
Camping undeveloped		
to developed	6–18 (12)	17
Big game hunting	18–65 (41)	59

Source: Sorg and Loomis (1984). With extreme highs deleted. Adjusted to 1992 by 45% increase in CPI.



The Maine Woods offer a distinctive value—as a setting for recreationists seeking remoteness and wildness. This value connects to conservation values held by many nonusers who will be a growing influence on policy, as we are already seeing. At the same time, the wildlands are a backyard fishing hole and snowmobiling ground for local residents who are looking for very different kinds of experiences. These people hold strong proprietary feelings about their freedom to do as they please, wherever they please, whenever they please, in “our forests.”

What is surprising, is how well the present system has worked for most of the recreational users. This is not to downplay the many problems and emerging concerns, only to put them in perspective. Surely, there are deficiencies and areas for improvement, and we have not yet learned all the lessons from this experience.

Supply/demand imbalances are more severe in the settled portion of the state than in the “Maine Woods.” Relative to the number of users, the wildlands are well endowed with public and private lands available for recreation. The imbalances in southern Maine affect far larger numbers of people. So it will be difficult to focus government attention on the issues of recreation in the wildlands. In a 1986 Conservation Department survey, only 3% of respondents mentioned recreation/wildlife as a major concern facing the Maine Woods. Yet the same sample placed wildness as the top priority in their personal interests in the forest.

In our ten million acres of wildlands, Maine can't afford the single use mindset—there is just not enough room. Users and managers must learn better ways to manage use conflict and peaking, and to explain these policies effectively to users. The tendency in our civic culture, however, is in the direction of polarization not accommodation. Getting more of what all parties want, retaining quality remote experiences, enhancing quality in heavily used areas, and accommodating new trends will all cost money and take careful management. As a first step, someone needs to prepare a business plan and proforma financial statements for the management of wildland recreation in Maine's backcountry.

Many major issues of the Maine Woods' future only peripherally concern recreation. Various possible forest futures will have different impacts on recreation users. Maine landowners, recreation users, and governments need to develop a vision of a desired future for the kinds of recreation the Maine Woods should provide, and how to better accommodate competing demands. Such a vision would be a useful focus for further discussion. While an overall vision will be useful, it is only a beginning. The policies, partnerships, and practices that are working in the Maine Woods took time to develop. They emerged from groups of people solving specific problems, one at a time, and not from a grand planning process. Perhaps there is a lesson in this as well.

## 10. Backpacking and Day Hikes: Resources, Opportunities, and Challenges for Public Ways in Maine

Trail corridors, termed public ways for this article, range in length, notoriety, use level, and importance from the Appalachian Trail to local snowmobile and firetower trails. At a time of major change in landownership, prices, and uses, a concern for the future of existing public ways is prudent. We should pay close attention to potential future public ways of state and regional importance that could be foreclosed unless they are identified and attended to promptly. While this chapter addresses Maine conditions, the issues raised certainly apply around the Northeast.

The term “public ways,” as used here, includes linear corridors accommodating a wide range of motorized and nonmotorized recreational activities. The term connotes a designated travelled way, possibly accompanied by a wider protective corridor, and it involves some existing or planned management scheme. This chapter discusses only areas outside of urban and suburban areas. Public ways often cross private land and may entail a fee for use or even be operated as a business. Congestion, not access, is already a widespread problem. The existing level of informal use of forest and rural land is already causing problems and risks for many landowners. According to Maine’s Bureau of Parks and Recreation, most recreation activities using trails are increasing (Figure 40).

A good deal of work has been done on identifying and protecting corridors like the Appalachian Trail. Social science and polling research enable us

to characterize the users of these trails, their aspirations, and their attitudes about management practices and use trends (see Manning 1986). Costs of provision have been studied, primarily for camping (Reiling and Anderson 1983).

A major portion of the demand, however, is not well understood. This consists of local day use, with visits frequently spontaneous and only a few hours in length. The availability of such opportunities is a key element of Maine’s quality of life. Because day use is so spontaneous and informal, it has no organized constituency, it is difficult to administer, and cost recovery is usually impractical. For this reason, the day use oriented forms of public ways have received far less policy attention than have the major hiking trails and snowmobile trails.

### EXISTING PUBLIC ACCESS OPPORTUNITIES

Maine ranks near the bottom of the states in publicly owned acreage as a percentage of total state area, but the wildlands have seen an increase in access opportunities as the private forest road network expands. Land available for public outdoor recreation use was lowest in the more settled areas of the state (Figure 41).

In addition to public and private nonprofit landholdings (i.e., Nature Conservancy, Maine Audubon, National Audubon, University of Maine Forest), Mainers have enjoyed access to private forest landholdings of over 17 million acres. Where

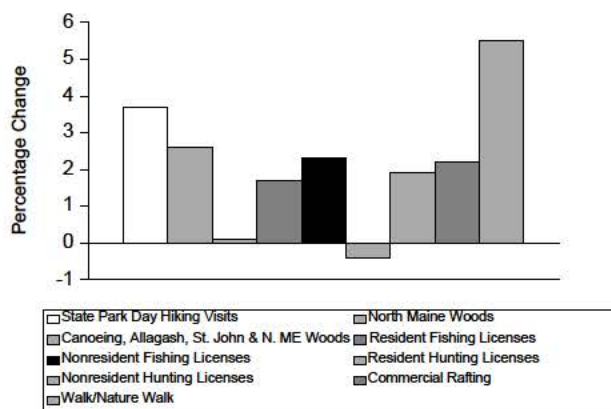


Figure 40. Average annual percentage change in use, 1970s to 1990s. Note: consult original source for annual data. Source: Maine Bureau of Parks and Recreation (1994:17–22, Appendix D).

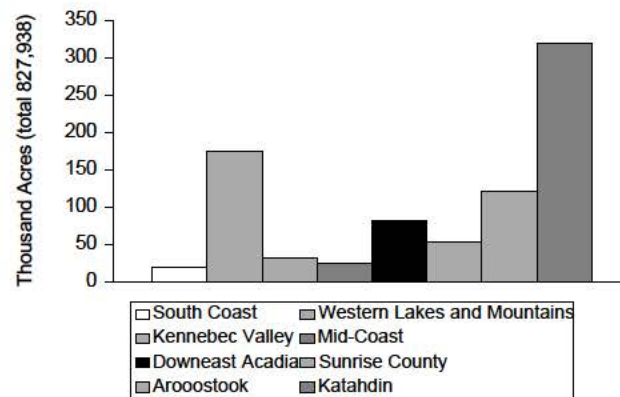


Figure 41. Land acres for recreation by travel region. Source: Maine Bureau of Parks and Recreation (1988); SCORP, pp. iv–20.

landowners have felt the need to manage for recreation, access fees have been imposed as in the case of North Maine Woods. Exclusive hunting or fishing leases and camplots have diminished accessibility, although not significantly. In parts of the state, land ownership patterns have made regulated access unfeasible. In addition, changing ownership patterns will continue to affect the nonindustrial landowners (see Governor's Commission on Outdoor Recreation in Maine 1986).

Maine's tourism industry caters to more than 6 million people each year. Availability of public ways is increasingly important to this industry. Based on increasing interest and demand, the Bureau of Parks and Recreation identifies the need to increase trails for "multi use" such as hiking, ski touring, nature walks, snowmobiling, and biking. The Bureau's inventory found that most of the recognized corridor mileage is in snowmobile trails (Figure 42).

Since many of these activities are day use oriented, recreationists depend on 'permissive access' to private lands not readily inventoried. Power lines owned or leased by Central Maine Power, Bangor Hydro, and Maine Public Service are used by bikers, cross country skiers, and hikers, although recreational use of the power lines is not promoted. There are an estimated 3,400 miles of power transmission lines in the state.

The state has worked with municipalities to discover forgotten right of way opportunities (Maine State Planning Office 1986). A handbook was developed to help towns in this pursuit. The state is currently focusing on better inventories of public

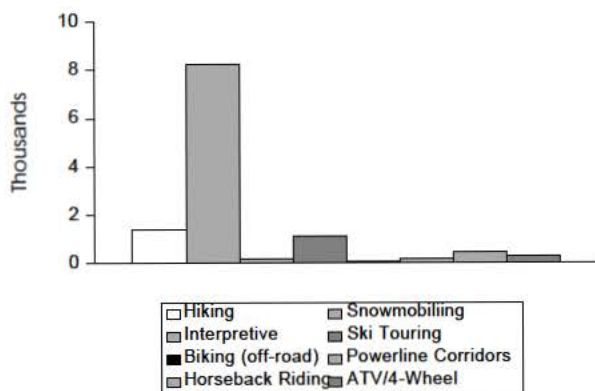


Figure 42. Miles of trails available. Source: Maine Bureau of Parks and Recreation (1993); SCORP Appendix N, p. 3.

and private networks to satisfy recreational demands (i.e., railroad rights of way, municipal and county abandoned roads, abandoned fire tower trails).

## POTENTIAL FOR ADDITIONAL PUBLIC WAYS

Maine clearly offers the potential for developing additional day-use and long distance public ways for walking, cross-country skiing, snowmobiles, and ATVs, as well as emerging uses such as mountain biking and horseback riding. In addition, abundant opportunities remain for securing access easements for hunting and fishing. The strip development built in Maine's current land boom has cut off access to large expanses of woodland, but providing access to the backland areas affected should not be difficult.

Protection, access development, and management of river corridors have received abundant attention, partially due to the organized constituencies supporting river protection (Hardy 1985; Maine Office of Legislative Assistants 1984; Maine Bureau of Parks and Recreation 1982).

Efforts have been underway for some time to secure and manage abandoned rail rights of way for walking paths. A key difficulty with this concept is that the railroad holder rarely owns the fee simple interest in the land. It only owns a right of passage that does not include the right to hike and picnic.

The ability to take an informal walk in the woods, once considered a normal part of rural life, is disappearing rapidly in many parts of rural Maine. In 1982, a U.S. Forest Service survey found that only 8% of Maine's private land was posted, but in parts of southern Maine posting affected up to 28% of the acreage (Birch 1986). A phone survey of citizens for the Department of Conservation found that of the respondents visiting the woods, 51% had found no trespassing signs recently in areas they had previously visited (Maine Department of Conservation 1986). Also, 45% of the respondents had found development precluding the use of lands previously visited. A survey of Maine small forest owners in 1990 found that 37% posted their land (Maine Tomorrow 1991). Just over 60% allowed hunting, and a similar proportion permitted hiking and bird watching.

With escalating public use, more litter, vandalism, and discourtesy, and even dumping of hazardous materials are plaguing landowners. In order to retain public access to private land, these problems need to be solved. Efforts such as the Maine Forest Products Council's Project Landshare need encouragement and support (see American Bar Associa-

tion n.d.; University of Maine Land and Water Resource Center 1988; Becker 1991; Noble 1991; Wulff 1991).

A public way is not truly established and useful without the provision of safe parking for the users' vehicles. This can consume considerable space when trailers are involved, as is true for snowmobiling and horseback riding. Significant costs for land, for construction, and for maintenance must be funded.

An obvious constraint to developing public access for recreation is the lack of suitable entities capable of management. Management includes upkeep, provisions for parking, facilities and trash disposal, fire protection and safety to name a few. For commercial forest landowners, at least partial recovery of management costs associated with recreation is needed to keep access open. On the Maine islands, the Maine Island Trail Association maintains a kayak "trail" through a cooperative effort (see Conkling 1981).

Legal issues and liability are additional constraints. The Great Ponds Act establishes that the public owns ponds of 10 acres and greater (Smith 1950). The public's rights of access, however, do not include a right to drive free of charge on private roads (Maine Office of Policy and Legal Analysis 1986; Maine Commission on Outdoor Recreation 1988). For landowners permitting access for the snowmobile program, the state provides liability insurance.

Given past experience with the Appalachian Trail, many landowners are likely to be skeptical of new public way proposals. They may not believe that informal ways based on limited interests in the land will remain that way for very long.

## CONCLUSIONS

The demand for Public Ways arises from a wide array of uses involving both direct demand for trail use as well as a need for access to other activities. Much of this use is informal. The existing resource is not well inventoried. While demands and use trends are well understood for activities like overnight backpacking and snowmobiling, they are poorly documented for most informal day uses (University of Maine Land and Water Resources Center 1988)

There is a contradiction here. On many beaches and in campsites and at major trailheads, heavy congestion is now the rule on peak weekends. For those managing these areas, access hardly seems a problem. In fact, there is regulatory concern over developing roads close to "remote ponds," which quickly eliminates prime fishing opportunities. In

many backcountry situations, the problem is over-use and crowding, not access.

Existing and potential opportunities for both informal forest recreation and for longer trip-oriented activities are diminishing because of changing land markets, increasing use pressures, and the strains being imposed on private landowners.

Public ways are a valid public concern for several reasons:

- a high availability of informal and backwoods recreation is an essential element in Maine's quality of life and sense of place;
- the availability of recreational opportunities is important to the state's tourism industry; and
- since demand for many activities is not represented by well-organized constituencies, federal, state, and local governments must play a role in identifying and meeting these needs.

There is no well-organized citizen constituency for day use trails. This is one reason for a lack of policy attention. Others are the lack of suitable organizations to implement needed management, the difficulty of cost recovery for primarily day-use activities, and the fact that state and municipal agencies are already overloaded maintaining existing facilities and meeting existing demands.

Some of the promising immediate opportunities are

- finding ways to mobilize suitable county, regional, and private agencies to own, manage, and develop public ways;
- promoting self-help by other groups following the model successfully used by many snowmobile clubs;
- ensuring that growth management and other planning processes make good faith efforts to identify existing and potential public ways;
- ensuring that innovative methods are employed during the permitting of large developments to find workable ways to continue to maintain traditional public use opportunities while allowing developments to proceed; and
- accelerate efforts to address legitimate landowner concerns raised by public use of private lands.

Considering the importance of public access to rural and wildlands to Maine's quality of life and,

indeed, its sense of place, a bolder set of initiatives should be considered. These might include

- a legislative resolve or other policy statement recognizing the significance of ready access to rural land and setting a general long-range goal for per capita availability;
- a specific funding mechanism for supporting public ways;
- create a public-private coalition of groups with an interest in the issue of access for day use recreation; and
- enhance county and local institutional capacity to develop and manage public recreation facilities in general.

Technical assistance supplied through Regional Planning Agencies would be a key element. Progress on this larger program will involve placing this issue far higher on the public agenda than it is now. A major effort of assessment and awareness-building would be needed. This is a major opportunity for citizen environmental groups to exert leadership on an issue of regional importance.

## 11. Lessons of Jo-Mary Pond: Reflections on Fish, Wildlife, and Forests

Citizens and professionals alike are concerned today with sound stewardship of the natural world that sustains us all. The professions of forest, fish, and wildlife management work with different facets of the same ecosystem. The fish restoration project at Jo-Mary Pond supplies a fine metaphor for the challenges facing us. What happened there? A small pond was closed to fishing for four years and carefully studied. A population of large trout developed there. The pond was fished out of legal-sized fish in two days. On the first day, there were as many people fishing as there were legal-size fish!

### JO-MARY POND

Several broader themes are illustrated by the events at Jo-Mary Pond. A resource management practice—the four-year closure—met its objectives. The pond was restored to a quality wild trout population, whose characteristics were well understood. The resulting benefits were thrown away in two days because it was impossible to control the level of use. Even a low use level over a season would have had the same result. There were no bad guys. No logging, no pesticides, no silt, no developers. Opening day saw a traffic jam and ten users per acre—the users did not even enjoy a quality fishing experience as they depleted the stock.

Economists have theories about natural resources that apply to experiences like this. The lesson is that more and more of our conflicts over fish, game, and forestry are conflicts without bad guys. They are increasingly caused by the difficulty of managing resource users.

Managers can do the biology correctly: the restocked ponds, restored turkey populations, the larch plantations attest to this, but we must become more adept at controlling the users so the benefits are not quickly lost. An example from forestry is the spruce-fir forest. Simulations show that, other conditions and policies being equal, a reduction in current cutting of spruce-fir can have a large effect on the condition of the forest 40 years hence. How to achieve this, however, is another matter. Compared to other resource management problems, the large brook trout in Jo-Mary Pond can be restored quickly, far more quickly than silted up salmon spawning areas or unmanaged, budworm-killed spruce stands.

Society is in the midst of a transition to a new world in which management can no longer ignore the burgeoning demand for resources and recreation. For a time, the most awesome demand was simply the market for land. Speculative land sales

and sprawling development were compromising the results of much work in forest care. Biological skills are no longer enough. This thrusts professional land managers into a world of politics and controversy for which they are, by inclination, training, and experience, often ill prepared.

### IS GOOD FORESTRY GOOD WILDLIFE MANAGEMENT?

The focus of this question should move away from individual disciplines to a focus on sound land stewardship. Also, rather than on forestry, fish, or wildlife, it should focus on land management. The common concerns of management are

- balancing competing objectives;
- allocating the limited resources available;
- controlling users, be they loggers or hunters;
- balancing perspectives between individual acres and large land units;
- making landscape design decisions over time and space.

The question as stated above implies that foresters agree on what is good forestry. When getting down to particulars, though, foresters frequently disagree. I have stood on a roadside listening to a company forester explain how he would treat the stand before us. A colleague from the same company flatly predicted that it would not work. I can recall the same experience when seeking advice from two experts on how best to apply Bt against spruce budworm. I suspect this may occur in game and fish management as well.

### PROFESSIONAL SIMILARITIES AND DIFFERENCES

The professions of forestry, fisheries, and wildlife management share important similarities. Reflecting on how substantial those similarities are leads me to wonder why their perspectives on land management differ so sharply at times.

Common features that most deserve comment are

- They all manage different facets of the same land organism;
- The scientific basis for predicting treatment responses is weak; in each field, rule of thumb and poorly digested experience must substitute for more rigorous predictions;

- They are all concerned with maintaining a sustained yield of benefits over time;
- A principal goal is the ultimate harvest of a crop; in fact, the harvest itself is the key management tool in many cases.

The differences among our professions are significant:

- Each is responsible to outside constituencies which often perceive their interests to be in conflict.
- It is much more difficult to arrive at a synoptic view of a state's wildlife or fish resource than for forests. It is easy to obtain narrative and statistical overviews of a state's forests. Such is almost impossible for fish and wildlife—each species is reported separately. Imagine if forest inventories were reported in separate bulletins, using different concepts, for maple, for spruce, and for alder.
- The deepest difference is in ownership. Trees are owned by an individual or a government unit. On private or federal land, however, the landowner does not own the fish or game or water. Water is a public resource, held in trust by the state. Wildlife and fish are the property of the state—even on federal land.

### WHOSE COSTS AND WHOSE BENEFITS?

The facts of ownership, the diverse constituencies concerned with forest land, and the complex ecological interactions all produce situations where costs and benefits of resource use fail to converge on a single decision maker. A landowner who allows shoddy logging may silt up a stream bed and damage a public resource—the salmon. A landowner who allows public hunting and invests in improved habitat enjoys no increases revenue and may bear costs of inconvenience and vandalism. Any manager's decisions will be affected by who bears the costs. If someone else will pay the premiums, then I'll take a million dollars worth of life insurance.

The best decisions are made when a single decision-maker participates substantially in both the costs and gains arising from a decision. Too often in forestry, wildlife, and fish management this is not the case. For example, what streamside buffer management policy would a wildlife agency set on its own land, when its own balance sheet absorbs lost stumpage revenue? Taking a course in

economics will not make divergent perspectives vanish. It will not change the competing expectations of different constituencies, or the fact that choices must be made. Nor will a better understanding of theory remedy the fact that the experts simply have not documented the total costs of all management practices—much less the benefits. One thing economists can do is to apply critical thinking to assertions about costs and benefits. They can ask about long-run effects of better roads on fuel, vehicle maintenance, and road maintenance costs.

A good example, fortunately now obsolete, is the valuation of budworm-killed wood. It is natural to value this wood at current stumpage rates, but in the mid-1980s there was far more dead and dying spruce and fir than industry could ever use. This means that the marginal cord of dead fir was worth zero to society, and to the typical large landowner too.

### LEARNING PROFESSIONS

Scientists, landowners, managers, inventory specialists, and field technicians are all students of the land organism. They need to continually sharpen their ability to learn from science and from experience. They need to assure that good biology is not wasted through failure to manage the resource users. They need to lower the noise level of controversy in order to seek the best ways for separate disciplinary perspectives to contribute to sound land stewardship.

Professional skills are tools for learning more about the forest and related water ecosystem. Too often, however, managers present themselves as “the experts” who possess a library of immutable truths—others should recognize our stature and leave us alone. Constituencies, legislatures, and the general public need to know—the experts still have a lot to learn.

### CONCLUSION

The experts have yet to agree on what is good pine, good deer, good trout management. More seriously, the best biological prescriptions will fail without successful management of resource users. Will more experiences like Jo-Mary Pond produce any lasting benefit?

Landowners and the public expect good land stewardship. Indifference to sound forestry, fishery, and wildlife management will not do the job. Mere good will or agreement on generalizations will not change the fact that management consists always of choice, choice between alternative management emphases on a given acre, between com-

peting uses of a given dollar, between strongly held positions of competing constituencies.

I'd like to close with the words of a great leader in our profession of land stewardship, Aldo Leopold. He writes of his three sons (Leopold 1966: 215):

I hope to leave them good health, an education, and possibly even a competence. But what are they going to do with these things if there be no more deer in the hills, and no more quail in the coverts? No more snipe whistling in the meadow, no more piping of widgeons and chattering of teal as darkness covers the marshes; no more whistling of swift wings when the morning star pales in the east? And when the dawn-wind stirs through the ancient cottonwoods, and the gray light steals down from the hills over the old river sliding softly past its wide brown sand-bars—what if there be no more goose music?



## 12. Challenges for the North Maine Woods

---

The Maine Woods together with the rocky coast, provide enduring images and metaphors associated with Maine's sense of itself as a place. Cultural, social, and economic changes in our society have fostered a new period of ferment and debate over the forest, just at a time when the traditional bread-and-butter conservation issues appeared to be under control. A period of contention over spruce budworm spraying, forest practices legislation, and land development seemed to be simmering down. Yet a new period of even more bitter debate is emerging, in which more fundamental issues are being joined. A federally funded multi-year study examined policy issues in the wildland (Northern Forest Lands Council 1994). A major Maine conservation group has advocated a strict new zoning policy for the wildlands. National environmental groups have advocated a new national park around Cobscook Bay, and a Maine Woods National Park covering 3.2 million acres surrounding Baxter Park (Restore North 1994). A referendum to establish a strict forest practice regulatory scheme in the wildlands will be debated during 1996. It is important to get beneath the surface of these events. The shifting role of public ownership and regulation is a significant aspect of Maine public policy about forests. Maine's pattern of private forest ownership ensures this.

How have Maine's wildlands suddenly captured such national interest and publicity? Four themes tie together recent developments. First, values attached to the forest are clearly changing. Amidst all this, perceived threats to the forest are changing. Citizens are ever more aware of trends in land development, harvesting technology, and global climate as they affect Maine's forests. Also, management and policy tools for managing timber and the other resources of the forest are changing. Finally, a debate is developing once again over how to pay for conserving the important public benefits these forests provide.

### FOREST POLICY ISSUES: HISTORICAL VIEW

During the colonial period and well into the 19th century, the resources and geographic facts about Maine's forests were poorly understood. It was believed that their ultimate fate was to be settled by yeoman farmers. The principal thrust of policy during this period was to place these lands in the hands of settlers. Even when large sales were made to investor groups, the hope was that those

investors would find their profits by selling in turn to small owners who would farm the land. It must have quickly become clear that the opening of the Erie Canal and of the deep black soils of the corn belt permanently ended this hope, but land policy never adjusted to this change. The most successful public land policy Maine ever had was its decision to dispose of the lands, which it substantially accomplished by 1868 (Irland 1986). A small acreage of public reserved lands survived this disposal policy, to later become the nucleus of a new public land system for the state in the 1970s and 1980s.

Instead of farmers and settlers, landowners of the late 19th century found willing buyers in the paper companies, who were drawn to the region by its waterpower, abundant supplies of clean water, and reserves of spruce and fir timber, which were ideal for papermaking.

In the 1840s, Thoreau visited the Maine Woods over a water route that changed little even up to the 1960s. Until the advent of light aircraft, the few visitors to the deep Maine Woods hauled canoes over Mud Pond Carry and travelled much as Thoreau did. The well-to-do sports who visited the grand hotels at Rangeley and Kineo were relaxing in a more genteel and less strenuous manner, but still claimed to have seen the real Maine Woods.

During the years around 1900 when the rest of the country was engaged in contentious struggles over federal lands, conservation issues, and wildlife management, the policy debate in Maine was confined to narrower fields and was much more restrained. Forest fire control and insect and disease programs were established. No state land acquisition was undertaken or even widely advocated.

Forestry reformers (see Smith 1972) inveighed against the waste of timber and the destruction of regeneration by sloppy logging, and the loss of timber to fire. Their concern was with future wood supply at a time when national per capita use of lumber was at its historic peak. In a 1907 Opinion of the Justices (Maine Report 1907), the Maine Supreme Judicial Court opined that the state held constitutional authority to protect itself against loss of timber supply by regulating private landowners. More strikingly, in the hard times of the Depression, few Maine landowners accepted the offers of federal land acquirers, as they did in the South and Midwest. A small bit of the White Mountain National Forest slipped over into Maine almost by accident. Maine's first state park (Aroostook) was acquired by donation in the 1930s.

Maine forest policy since 1868 has always been about timber supply and recreation. The general policy of allowing free public access to the wildlands was sanctified by colonial ordinance and immemorial custom (Smith 1950). Those who wished to hunt or pursue canoe expeditions could do so. The farms and woodlots of southern Maine were available to hunters as well, and the lakes were large and little developed. So few Mainers felt a need for public land acquisition programs. During the 1970s, it took the Fish and Wildlife Department ten years to spend a small land acquisition bond issue. For some years, the “third sector” groups like the Maine Coast Heritage Trust and the Nature Conservancy were the principal actors in conservation land acquisition in Maine.

### CHANGING VALUES OF THE FOREST

In colonial and early statehood times, Maine’s forests were not seen as an enduring resource. It was assumed that they represented a passing, primitive phase of land use prior to settlement and agricultural development. These lands were to serve an egalitarian social policy inherited from Puritan times, in which cultivators willing to work would receive farmsteads at modest prices. Landowners harvested pine and spruce logs and then pulpwood from the wildlands for generations, and rearranged the rivers and lakes with dams and cuts when needed. When the age of electricity arrived, paper mills grew larger and then dominated the wood use picture in the wildlands. Visits to the Maine Woods by individuals not engaged in logging or other business were few; few recreationists were inconvenienced by the log drives which blocked the streams for several months each spring.

Few members of the general public thought about the forest. There was general acceptance of private ownership and private management. When Governor Percival Baxter attempted to persuade the legislature to preserve Mt. Katahdin as a public park, there was little public or legislative support. Baxter gave up talking to this legislative stone wall, and instead acquired the Park with his own fortune and donated it to the state (Hakola 1981).

In the 1970s, conflicts emerged over use values of the wildlands. How were timber and deer habitat to be balanced when they came into conflict? Should a federal hydroelectric dam (Dickey-Lincoln) be built that would flood 80,000 acres of forest to generate peaking power? How should the impacts of logging on streams and fish be controlled? How can the “visibility” of the region’s clean air be protected from air pollution? (U.S. EPA 1979; U.S. General Accounting Office 1990.) These were es-

entially industrial interests in conflict—controversies over which crop should take precedence. The governance and decision-making issues they raised were dealt with through existing institutions or by creating new instrumentalities like the Land Use Regulation Commission which administered closely circumscribed zoning powers over private decisions in the wildlands.

The conflict of values emerging in the late 1980s and early 1990s is of an entirely different character. The past one-crop, industrial interest conflicts remain. Rafting companies are not in any sense a manifestation of some large “public interest”; they are merely another competing industrial claimant to the woods and rivers. Increasingly, however, emerging values are placed on wildness for its own sake, on biodiversity, and on preserving habitat for rare complexes of plants and animals, as summarized by the evocative terms “old growth” and “Ancient Forests.” The past focus on single crops—or on accommodating competing crops through multiple use—is being replaced by concerns on an ecosystem or landscape scale (see Briggs 1989; Hunter 1990).

During the traditional period of conservation in the United States, which can be identified with the 1950s and 1960s, citizens approved of forestry and conservation. Planting trees and thinning forests received general approval. The benefits of active land management were at least dimly understood and approved. Today, however, citizens increasingly focus on what is lost when trees are planted, cultured, and cut. They no longer see what is gained. It would be a mistake to put this trend down as misinformation due to shallow or biased reporting, though there is plenty of this. We are seeing a long-term and major shift in public values and concerns about the forest. The country’s—and the world’s—supply of renewable raw materials is a distant abstraction, but the view from a put-in point over the Allagash, which one visits once every few years, is a major issue. Visitors believe themselves entitled to have their needs accommodated when visiting “our forest.”

The public has never clearly perceived the Maine Woods as private property. The phrase “our forests” is repeatedly heard in the rhetoric of hunters, canoeists, and snowmobilers as well as citizens concerned about broader values. Because of this, it is easy to obtain public support for acquisition and regulatory moves designed to change the way “our forest” is managed.

The organized citizens’ environmental movement is a new actor in this policy process. Maine organizations are stronger than in the past, have

more members, and are more experienced in lobbying and appealing to public opinion. They are now joined by major national groups with large budgets, formidable lobbying and public relations savvy, extensive research and legal staffs, long-term perspectives, and significant clout in Washington committee rooms. Several of these groups have identified a dramatic preservation initiative in the Maine Woods as a national priority. The routine participation of national groups in Maine's local policy development process and in its media and legislative debates is a major development. Its long-term implications remain unclear.

So the values attached to the Maine wildlands by citizens are changing. Traditional concerns over fishing and hunting have not diminished, though their adherents are not growing in numbers. New concerns over values unrelated to individual use or to any individual one-crop interest are growing more powerful and more widely held. While accommodating one-crop use conflicts proved relatively easy (at least in retrospect), accommodating the pressures raised by this new suite of ecosystem and landscape values will be a good deal more difficult (Irland 1994).

### CHANGING MANAGEMENT AND POLICY MIX

Successive sets of values were roughly reflected in the broad lines of government action characteristic of each period. Never was there unanimity on these policies. It would be fair to say, though, that during the years prior to 1970, there existed a rough mainstream consensus about how to manage the Maine Woods, at least among most of the people who ever gave the matter a thought. The mix of policy presumptions implicit in public action and informed discussion included

- Land would continue in private ownership.
- Public access would be permitted, with fishing and hunting a useful by-product of wood growing.
- Public agencies would tend to fire and insect control (Wilkins 1978) and to forestry and game research. They would from time to time conduct inventories of the forest's resources.
- Public ownership of land in the wildlands was neither wanted nor needed.
- Taxes should be low, recognizing the low financial yield and long-term nature of forest management, and the minimal demands made by those lands

on public services. Property taxes paid by the mills would support municipal services.

During this period, there was little happening in the Maine Woods that would lead anyone to suppose that a more active public policy stance was needed. The public policy peace was broken by occasional conflicts, such as the acquisition of the Allagash Waterway Corridor, but these events were place-specific. They never generated any general change in the overall policy approach to forestry.

The environmental awareness of the late 1960s and 1970s brought new concerns to the fore, and with them the invention of new policy tools. For the 1970s and much of the 1980s, a modified set of policy presumptions might be summarized as follows:

- The state, with federal support, would fight the spruce budworm.
- The new Tree Growth Tax would place on a permanent basis a use-value approach to forest taxation in the wildlands.
- The federal presence would be limited to funding for budworm, fire, service forestry, and planning.
- An expanded university, Forest Service, and industry research effort would support better management of all forest resources.
- Regulation of pesticide use would be reformed and placed on a more professional basis.
- Multiple use forest management would enable continued cropping of timber with increasingly intensive management, while also meeting rising demands for recreation and wildlife. Minor adjustments such as streamside and roadside buffers, and special cutting prescriptions for deeryards, would enable this to occur.
- Land use and forest practice issues in the wildlands would be overseen in the wider public interest by a Land Use Regulation Commission (LURC) with strictly limited powers to control private landowner activities.
- Growing public needs for recreation would be met by a combination of better management on the rivers, private provision of campsites, and the newly revitalized system of public reserved lands. Significant state or federal land acqui-

sition beyond this remained unnecessary, with only occasional exceptions.

- A Forest Practices Act would finish the unfinished business left by the absence of any regulation outside of the unorganized territories, and the minimal previous regulatory mandate given to the LURC. This would complete the public policy agenda on forest practice issues.
- Creation of the Department of Conservation would provide an improved and better-coordinated administrative and policy focus for these activities within state government.

The elements of this policy mix were not easily put into place, especially those concerning the LURC, which major landowners fiercely resisted at first. Even as landowners adjusted to routinely doing business with that body, however, the early 1970s consensus on spruce budworm unraveled, resulting in cutbacks in spraying and in major amendments to the state's pesticide laws. So the period was more dynamic and complex than this brief summary suggests.

The policy shifts of the 1970s were largely built on traditional resource concerns. They were primarily one-crop in nature. They sought a more suitable balance between the timber crop of the land and the electricity crop of the rivers on the one hand, and the game and fish and scenery crops. A few new agencies were created (Public Lands and LURC), but they operated on familiar lines and brought no radical change to the system as a whole, however lustily they were debated at the time. During a time of increased public concern about resources, rising recreational use, and more activist state government, these changes can be seen as catching up with a variety of issues that had reached Maine later and in less severe form than elsewhere in the Northeast.

Maine's public lands system took shape during this period, rather late in comparison to other northeastern states. General purpose conservation land acquisition was never a major state priority. The state's public lands were collected into large management units through trades with private owners, to be managed by the Bureau of Public Lands. From the early 1970s to the early 1990s, land under BPL management increased from 65,000 acres to 460,000 acres. Major units like T15R9 (Deboillie Mountain and Lakes), the Bigelow Preserve, and Mahoosucs, and Duck Lake were assembled. These were not intended to preserve ecosystems or particular habitats, though they may

serve this purpose. They were designed to retain in public ownership major scenic and recreational features, but these valued natural features were at the core of land units managed for timber. A certain Yankee thrift in attending to the economy's needs for raw material is ensured by the requirement that the Bureau's budget come from its own revenues. In other agencies, the one-crop model prevailed. Acquisitions were made by separate agencies for hunting and waterfowl, for state parks, to protect lakeshores, river corridors, and hiking trails. In no case was an ecosystem or landscape view evident.

There was no clear moment at which it could be said that this consensus broke down. Indeed, that would be too strong a description. Just as it seemed that a system had finally been completed, however, new concerns overwhelmed the situation.

The land boom of the mid-1980s led to widespread subdividing and to some clearing and development of forest land. Advertisements in popular publications left an exaggerated impression of the acreage being affected—"Last chance for a wilderness lot on the Narraguagus!" A new potential threat, however, was clear. The permanent character of subdivisions' impact alarmed many. It was argued that traditional forest values were hardly affected because the acreage actually subdivided was very small, but this claim missed the point, as the wider values of wildness, biodiversity, and the natural condition of the landscape were threatened far more directly. Widespread media coverage of the threats to tropical forests, the increased awareness of how few undisturbed wild forests remain, and reporting on acid rain and global warming all blended together to create an escalated sense of urgency.

Conservation groups were able to interest the congressional delegations of New York, Vermont, New Hampshire, and Maine in the various threats to the region's forests. An appropriation was made to the USDA Forest Service (1990) to conduct the Northern Forest Lands Study, which would ascertain the true threats to the forest, frame a vision for its future, and map out a course of state-federal action. Following up on the study, Congress funded a Northern Forest Lands Council which worked for three additional years (Northern Forest Lands Council 1994).

The highly publicized subdivision boom created a sense of urgency that sparked Maine voters to authorize the state's first-ever general purpose land acquisition bond issue. By requesting proposals from communities, the state's Land for Maine's Future Board generated widespread interest in local and regional land conservation needs. Several

important land acquisitions were made under this bond issue. The agency has spent its budget and gone out of existence.

In 1990, the Wilderness Society (Kellett 1989) unveiled a major proposal to create a Maine Woods Reserve, a 2.5-million-acre conservation zone centered on Baxter Park and the headwaters of the Allagash and Penobscot Rivers. The concept was that within this region key natural and recreational features would be more tightly protected. Land development would be prohibited, and commercial timber could still be produced, but perhaps under more strict rules than apply elsewhere. Claims by the proponents that they want to preserve the forest as a raw material supply for industry were met with understandable skepticism on the part of forest industry. This idea later reemerged as a proposal for a 3.2-million-acre Maine Woods National Park, within which logging would be banned (Fig. 43). Lands were to be acquired from willing sellers.

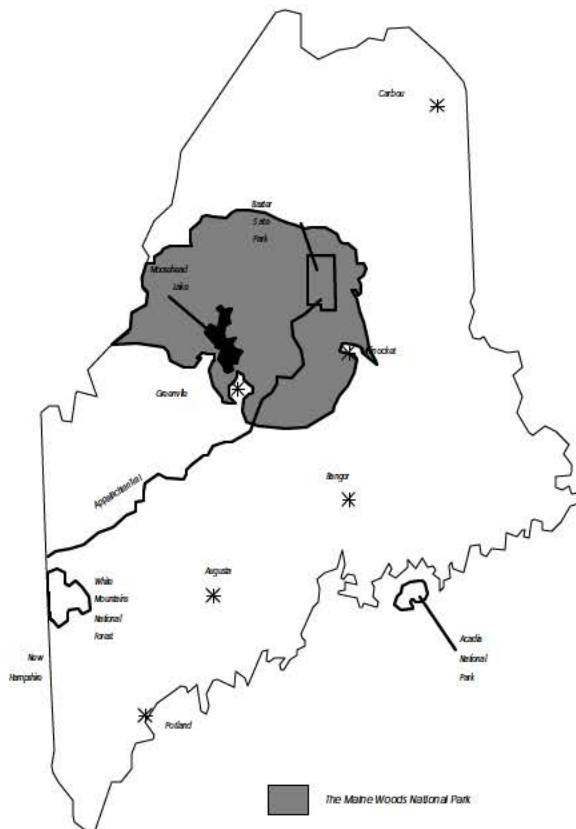


Figure 43. Proposed Maine Woods National Park (3.2 million acres). Source: Restore North (1994).

Not long after the Maine Woods Reserve proposal was announced, the Georgia Pacific-Great Northern Paper Company merger shifted the corporate ownership of some of the most significant lands in the proposal. This acquisition of a corporation that had been strongly identified with Maine for 90 years was a dramatic reminder that “our forest” was really private property. At the same time and somewhat unexpectedly, a minor revolt arose over user fees for recreational use of private lands. This was a reversal of trend, for it had appeared that, with even Acadia National Park charging an entry fee, public acquiescence to fees for wildland use had finally been achieved.

It is difficult to know, in an opinion poll sense, how widespread the support may be for this agenda of new policies based on the ecosystem view for the Maine Woods. A new consensus as to suitable policy tools has yet to emerge. Some major issues are

- What shall be the role of federal funds and policy in defining the agenda for conservation and preservation in the wildlands and in paying for it?
- What should be the relative roles of improved incentives for better forest management and stable ownership, of regulation, and of public ownership in future management of this forest?
- What shall be the role of multi-state cooperation in dealing with region-wide concerns about the northern forest?
- How will the “third sector” private groups fit in?
- How will national groups like the Sierra Club and Wilderness Society represent national and regional preservation and recreational interests in Maine’s forests, at times in conflict with local groups?
- Can a system of dispersed private ownerships ensure sustainable long-term timber productivity or will public regulation be required?
- What can be done to ensure retention of the forest landbase in the face of competing demands for land?
- Will the previous balance of methods for addressing conflict in the Maine Woods be radically changed? Or will some modifications of the established roles of regulation and private ownership be found adequate?
- Is the concept of a privately owned, “working forest” producing industrial

wood and a wide range of other benefits, politically sustainable in our increasingly fragmented and polarized polity?

- How can the public waterways of the forest be protected?
- What should be the public role in land-ownership?
- How should forest land uses and forest management practices be regulated? If so, how?
- How should recreational uses be provided for, controlled, and funded?
- What forest protection measures are required, and how should they be funded?
- What is the role of the forest in sustainable economic development?
- How can landscape-level values be conserved across multiple ownerships? (Irland 1994)

The tools of regulation affecting forest land are numerous (Table 26; Connors 1992). Evaluation as to the true effectiveness of these regulations is sparse, but this has not hindered interest groups from advocating still more extensive and stringent regulatory programs.

### CHANGING WAYS TO PAY FOR FOREST BENEFITS

While regulation receives public attention, spending and tax policy also influence the forest. During the years up to the late 1980s, it was assumed that those wishing to have the benefit of timber from private lands would pay for it. Those

wishing to use privately owned and maintained roads in parts of the wildlands would also pay for the opportunity. In limited instances where the state wished to preserve or make available particular parcels of land for public purposes, it would acquire the land and pay for it. On the other hand, the state held the right to enforce sound conservation of water, wildlife, and fish, which are not privately owned. Costs associated with conserving those values are properly internalized in the costs of forest management and should be borne by the landowners involved.

In the mid-1980s there occurred a brief conflict over proposals by certain large forest landowners in leasing particular areas for exclusive recreational use of clubs or other small groups. The motivation was to help pay the costs of ownership and upgrade returns. While this is not a new practice, the company's announcement of this intent sparked widespread criticism and was seen as yet another threat to established public uses of the forest. The event illustrated yet again how fragile public use rights may actually be in the Maine Woods.

Periodically the taxation of woodland in Maine becomes a contentious issue. The Tree Growth Tax has come under assault at various times over how closely it should be tied to planned, active forest management, whether it should be repealed and replaced by the general property tax, and how its valuations should be conducted. Ironically, in sweeping away the Uniform Property Tax, Maine voters turned the Tree Growth Tax into a strictly local revenue source for services used within the unorganized territories. During the 1980s, the method of funding forest fire control was repeatedly revised in efforts to cure a meaningless legal technicality

Table 26. Regulations affecting forest landowners in the North Woods.

Subdivision of Development	Land Use Regulation Commission
Cutting in Protection Zones Deer Wintering Areas	LURC, in consult. with Inland Fish & Wildlife
Roadbuilding, Stream Alterations, Sedimentation	LURC, EPA
Wetlands Alteration (many log all defined wetlands support merchantable timber)	Corps of Engineers (general permit), EPA
Fire Safety Practices	Maine Forest Service
Regulated Cutting Practices	Maine Forest Service
Cutting in Allagash 1 Mile Corridor	Bureau of Parks and Recreation
Management Plan Requirement Tree Growth Tax	Bureau of Taxation
Eagle Nests/Endangered Species	U.S. Fish & Wildlife Svc.

and to find a more politically feasible funding source. The net result of all of these policy changes has been to further discourage many small forest landowners and to undermine any previous sense that Maine had a favorable and predictable tax environment for forest ownership and management. The Northern Forest Lands Council emphasized the importance of a more stable tax environment for forestry. Yet groups most concerned about preserving the forest land base vigorously condemned these suggestions.

The entrance of the national environmental groups into the Maine Woods policy debate brings with it the issue of what role will be played by federal funding. Already the Forest Legacy program, an avowedly experimental effort to acquire easements to conserve forest landscapes, is spending funds in selected states. Whether this is the entering wedge for a major Federally funded acquisition effort is uncertain. Increased Federal involvement has been resisted in the past. Recent experiences in New Hampshire and elsewhere have given many in the Maine forest owner community reasons beyond general ideological distaste for a federal presence. It is clear that national environmental groups want federal involvement for two reasons. First, it will enable them to fund large preservation programs that simply could not be funded locally and that would have uncertain prospects for gaining public support. Second, and perhaps more importantly, by tying federal requirements to those dollars, the national environmental groups would gain a place at the table on all management decisions, large and small. Such a prospect naturally terrifies many forest industry officials and local government officials as well.

So the range of ways to pay for conserving and using these emerging forest values is changing, growing in scope and complexity. How far the trend will move cannot yet be said with any assurance, as the hidden agendas involved touch critical interests of both industry and environmental groups, and their relative political power has yet to be tested.

## OVERVIEW

We see, then, a dynamic picture of rapid change in the values of the forest as perceived by the public, in the threats to those values, in the policy tools for managing those conflicts, and in ways of paying for forest benefits. In the extraction period, the only concerns for managers were with timber inventories and with roads and other methods of moving the product to market. In the 1950s, landowners

upgraded management techniques and reinvestment in future crops, but still largely on a one-crop basis. Scientists improved knowledge of the forest and installed sustained yield experiments. Game officials controlled the harvest of deer. During the 1970s, foresters and wildlife managers converged on a rough consensus that it would be possible, by suitably constraining forest practices, to have the best of both worlds and enjoy multiple forest benefits from managed private forest land. In the late 1980s, however, this perspective was challenged by an emerging ecosystem view of the forest. In this view, the most important fact about the Maine Woods is its relatively undisturbed character and its unique potential as a stage on which extensive areas of more mature forest can be recreated. According to this view, large areas of remote forest are important as locations for conserving and improving habitat for rare creatures that need extensive undeveloped wildlands (National Audubon Society et al. 1991).

The emergence of an ecosystem perspective coincides with a potent political campaign aimed at conserving the remaining "Ancient Forests" on federal lands in the West. The most powerful weapons in that campaign have been the Endangered Species Act and the fact of federal ownership. The ecosystem period of Maine forestry history is the first time when there has been substantial and long-term involvement of these large nationally based conservation groups in Maine forest politics.

Regulation is destined to play a larger role in the policy mix for these new forest values. This is ensured by the absence of options. There is neither state nor federal money on a scale that can contend with landscape-scale conservation through acquisition. Nor is there any but fringe support for major state or federal ownership. In the LURC jurisdiction, innovations are underway in the form of lakes planning and other steps. A new Comprehensive Land Use Plan, required by statute, has been drafted. The Natural Resources Council of Maine has called for a regulatory ban on all development in the wildlands. Outside the LURC jurisdiction, the growth management process prompted many town-by-town deliberations over local forest practice regulation, until the effort was ended due to budget cuts. In an unfortunate capitulation to localism, the legislature failed to nail this Pandora's Box shut in the Forest Practices Act. This throws away one potential benefit of a statewide policy—uniformity. Periodically, regulatory provisions are reviewed by major commissions (Office of Legal and Policy Analysis 1994).

During 1996, Maine citizens, industry groups, and conservation groups will conduct an intense debate over a referendum that essentially bans clearcutting and tightly regulates partial cutting. The outcome of this referendum will shape private forest ownership and management and public policies for many years. The unprecedented severity and intrusiveness of the proposed regulations illustrates the kinds of proposals that can emerge from an extremely polarized political environment.

The ecosystem perspective brings a valuable new focus to the traditional debates over Maine forest policy. The values it highlights are real. The forest possesses unique values of wildness, values of regional and national importance. For generations those values were protected in private ownership, shielded by low market demands for wood and by a benign harvesting technology. The new mix of values and threats, however, clearly calls for a correspondingly new mix in the balance of ownership, regulation, and taxation as the basic policy tools of forest policy (see USDA Forest Service 1990, Appendixes F, G, H, and I; Northern Forest Lands Council 1994). How this new mix will be designed in the new political situation of the 1990s is uncertain.

The opportunity facing the Maine Woods today is of historic significance. If a better way of balancing the one-crop, technically oriented production systems with the ecosystem perspective can be found, and can be designed into a workable policy structure, nationally significant forest values can be preserved for future generations. And in the process the opportunity for present and future generations of Mainers to benefit from the employment, wage payments, and tax revenues generated by a major processing sector will also be retained.



## 13. References

---

- Aber, J.D., and J. Melillo. 1991. Terrestrial ecosystems. Philadelphia: Saunders College Publishing.
- Aber, J.D., S. Ollinger, and C.A. Federer. 1994. Forest ecosystem vulnerability. In: Proceedings of a U.S./Canada Symposium—Regional Response to Global Climate Change: New England and Eastern Canada, Orono: Univ. of Maine Water Resources Program, pp. 80–92; see also p. 158 ff.
- Adams, D., K. Jackson, and R.W. Haynes. 1988. Production, consumption, and prices of wood products. USDA Forest Service Pac. Northw. For. and Range Exp. Sta., Res. Bull. PNW-RB-151.
- American Bar Association. n.d. (ca. 1979). Opportunities for enhancing public benefit from private land. Proc. 9th Annual Airlie House Conf. on the Environment.
- American Forest and Paper Association. various years. Lumber production statistical releases. Monthly.
- . 1994. Sustainable forestry principles and implementation guidelines. Washington. Oct. 14.
- Aplet, G., N. Johnson, J.T. Olson, and V.A. Sample. 1993. Defining sustainable forestry. Washington: Island Press.
- Apey, M., and L. Reed. 1995. World timber resources outlook current perceptions: a discussion paper. Vancouver, BC: Council of Forest Industries of British Columbia.
- Askins, R.A. 1995. Hostile landscapes and the decline of migratory songbirds. *Science* 267: 1956–1957.
- Askins, R.A., J.F. Lynch, and R. Greenberg. 1990. Population declines in migratory birds in Eastern North America. *Current Ornithology* 7:1–57.
- Baxter Park Authority. 1992. Baxter State Park 1991 annual report. Millinocket, ME.
- Becker, J.C. 1991. Landowner or occupier liability for personal injuries and recreational use statutes: how effective is the protection? *Indiana Law Rev.* 24(4): 1587–1614.
- Beem, E.A. 1990. Maine art now. Gardiner, ME: Dog Ear Press.
- Bennett, D. 1988. Maine's natural heritage: Rare species and unique natural features. Camden: Down East Books.
- Beuter, J.H. 1990. Social and economic impacts in Washington, Oregon, and California of a conservation program for the northern spotted owl: An overview. Portland, OR: Mason Bruce and Girard for American Forest and Paper Association.
- Binkley, C.S., and P.R. Hagenstein, eds. 1989. Conserving the North Woods: Issues in public and private ownership of forested lands in Northern New England and New York. New Haven: Yale School of Forestry and Environ. Stud. Bull. 96.
- Birch, T.W. 1986. Forest-land owners of Maine, 1982. USDA For Serv. Northeastern Station, Res. Bull. NE-90.
- Birdsey, R.A. 1992. Carbon storage and accumulation in U.S. forest ecosystems. USDA Forest Serv., Gen. Tech. Rept. WO-59. p. 22.
- Bissonette, J.A., ed. 1986. Is good forestry good wildlife management? Maine Agr. Exp. Sta. Misc. Publ. 689.
- Briggs, R., W.B. Krohn, J.G. Trial, and W.D. Ostrofsky, eds. 1989. Forest and wildlife management in New England: What can we afford? Maine Agr. Exp. Sta. Misc. Rep. 336.
- Briggs, R.D., and W.B. Krohn, eds. 1993. Nurturing the northeastern forest. Maine Agr. and Forest Exp. Sta., Misc. Rept. 382.
- Brodeur, P. 1985. Restitution: The land claims of the Mashpee, Passamaquoddy, and Penobscot Indians of New England. Hanover, NH: Univ. Press of New England.
- Brooks, R.T., T.S. Frieswyk, and A. Ritter. 1986. Forest wildlife habitat statistics for Maine, 1982. USDA Forest Service NEFES Res. Bull. NE-RB-96.
- Canadian Forestry Service. 1994. Timber supply in Canada: Challenges and choices. Ottawa: Natural Resources Canada.
- Cary, A. 1896. In Third Annual Report of the Forest Commissioner of the State of Maine. Augusta: Burleigh and Flynt, Printers. p. 15–203.
- Clark, C.E. 1990. Maine: A history. New York: W.W. Norton.
- Clawson, M., and W. Harrington. 1991. The growing role of outdoor recreation. In America's renewable resources: Historical trends and current challenges, ed. K.D. Frederick and R.A. Sedjo, Chapter 7. Washington: Resources for the Future.
- Colby, F.H. 1917. Forest protection and conservation in Maine. Augusta. Dept. of Forestry.
- Cole, D.N., M.E. Petersen, and R.C. Lucas. 1987. Managing wilderness recreation use: Common problems and potential solutions. USDA For. Ser. INTRES Gen. Tech. Rept. Int-230.
- Colgan, C.S., and L.C. Irland. 1993. The sustainability dilemma: Observations from Maine history. In Toward a sustainable Maine, ed. R.E. Barringer, pp. 60–76. Portland: Univ. of Southern Maine, Muskie Institute.

- Commission to Study the Future of Maine's Paper Industry. 1995. Report. Augusta: Office of Policy and Legal Analysis.
- Commission to Study the Use of Herbicides. 1991. Final report. Augusta: Office of Policy and Legal Analysis.
- Conkling, P.W. 1981. Islands in time. Camden: Downeast Publishers.
- . 1995. From Cape Cod to the Bay of Fundy: An environmental atlas of the Gulf of Maine. Cambridge: MIT Press.
- Connors, J.F. 1992. A guide to forestry regulations in Maine. Orono: Univ. of Maine, Margaret Chase Smith Center for Public Policy.
- Coolidge, P.T. 1963. History of the Maine Woods. Bangor: Furbush and Roberts.
- Cordell, H.K., J.C. Bergstrom, L.D. Hartmann, and D.B.K. English. 1990. Analysis of the outdoor recreation situation in the U.S.: 1989–2040. USDA For. Ser. RMFRES Gen. Tech. Rep. RM-189.
- Cost, N., J. Howard, B. Mead, W.H. McWilliams, D.D. VanHooser, and E.M. Wharton. 1990. The forest biomass resource of the U.S. USDA Forest Serv. Gen. Tech. Rept. WO-57. p. 8.
- Cronon, W. 1983. Changes in the land: Indians, colonists, and the ecology of New England. New York: Hill and Wang.
- deGraaf, R.M., M. Yamasaki, W.B. Leak, and J.W. Lanier. 1992. New England wildlife: Management of forested habitats. USDA Forest Service NEFES Gen. Tech. Rept. NE-144.
- Demeritt, D. 1991. Boards, barrels, and boxhooks: The economics of Downeast lumber in nineteenth-century Cuba. *For. & Conser. Hist.* 35(3): 108–120.
- Deming, L.S., and S.F. Gage. 1994. The effects of forest practices on the wildlife and ecology of the northern forest. Summary report. Concord, NH: Audubon Society of New Hampshire.
- Dobbs, P., and R. Ober. 1995. The northern forest. White River Junction, VT: Chelsea Green Publ. Co.
- Dominie, H., and F. O'Hara. 1993. Working and living with the land. Report to the Maine Alliance Foundation. March.
- Dominie, H., and J. Scudder. 1987. Land use and cumulative impacts of development: A study summary. Augusta State Planning Office.
- Duncan, R.F. 1992. Coastal Maine: A maritime history. New York: W.W. Norton.
- Ferguson, R.H., and F.R. Longwood. 1960. The timber resources of Maine. USDA For. Ser. NEFES.
- Ferguson, R.H., and N.P. Kingsley. 1972. The timber resources of Maine. USDA For. Ser. NEFES Res. Bull. NE-26.
- Field, D.B. 1980. The economic importance of Maine's spruce-fir resource. Univ. of Maine at Orono, Coop. For. Res. Unit. Res. Bull. (March).
- Field, D.B., ed. 1994. Proceedings second Munsungan conference: The triad concept for Maine's future forest: A model for harmony or discord? Maine Agr. and Forest Exp. Sta. Misc. Rept. 338.
- Flather, C. H., L. A. Joyce, and C.A. Bloomgarden. 1994. Species endangerment patterns in the U.S. USDA Forest Service, Rocky Mtn. For. and Range Exp. Sta., Gen. Tech. Rept. RM-241.
- Forest Commissioner. 1906. Sixth report of the Forest Commissioner. Augusta: Kennebec Journal Print.
- Governor's Commission on Outdoor Recreation in Maine. 1986. Report of findings and recommendations. Augusta: Dept. of Conservation.
- Greenleaf, M. 1829. A statistical view of the District of Maine. Reprinted by Maine State Library, 1970. Portland: Shirley and Hyde.
- Hagan, J. 1993. Migratory land birds in an industrial forest landscape: abundance and diversity. In *Nurturing the northeastern forest*, ed. R.D. Briggs and W.B. Krohn, pp. 205–216. Maine Agr. and Forest Exp. Sta., Misc. Rept. 382.
- Hakola, J.W. 1981. Legacy of a lifetime: The story of Baxter State Park. Woolwich: TBW Books.
- Hardy, J. 1985. Maine rivers access and easement plan. Bureau of Parks and Recreation. January.
- Harper, V.L. 1949. Timber resources of New England with reference to pulpwood supplies. USDA For. Ser. NEFES Sta. Pap. No. 5.
- Harrington, F. 1994. Wee tooke great store of cod-fish: Fishing ships and first settlements on the coast of New England, 1600–1630. In *American beginnings: Exploration, culture, and cartography in the land of Norumbega*, ed. E.W. Baker, et al., pp.191–216. Lincoln: Univ. of Nebraska Press.
- Hartman, H. 1992. Maine's forest recreation resource demand. In *First Munsungan conference proceedings*, ed. C. Murdoch and D. Stone, pp. 35–39. Maine Agr. Exp. Sta. Misc. Rep. 378.
- Henley, R.K., and P.V. Ellefson. 1986. State forest practice regulation in the US: Administration, cost, and accomplishment. Univ. of Minnesota Agr. Exp. Sta. Bull. AD-SB-3011.
- Hillard, M. 1990. Maine's changing workplace: lessons of the IP strike. In *Toward a sustainable Maine*, ed. R.E. Barringer, pp. 60–76. Portland: Univ. of Southern Maine, Muskie Institute.
- Hudnut, D., and S. Golden. n.d. (ca. 1989) Public ways in the NFL Study Area. Study undertaken by the National Park Service, to be submitted in conjunction with the Northern Forest Lands Study. Avail. from Nat. Park Serv., Branch of River and Trail Cons., N. Atl. Region, Boston.

- Hunter Jr., M.L. 1990. Wildlife, forests, and forestry: Principles of managing forests for biological diversity. Engelwood Cliffs, NJ: Prentice-Hall.
- Irland Group. 1988. Clearcutting as a management practice in Maine forests. Augusta: Maine Dept. of Conservation.
- . 1989. Northern Forest Lands Study Real Estate Market Survey. Report to Northern Forest Lands Study, USDA For. Ser. Unpublished.
- Irland, L.C. 1981. Maine's timber supply. In Proc. Blaine House Conference on Forestry, pp. 39–54. Augusta: Maine Dept. of Conservation.
- . 1982. Wildlands and woodlots. Hanover: Univ. Press of New England.
- . 1984. Future employment in the Maine Woods. In Proceedings, A Forest Based Economy: Blaine House Conference on Forestry, pp. 78–108. Augusta: Dept. of Conservation.
- . 1986. Rufus Putnam's ghost: An essay on Maine's public lands, 1783–1820. *J. For. Hist.* (April): 60–69.
- . 1994. Getting from here to there: Implementing ecosystem management on the ground. *J. Forestry* 92(8): 12–17; see also other excellent papers in the same issue, and the references cited in them.
- . In press. The Northeast's changing forest. Hanover: Univ. Press of New England.
- Irland, L.C., J.B. Dimond, J.L. Stone, J. Falk, and E. Baum. 1988. The spruce budworm outbreak in Maine in the 1970s. *Maine Agr. Exp. Sta. Bull.* 819.
- Irland, L.C., and J.F. Connors. 1994. State nonpoint source programs affecting forestry: The 12 northeastern states. *North. J. Appl. For.* 11(1): 5–11.
- Irland, L.C., and D.I. Maass. 1994. Regional perspective: Forest conditions and silvicultural trends in the northeastern USA. *Forestry Chronicle* 70(3): 273–278.
- Irland, L.C., and T. Rumpf. 1980. Trends in land and water available for outdoor recreation. In Proc., 1980 Outdoor Recreation Trends Symposium, USDA For. Ser. NEFES Gen. Tech. Rep. NE-57, vol. 1. p. 77–87.
- Jackson, C.T. 1837 and 1838. First and second reports on the geology of the public lands of the State of Maine. Maine State Senate No. 89. Boston: Dutton and Wentworth, Printers, 2 vols.
- Judd, R.W. 1989. Aroostook: A century of logging in northern Maine. Orono: Univ. of Maine Press.
- Judd, R.W., E.A. Churchill, and J.W. Eastman, eds. 1995. Maine: The pine tree state from prehistory to the present. Orono: Univ. of Maine Press.
- Kellett, M.J. 1989. A new Maine Woods reserve: Options for preserving Maine's northern wildlands. Boston: The Wilderness Society.
- Kelly Jr., R.D. 1993. Maine land in federal, state, municipal, and non-profit conservation ownership. Augusta: State Planning Office, Nat. Res. Pol. Div. (August): 65–66.
- Kendall, D.L. 1987. Glaciers and granite: A guide to Maine's landscape and geology. Unity: North Country Press.
- Kimmins, H. 1992. Balancing act: Environmental issues in forestry. Vancouver: Univ. British Columbia Press.
- Klyza, C.M., and S.C. Trombulak. 1994. The future of the northern forest. Hanover: Univ. Press of New England.
- Land and Water Associates. 1993a. Historical demand for development in the wildlands: A characterization of LURC permit recipients by type, resident state, and Maine county of origin. Draft. Augusta. Land Use Regulation Commission.
- . 1993b. Location of new development in the wildlands. Draft. Augusta. Land Use Regulation Commission. Oct. 19.
- Land Use Regulation Commission. 1976. Comprehensive land use plan. Augusta: Maine Dept. of Conservation.
- . 1983. Comprehensive land use plan. Augusta.
- . 1987. Maine wildlands lake assessment. Prel. Findings. Augusta.
- . 1995. Revised comprehensive land use plan—draft for public comment, December. Augusta. 2 vols.
- Lansky, M. 1992. Beyond the beauty strip. Gardiner, ME: Tilbury House.
- Leopold, A. 1966. A sand county almanac. New York: Oxford University Press.
- Lime, D.W. 1990. Managing America's enduring wilderness resource. Minnesota Agr. Exp. Sta.
- Lorimer, C. 1995. Timber harvest effects on non-game birds. What does the evidence show? *The Timber Producer* (June): 46–58.
- Mahendrappa, M.K., C.M. Simpson, and G.D. van Raalte. 1991. Proceedings of the symposium on the impacts of intensive harvesting. Fredericton. Forestry Canada—Maritimes Region.
- Maine Bureau of Parks and Recreation. 1982. Maine rivers study, final report. Augusta: Dept. of Conservation. May.
- . 1988. State of Maine outdoor recreation plan. Augusta: Dept. of Conservation. Volumes I and II.
- . 1993. State of Maine outdoor recreation plan. Augusta: Dept. of Conservation. Volumes I and II.

- . 1994. Maine outdoor recreation activity participation and trends. Augusta: Dept. of Conservation.
- Maine Bureau of Parks and Recreation, with J. W. Hardy. 1985. Recreation management and resource protection for Maine's rivers. Summary report. Augusta: Dept. of Conservation. April.
- Maine Commission on Outdoor Recreation. 1988. Final report. Office of Policy and Legal Analysis.
- Maine Commissioner of Industrial and Labor Statistics. 1907. Twelfth annual report of the Bureau of Industrial and Labor Statistics for the State of Maine, 1905. Augusta: Kennebec Journal Print.
- Maine Cooperative Extension Service. 1988. Forester's guide to managing wildlife habitats in Maine. Orono: Maine Coop. Ext. Serv. and Maine Chapt. of Wildl. Soc.
- Maine Department of Conservation, Forest for the Future Program. 1986. The forest of Maine: A survey of public opinion. Augusta.
- Maine Department of Inland Fisheries and Wildlife. Annual reports. Eagle recovery is a national trend, see "Eagle population soars," *Science* 263: 92, (18 Feb. 1994).
- Maine Department of Labor. various years. Census of Maine Manufacturers. Augusta.
- . 1992. Maine employment statistical handbook. Augusta: Div. of Economic Analysis and Research. Oct. SDS SH-11.
- Maine Environmental Priorities Project. 1995. Reports from the technical working groups to the steering committee. Augusta Dept. of Environmental Protection.
- Maine Forest Products Council. 1995. Cycles of growth in the Maine forest. Augusta.
- Maine Forest Service. various years. Annual Silvicultural Report. Augusta.
- . 1993. Assessment of Maine's wood supply. Augusta: Dept. of Conservation.
- . 1995. Evaluation of the effects of the forest practices. Oct. Submitted to Joint Standing Committee of the 117th Legislature on Agriculture, Conservation, and Forestry, Augusta, April 11.
- . n.d. Forest Practices Act, Regulations and Summary. Augusta: Dept. of Conservation.
- Maine Office of Policy and Legal Analysis. 1986. Public access to Great Ponds, Legal Analyst Memorandum. Augusta. July 1.
- . 1988. Report of the Forest Lands Taxation Commission to the Second Regular Session of the 113th Legislature. Augusta.
- . 1994. Integrating land use and natural resource management. Final report of the Land Use Regulatory Reform Committee. 116th Legislature First Regular Session.
- Maine Office of Legislative Assistants. 1984. Camp lot leases on and access to public reserved lands. Augusta. January.
- Maine Report. vol. 103, Maine 1907. (Opinion of the Justices on forest practices regulation.)
- Maine State Planning Office. 1986. Public access to the Maine Coast. Augusta.
- Maine Tomorrow. 1991. Small woodland owners in Maine: An analysis of trends. Hallowell.
- Manning, R.E. 1986. Studies in outdoor recreation. Corvallis: Oregon State University Press.
- Marchand, P.J. 1987. North Woods: An inside look at the nature of forests in the Northeast. Boston: Appalachian Mountain Club.
- Market Decisions, Inc., and Land and Water Associates. 1993. Maine LURC: A summary of current policy and net effect on 20 years of development. Nov. 16.
- Martin, B.H. 1984. Fees for outdoor recreation on lands open to the public. Conf. Proc. Res. Dept. Appalachian Mountain Club. Gorham, NH.
- McCormack Jr., M.L. 1994. Reductions in herbicide use for forest management. *Weed Technology* 8:344-349.
- McMahon, J., and J. Bernard. 1993. An ecological reserves system for Maine: Benchmarks in a changing landscape. Augusta: Maine State Planning Office. Report to 116th Maine Legislature.
- McNutt, J., R. Häggblom, and K. Ramö. 1992. The global fiber resource picture. In Wood Products Demand and the Enrichment. Madison: Forest Products Research Society.
- Millers, I., D.S. Shriver, and D. Rizzo. 1989. History of hardwood decline in the eastern U.S. USDA For. Ser. NEFES Gen. Tech. Rep. NE-126.
- Mladenoff, D.J., and J. Pastor. 1993. Sustainable forest ecosystems in the northern hardwood and conifer forest region: concepts and management. In Defining Sustainable Forestry, ed. G. Aplet et al., p. 145-180. Washington: Island Press.
- Mroz, G.D. and D.D. Reed. 1986. Proceedings, a conference on the northern hardwood resource: Management and potential. Houghton: Michigan Tech. Univ.
- National Audubon Society, National Wildlife Federation, Sierra Club, and Wilderness Society. 1991. Saving the northern forest: An issue of national importance. Oct. 22.
- Natural Resources Canada. 1995. The state of Canada's forests, 1994. Fifth report to Parliament. Ottawa. Canadian Forestry Service.
- NCASI. 1993. Forestry, wildlife, and habitat in the East (an annotated bibliography). 1986-1990. New York: Nat. Council on Air and Stream Improvement of the Paper Industry. Tech. Bull. 651.

- Noble, M.J. 1991. Recreational access to agricultural land: Insurance issues. *Indiana Law Rev.* 24(4): 1615–1640.
- Northeast Forest Alliance. ca. 1993. The economic importance of Maine's forest. Saranac Lake, NY and Maine Forest Service, Augusta
- Northern Forest Lands Council. 1994. Finding common ground: The recommendations of the NFLC. Concord: NFLC.
- Nyland, R.D. 1992. Exploitation and greed in eastern hardwood forests. *J. Forestry* 90(1): 33–37.
- Oliver, D., and B.J. Larson. 1990. Forest stand dynamics. New York: McGraw-Hill.
- Patric, J.H. 1993. Water, woods and people: A primer. Some effects of human actions on water resources of the eastern forest. Greeneville, TN: Artistic Printers.
- Peterjohn, B.G., and J.R. Saver. 1994. Population trends of breeding birds from the North American Breeding Bird Survey. *Wildl. Soc. Bull.* 22: 155–164.
- Powell, D.S. 1985. Forest composition of Maine: An analysis using number of trees. USDA NEFES Res. Bull. NE-85.
- Powell, D.S., J.L. Faulkner, D.R. Darr, Z. Shu, and D.W. MacCleery. 1993. Forest resources of the U.S., 1992. USDA-FS RMFRES Gen. Tech. Rept., RM-234, p. 36.
- Powell, D.S., and D.R. Dickson. 1984. Forest statistics for Maine, 1971 and 1982. USDA For. Ser., NEFES Res. Bull. NE-81.
- Prudential Securities. 1995. Paper and forest products monthly review. Monthly. New York.
- Reiling, S.D., and M.W. Anderson. 1983. Estimation of the cost of providing publicly-supported outdoor recreation facilities in Maine. *Maine Agr. Exp. Sta. Bull.* 793.
- Restore North. 1994. Maine Woods proposed national park. Concord, MA.
- Ring, E. 1902. Fourth report of the forest commissioner of the State of Maine. Augusta: Kennebec Journal Print.
- Sargent, C.S. 1884. Report on the forests of North America (exclusive of Mexico). U.S. Census, vol. X of the tenth census. Washington, D.C. p. 494.
- Seal, C. 1992. Thoreau's Maine Woods: Yesterday and today. Emmaus, PA: Yankee Books.
- Sedjo, R.A. 1991. Forest resources: Resilient and serviceable. In *America's renewable resources: Historical trends and current challenges*, ed. K.D. Frederick and R.A. Sedjo, Chapter 3. Washington: Resources for the Future.
- Sewall Co., J.W. 1984. Analysis and interpretation of statistical tables derived from the third forest survey of Maine. Report to Maine Dept. of Conservation, Augusta.
- . 1983. Spruce-fir wood supply/demand analysis, final report. Augusta: Maine For. Ser.
- Sewall Co., J.W., and Market Decisions, Inc. 1993. Northern Forest Lands Council land conversion study. Concord, NH. Northern Forest Lands Council.
- Seymour, R.S. 1992a. The red spruce-balsam fir forest of Maine: Evolution of silvicultural practices in response to stand development patterns and disturbances. In *The ecology and silviculture of mixed-species forests*. A festschrift for David M. Smith, ed. M.J. Kelty, et al., pp. 217–244. Norwell, MA: Kluwer Publishers.
- . 1992b. Production silviculture in northeastern North America. *Proc. SAF, 1992 National Convention*, pp. 227–232.
- . 1993. Trade-offs for high-yield silviculture. In *Nurturing the northeastern forest*, ed. R.D. Briggs and W.B. Krohn, pp. 16–32. *Maine Agr. and Forest Exp. Sta., Misc. Rept.* 382.
- Seymour, R.S., and M.L. Hunter Jr. 1992. New forestry in eastern spruce-fir forests: Principles and applications to Maine. *Maine Agr. Exp. Sta. Misc. Pub.* 716.
- Seymour, R.S., and R.C. Lemm Jr. 1989. Timber supply projections for Maine, 1980–2080. *Maine Agr. Exp. Sta. Misc. Rep.* 337.
- Seymour, R. S., D.G. Mott, S.M. Kleinschmidt, P.H. Triandifillou, and R. Keane. 1985. Greenwood model: A forecasting tool for planning timber harvesting and protection of spruce-fir forests attacked by the spruce budworm. USDA For. Ser., NEFES Gen. Tech. Rep. NE-91.
- Simpson, C.M. ed. 1991. *Proceedings of the Conference on Natural Regeneration Management*. Fredericton, NB: Forestry Canada, Maritimes Region.
- Sinclair, S.A. 1992. *Forest products marketing*. New York: McGraw-Hill.
- Skolnick, A. 1991. *Paintings of Maine*. New York: Clarkson N. Potter.
- Smith, D.C. 1972. *History of lumbering in Maine, 1860–1960*. Orono: Univ. of Maine Press.
- Smith, D.M. 1986. *The practice of silviculture*, 8th ed.. New York: John Wiley.
- Smith, L. 1950. The great pond ordinance—Collectivism in northern New England. *Boston Univ. Law Rev.* 30(2): 178–190.
- Society of American Foresters. 1993. *Task force report on sustaining long-term forest health and productivity*. Bethesda, MD.
- Sorg, C., and J. Loomis. 1984. Empirical estimates of amenity forest values: A comparative review. USDA For. Ser., RMFRES Gen. Tech. Rep. RM-107.
- Steer, H.B. 1948. *Lumber production in the U.S., 1799–1946*. USDA For. Ser. Misc. Publ. 669.
- Stine, R.A., and M.J. Baughmann, eds. 1992. *Proceedings, White Pine Symposium*. St. Paul: Univ. Minnesota College of Forest Resources. NR-BU-6044-5.

- Tellman, B., H.J. Corther, M.G. Wallace, L.F. DeBano, and R.H. Hamre. 1993. Riparian management: Common threads and shared interests. USDA Forest Service, RMFRES, Gen. Tech. Rept. RM-226.
- Terborgh, J. 1992. Why American songbirds are vanishing. *Scientific American* (May):98-104.
- Thoreau, H D. 1987. The Maine Woods, pp. 212, 213.. New York: Harper and Row.
- United Nations, Food and Agriculture Organization. Annual. Forest Products Yearbooks. Rome.
- United Nations, Food and Agriculture Organization. 1988. Forest products: world outlook projections. FAO Forestry Paper 84. Rome.
- USDA Economic Research Service. Agricultural land values and markets. Periodic statistical release.
- USDA Forest Service. 1990. Final report — northern forest lands study. Rutland, VT. 206 p.
- . 1993. Northeastern area forest health report. Northeastern Area, Radnor, PA, NA-TP-03-93.
- . 1994. RPA assessment of the forest and rangeland situation in the U.S.—1993 update. USDA Forest Resource Rept. No. 27. 75 pp.
- U.S. Department of Commerce. Annual. Lumber production and mill stocks. Current Industrial Report, MA-24.
- U.S. Department of Commerce, Bur. of Census. 1988. Lumber production and mill stocks. 1987. MA24T(87)-1. 9 p.
- U.S. EPA. 1979. Protecting visibility: An EPA report to congress. Office of Air Quality Planning and Stds. EPA-45015-79-008.
- U.S. General Accounting Office. 1990. Air pollution: protecting parks and wilderness from nearby pollution sources. Washington, D.C.: GAO/RCED-90-10.
- U.S. International Trade Commission. 1992. Softwood lumber from Canada. USITC Publ. 2530. July. various pages.
- University of Maine Land and Water Resources Center. 1988. Access to coastal and inland waters, the public use of private land. Natural Resources Highlights. Orono. May.
- Vanderstoep, G. 1991. Proceedings, 1991 Northeastern Recreation Research Symposium. USDA For. Ser. NEFES Gen. Tech. Rep. NE-160.
- Whitney, R.H. 1989. Forces for change in forest land ownership and use: The large landowner's situation. In *Conserving the North Woods: Issues in public and private ownership of forested lands in northern New England and New York*, ed. C.S. Binkley and P.R. Hagenstein, pp. 72-96. New Haven: Yale School of Forestry and Environ. Stud. Bull. 96.
- Whitney, R.H., B. Halsey, and P.J. Bedard, 1994. Forum on land sales of Coburn Land Trust and former Diamond International Corporation. In Northern Forest Lands Council, Technical Appendix. Concord, NH. (The Council no longer exists: documents are obtainable at libraries or from USDA Forest Service, State and Private Forestry, Durham, NH.)
- Wilkins, A. H. 1932. The forests of Maine—Their extent, character, ownership, and products. Maine For. Ser., Bull. No. 8.
- . 1978. Ten million acres of timber: The remarkable story of the Maine forestry district 1909-1972. Woolwich: TBW Books.
- World Resources Institute. 1994. World resources: A guide to the global environment. New York: Oxford University Press.
- Wulff, H. 1991. Recreational access to agricultural land: The European experience. *Indiana Law Rev.* 24(4): 1641-1656.
- Wunderlich, G. 1990. Trends in ownership transfers of rural land. USDA, Econ. Res. Serv. Agr. Info. Bull. 601..
- Zinn, H.C. 1990. Comparison of Allagash wilderness waterway users summer of 1988 and spring of 1989. Rep. to Maine Bur. Public Relations.

## 14. Sources and Permissions

---

- Chapter 1. New for this volume., copyright Lloyd C. Irland 1994.
- Chapter 2. *Maine Scholar*, vol. 7, Autumn 1994. pp. 1–12.
- Chapter 3. *Maine Business Indicators*, Spring 1992, p. 4–6.
- Chapter 4. Adapted from a portion of C.S. Colgan and L.C. Irland. 1993. The sustainability dilemma: Lessons from Maine history. In *Toward a sustainable Maine: the politics, economics, and ethics of sustainability*, ed. R.E. Barringer, ed., pp. 53–116. Portland: Univ. of Southern Maine.
- Chapter 5. Excerpted and updated from The Irland Group. 1988. Clearcutting as a management practice in Maine forests. Augusta: Department of Conservation, *Forests for the Future* program. 45 p. + 53-page bibliographic essay and reference list.
- Chapter 6. Expanded from “Wall Street in the Woods.” *Appalachia* (Sept. 1990): 18–22.
- Chapter 7. Adapted from The Irland Group. 1990. Appendix D to *Northern Forest Lands Study*, Rutland, VT. USDA Forest Service. pp. 104–115.
- Chapter 8. L.C. Irland. 1992. Outdoor recreation supply in the Maine Woods: Issues for the future. Proc. First Munsungan Conference. *Maine Ag. & For. Exp. Sta. Misc. Rep.* 378, pp. 24–34, also reprinted in *Renewable Resources Journal* 11(3): 6–16.
- Chapter 9. Is Good Forestry Good Wildlife Management? Proceedings, New England Society of American Foresters, ed, J.A. Bissonette, pp. 365–370. *Maine Agr. Exp. Sta. Misc. Pub.* 689, 1986.
- Chapter 10. Adapted from The Irland Group paper prepared for the National Park Service as part of a regional assessment of Public Ways, which in turn was submitted to the Northern Forest Lands Study (Hudnut and Golden n.d.).
- Chapter 11. *Maine Policy Review*, 1(1): 71–82. Dec. 1991.
- Note: In a number of instances, versions printed here differ in minor ways from those published as cited above. Minor additions and updates have been made, some items deleted for publication have been retained, and occasional deletions were made to reduce duplication.