

Clearcutting Maine: Implications for the Theory of Common Property Resources

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One of the basic tenets of the theory of common property resources is that private property rights work to conserve natural resources. There is growing evidence, however, that some large forest owners in Maine are cutting their forests heavily, using poor-quality silviculture techniques. This overexploitation is being done by paper companies, forest contractors, and some private land owners, who are being motivated by very different sets of factors. This article explores the reasons that private owners of forest resources are overexploiting their own lands and the implications of this for the theory of common property resources. Secure private property rights alone will not be enough to conserve resources and do away with externalities when the owners are operating in a system demanding constant short-term profits, where they are producing undifferentiated commodities in a highly competitive market, where the future value of slow-growing resources is very low, and where harvesting has so many ramifying biological and social effects.

KEY WORDS: deforestation; Maine; common property; industrial forestry; clearcutting.

INTRODUCTION

During the past three decades, the modern world has become aware of the damage humans have done to their natural environment. Virtually every day sees a major news story about acid rain, fishery failures, toxic wastes, loss of agricultural land, degeneration of forests, loss of wildlife, erosion, overgrazing, etc. One of the most popular and controversial expla-

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nations for these problems is the theory of “common property resources,” which has become one of the most important bodies of theory guiding the management of resources in the world today.

Essentially, the common property issue is concerned with the way in which resources—especially those shared by all of the people of a society—can best be protected. According to this theory, all resources held in common such as air, oceans, rivers, parks, or publically owned forests will inevitably be overexploited. Since such resources have no private owner, it is in no one’s interest to protect them. Even more devastating, there are strong incentives making it rational for users to overexploit such resources, and no reasons for them to conserve. Why should a fisherman who comes on a school of herring conserve the school when someone else will certainly take the herring later in the day? In these circumstances, it is only rational to take as many fish as possible. Such resources are likely to be stripped bare by an uncaring public, resulting in what Hardin (1968) called the “tragedy of the commons” (Acheson, 1989, pp. 352–357). According to this theory, privately owned property, in contrast, will be conserved. Resources which are considered privately owned have an owner to protect them, and it is not in the interests of an owner to damage his own property.

A number of very reputable economists who have devoted themselves to studying the effects of ownership rights on exploitation rates have concluded that private ownership of natural resources has a number of benefits. In addition to conserving the resources, it ensures efficient use of those resources and reduces transaction costs and overcapitalization (Cheung, 1970; Johnson, 1972; Scott, 1955).

According to this body of theory, the benefits of private property stem from the fact that secure property rights do away with externalities. That is, the products produced by the firm are the property of the owner, who can use them to his or her own best advantage. An externality is a factor of production or a good not under the direct control of the producer or consumer (Cheung, 1970). If the firm produces no benefits for others, and all of the costs of production are assumed by the owner as well, then all of the costs and benefits are internal to the firm. However, some firms produce external costs and benefits as well. A power plant that pays a large percentage of the taxes in a community and thus lowers the taxes of all homeowners in town is creating an external benefit, while a plant that produces pollution is passing on costs to all others downstream and is thus producing external costs (Acheson, 1989). Private property rights permit owners to capture the benefits of their productive efforts and avoid having to assume the costs of others’ activities. Secure property rights lower transaction costs. They minimize the amount of time and effort owners must spend in entering into deals concerning their property, making allocation decisions, and defending the property in court.

Private property rights unleash the power of markets, leading to efficient use of resources. That is, private property leaves owners free to enter into the kinds of market exchanges with others which give the highest returns. They can use the resources to produce goods, lease them, sell them, or simply allow them to lie fallow, whichever is in their own rational best interest. Efficiency stems from the fact that it is in the interest of the owner to use those resources in the most productive and profitable manner possible. Secure property rights also give owners incentives to invest in the resources, since they will be allowed to gain the returns on that investment.

Since it is in the interests of society to have resources used efficiently, private property leads to the use of resources in ways in which the interests of society are also served. With secure property rights, what is optimal for the individual is congruent with what is optimal for society (a situation in which Nash equilibrium is equivalent to Pareto Optimum).

In contrast, insecure or incomplete property rights lead to a number of problems. There is little or no incentive for an individual to invest in such resources since some or all of the benefits of this investment will be captured by others (i.e., positive externalities). Moreover, the lack of secure property rights does not permit efficient use or exchange of resources since one has difficulty exchanging what one does not own. Thus, the externalities associated with insecure property rights lead to high transaction costs, less than optimal use of resources, or outright waste. Two solutions to the common property problem have been suggested. First, economists tend to reason that since property rights have such favorable results, the solution is to establish property rights or simulate property rights through communal ownership arrangements, quotas, licensing, ITQs², etc. (Acheson, 1989; Feeney *et al.*, 1996; Scott, 1955). Another solution is control of resources by the government (Hardin, 1968; Ostrom, 1990, pp. 8–10).

In short, the basic tenet of the theory of common property resources is that private property rights lead to conservation of resources. Since virtually all of Maine's forests are privately owned, one might expect, based on this body of theory, that these forests would be well maintained and conserved. As we shall see, this is not the case by any means. While many aspects of the theory have been criticized (Feeney *et al.*, 1996), little has been done to explore the circumstances leading to the over-exploitation of privately owned resources. This is the goal of this article

There are two questions that need to be answered before we can discuss theoretical implications of this situation. (1) To what extent are

²ITQs are "individual transferable quotas." This technique would allocate the right to catch a certain quota of fish to individuals who would be allowed to buy and sell them among themselves.

Maine forests being overexploited, and by whom? and (2) Why are some landowners engaged in practices that destroy the resource they own?

THE MAINE FOREST INDUSTRY

Forests are one of Maine's greatest resources. Over 90% of the state is in forest, the highest percentage of any state in the United States (Griffith and Alerich, 1996, p. 1). Most of these forests are in private hands, although the State of Maine holds several large pieces in various parklands. In the southern third of the state, most of the forests are owned by small land owners who generally do not manage them "scientifically," if they manage them at all. The forests of the sparsely populated northern, eastern, and western parts of the state are owned by 20 large companies. Some two-thirds of these "wildlands" are owned by nine paper companies, large multinational firms with headquarters in places such as New York, Seattle, and Stamford, Connecticut, which run 13 paper manufacturing plants employing thousands of workers. Until 1998, Bowater Corporation alone owned 2.1 million acres, or 10% of all the land in the state. In the past, the political and economic influence of these companies was so great that Maine has been referred to derisively as the "Paper Plantation" (Osborne, 1974).³

In the last part of the twentieth century, the Maine forest industry, especially the paper companies, have been faced with a number of problems that have influenced how they have treated their forests. First, between 1972 and 1986 there was a severe spruce budworm epidemic that killed millions of trees (Gadzik, *et al.*, 1998, p. 3). Maine and the large landowners attempted to cope with the epidemic by spraying pesticides over millions of acres of forest. In the 1970s and 1980s large land owners clearcut a good deal of acreage, partially, but not completely, to salvage the wood from dead or diseased trees.

Second, over the course of the last 40 years the management of Maine's forests has become increasingly contentious and politicized. In 1974 William Osborne, an associate of Ralph Nader, published *The Paper Plantation*, in which he indicted the paper companies for poor forestry practices, overexploitation of forests, and helping to retard the development of the state (Osborne, 1974, pp. ix, 2). In 1975, the Maine Woodsmen's Association, an organization of wood cutters, struck the paper companies to protest a long list of grievances, including unfair contracts, price fixing, the importation of Canadian workers, and forest practices which they saw as destroying

³The pattern of forest ownership in Maine is very different from that in nearby New Brunswick, where 48% of all forest land is Crown Land owned by the Province; only 21% is privately owned by industry (Baskerville, 1995, p. 40).

the forests and the environment. They were particularly concerned about the widespread use of mechanical harvesters, clearcutting, and the use of chemicals.

In the 1990s, in a growing portion of the public there is concern about the condition of the northern forests and a hardening conviction that they are being poorly managed and overexploited—particularly by the large paper companies, who, it is thought, do not have the well-being of the environment, the forests, their own workers, or the state at heart. Many have dark suspicions that the paper companies are in the process of liquidating their holdings in Maine, with a view toward moving to other parts of the globe where costs are lower, leaving Maine with thousands of people unemployed and whole townships with nothing but depleted forests.

In the 1970s, the Maine Land Use Regulation Commission passed rules regulating cutting along waterways to curtail silting and to create aquatic buffer strips, locally called “beauty strips.” In 1989 the Maine legislature passed the Forest Practices Act to regulate the size of clearcuts and promote “sustainable forests” (Maine Public Law, 1989). In 1996 and 1997, two referenda to regulate forest practices came to a vote. While both were defeated after months of politicking, the environmental industry will almost-certainly succeed in getting additional regulations passed in the future regulating forest harvesting practices. The forest industry is being forced to devote considerable resources to lobbying for laws with which it can live.

Third, and most important, after 1980, the paper companies have faced a decline in demand for paper products and increased foreign competition. Several plants have downsized, others have closed, and some companies have sold large amounts of their forest land to other corporations. Little investment has gone into Maine mills and forest holdings. This highly competitive environment has had a marked influence on the silviculture practices of these companies.

AN OVERVIEW OF THE CONDITION OF MAINE'S FORESTS

It is very difficult to assess the state of Maine's forests. Part of the problem is that it is difficult to get the facts since the forest industry and those who would regulate it are engaged in a political confrontation in which spin, fog, and obfuscation play a role in gaining their goals. The bureaucracies involved have reacted to the political pressure—as they always do—by avoiding producing data and interpretations which are critical of anyone.

A much larger part of the problem is that forestry is an applied science

involving some very difficult tradeoffs. Complicating the picture is the fact that the environment and the industry are not homogenous. Temperature, soil type, and species mix are quite varied from one part of the state to another. Perhaps most important, different types of landowners have long treated their forest lands quite differently with different goals and strategies in mind.

Measuring Forests

Part of the problem of assessing forest practices is the difficulty of defining forest health and sustainability. Much of this problem, in turn, stems from the fact that harvesting forests has multiple and complex effects on the ecological system. Harvesting affects the stock of trees, future timber supply, quality of stands, and the diversity of the species in the forests. It affects the nutrients in the soil, and heavy cutting can cause severe runoff and silting of waterways. In addition, it influences the habitat for wildlife and the aesthetics of the landscape. As a result, there is no single indicator of health or sustainability, and the criteria to indicate health and sustainability have changed over time. A healthy forest is not necessarily one that produces the most saleable timber.

Recently, Governor King of Maine appointed a task force to define the criteria and goals for sustainable forest management in Maine. After 2 years, they submitted a report calling for Maine's forests to be managed with seven criteria in mind: soil productivity, water quality, productive capacity and quality of timber resources, aesthetic impacts of timber harvesting, biological (flora and fauna) diversity, traditional recreational opportunities, and competence and public accountability of forest owners and managers. Defining and measuring each of these criteria is difficult enough, making it necessary to specify several subgoals or "benchmarks" for each criterion (Maine Council on Sustainable Forest Management, 1996, pp. iii-vi). Other experts define health and sustainability using similar lists of factors (e.g., Lucier, 1994, p. 22). Smith (1984), for example, defines forest health in terms of "efficient use of resources and rapid recovery from disturbance."

To assess the condition of a forest we need to know the balance between the rate of cutting and the rate of growth, as well as the quality of the cuts that were made. Heavy cutting using the worst forest harvest practices will do little damage if it is confined to a small area, and large areas can be cut with little damage to forest health if good harvesting practices are being used.

One of the best indications of the state of the forests and the timber

supply projections is the growth-to-removals ratio, which measures the balance between the total amount of trees removed by cutting and natural mortality to the total amount growing back per unit of time. "A ratio of more than 1:1 indicates increases in volume [of the "growing stock" of trees]; a ratio of less than 1:1 indicates decreases" (McWilliams, 1997, p. 179). A ratio of over 1:1 indicates that the average age of trees is increasing.

Another measure of the amount of cutting is annual harvest rate, which is measured in terms of the percentage of forest cut per year. The higher the percentage of the forest that is cut per year, the smaller the trees on the average. For example, if the annual harvest rate is 0.05%, then 60% of the landscape will be covered with mature trees 80 years old or older. If the annual harvest rate is 1%, then only 20% of the landscape will be covered with trees 80 years old (Hagen, 1996, p. 9). The annual harvest rate has implications for the value of the forest. Forests cut with a high annual harvest rate will produce a high percentage of small trees, low value trees useful for pulp. Thirty-year-old trees are small and have little strength. Forests with a high percentage of 80-year-old trees will produce a much larger number of saw logs and very high-value veneer logs highly prized for making furniture.

The quality of cutting on any given piece of land is not measured by how much wood has been harvested, but by what is left after a piece of land has been cut. This is generally assessed in terms of residual stocking standards measured in terms of how much "basal area" of wood remains.⁴

When an inadequate amount of basal area remains after cutting, the remaining trees are subject to a high probability of windthrow (blown down by wind); regeneration can be poor, soil erosion can be high on slopes, and many poorly formed trees can result. It also changes the composition of the forests. When an area has been heavily cut, the species mix that results consists of a high percentage of "pioneer species" such as aspen and birch, and hardwoods such as red maple, and a low percentage of the more valuable species such as spruce and white pine.

Another method of assessing the quality of cutting is to measure the "rate of removal," although this technique is considered less exact. Since there is a good deal of variation in type of trees, soil type, etc., from one part of the state to another, the rate of removal standards vary from one

⁴Basal area pertains to the cross-section area of tree trunks, measured at 4.5 ft off the ground. Stock is a measure of the density of trees occupying an area measured in terms of basal area. Stocking is evaluated in terms of the number of trees of a certain diameter. The smaller the diameter of the trees, the smaller the residual basal area needed to stock an acre adequately. Thus an acre with trees an average of 16 in. in diameter could be considered well stocked if 240 ft² or more of basal area remained; if the trees were very small (e.g., 4 in. in diameter), the same acre might be considered well stocked if only 125 ft² of basal area remained. (Solomon *et al.*, 1987, pp. 2-3).

locality to another. In many parts of Maine, the maximum amount that can be removed without substantial stand damage is 40% of the basal area, and 33% is better. For all practical purposes, clearcuts exist when 80% or more of the basal area is removed (Lansky, 1996).

The Condition of Maine's Forests

Although there is considerable variation in the estimates, all of the data indicate that Maine's forests have been very heavily cut in recent decades. In the state as a whole, "The area of timberland has remained stable, total growing-stock volume decreased by 7%, and the current growth to removals ratio is .8 to 1, indicating that for every cord of wood cut only .8 cords were growing back" (McWilliams, 1997, p. 1). However, the growth-to-removals ratio for softwoods in the state was 0.5 to 1. Softwood is being cut at twice the rate it is growing back (McWilliams, 1998, p. 18).

A study done by officers of the Maine Forest Service uses simulation modeling to demonstrate that the growth to removals ratio would be negative well into the 21st century. The results of this modeling exercise showed that in the year 2005, the ratio of net growth to harvest is 0.80, indicating that only 0.8 ft³ of wood is growing back for every one harvested. In 2015 the ratio is 0.80; in 2025 it is 0.86. When the model was run assuming that improved harvesting techniques had been used, net growth-to-harvest ratio was improved but still remained under 1.0 for most of the 21st century (Gadzick *et al.*, 1998, pp. 15, 19). The report concluded that "the current rate of growth in Maine's forests cannot sustain indefinitely the current level of timber harvest. . . . Current management is capable of sustaining 86% of current harvest levels" (Gadzick *et al.*, 1998, pp. 1, 2).

There is reason to believe that these figures on rate of cutting may be relatively optimistic, since there is widespread agreement among those familiar with the forest industry that there has been a good deal of underreporting of the amount of acreage cut. This is particularly true of the years before the Forest Practices Act was passed in 1990. Since the legislature has learned the hard way that cutting data from the industry are not accurate, it has passed a law requiring the Maine Forest Service to do an annual forest inventory beginning in 1999 (Gadzick *et al.*, 1998, p. 26).

The figures on the annual harvest rate also indicate that the forests are being cut heavily. Hagen (1996, pp. 8–10), for example, says that the paper companies are cutting 1.5% of their land per year, which "is consistent with a 60 to 70 year harvest rotation." Lansky (1998, p. 17) says that cutting rates are considerably higher than this and that "the entire forest will be cut-over in 30 years." Figures given by William Vail, Executive Director

of the Maine Forest Products Council, indicate that the cutting cycle on privately owned forest is 34 years (Kinzie, 1998). While these estimates of the annual harvest rate vary considerably, they all indicate that Maine's forests will be younger in the future than they are at present. Even if Hagen's estimate of a 60- to 70-year rotation is accurate, he admits that there will be a considerable change in the appearance of the forest, and that such cutting rates "will not maintain the forest we see today on Maine's landscapes" (1996, p. 9).

Moreover, there has been a considerable change in the composition of forests in the state as a whole in recent decades. Between 1982 and 1995, there was a "20 percent decrease in the area of spruce/fir timberland along with a 16 percent increase in northern hardwood stands" (Irland and McWilliams, 1997; McWilliams, 1997, p. 177; Seymour and Lemin, 1989, pp. 19ff.). The 46% decline in red spruce and balsam forest is so precipitous that foresters are predicting a shortage of these softwoods in the near future. In addition, while the amount of land in hardwoods has increased, there has been a decline in the quality of hardwood stands due to "high grading."⁵

This change to a younger forest has resulted in a marked change in the stand size classes. In 1959, 46% of all forest acreage was in pole timber; in 1995 the figure had dropped to 41%. In the same time period, the percentage of land in large saw timber has decreased from 39 to 34%. There has been a huge increase in the amount of acreage in seedlings and saplings. In 1959, only 14% of forest acreage was in seedlings and saplings; in 1995 fully 25% of the forest was in such very young stands (Gadzik *et al.*, 1998, pp. 3–4; McWilliams, 1997, pp. 177–178).

For our purposes it is important to note that there is considerable variation in the condition of the forests from region to region. According to the 1995 U.S. Forest Service Inventory of the Maine Woods, the quality of forests in the northern counties of Maine (i.e., Aroostook, Piscataquis, Somerset, Washington, and Franklin) was much worse than in the southern counties (Lansky, 1998, pp. 21–22; McWilliams, 1998, p. 14). In comparison with the southern counties, the forests of the north had low productivity per acre of wood, a high percentage of land in seed and seedlings (25 to 31% of the total area), and very low growth rates. Perhaps most important, these areas had very high cut to growth ratios. In all of these counties the ratio was 2 to 1, indicating that twice as much wood was being cut as was growing back. The exception was Piscataquis County where the ratio was 3.6 to 1. (In reading these figures it is critical to note that this 1995 Forest

⁵"High-grading" refers to the practice of harvesting all of the high-grade, valuable trees and leaving low-grade trees.

Service study was done only a few years after the spruce budworm epidemic when unusually heavy cutting took place. Nevertheless, these figures give a picture of the condition of the forests in 1995.)

THE CUTTING PRACTICES OF LANDOWNERS

Who is responsible for the problem of overexploitation of the Maine woods? This is a complex question, because there are thousands of land owners, and their forest practices vary considerably. Not all are equally guilty by any means. Some landowners practice good forestry.

It is standard to divide land owners into several types: (1) “industrial”—land owned by a company that also owns primary wood processing facilities such as paper mills or sawmills; (2) “large nonindustrial”—land owners with more than 5000 acres who do not own primary wood processing facilities; (3) “private”—land owned by private individuals with less than 5000 acres (timber companies); (4) “contractor”—land bought and cut by logging contractors; and (5) “other”—land owned by government including Native Americans (Lansky, 1992, 1996, pp. 19–23).

Mitch Lansky has done the most complete study of the forest practices of various kinds of landowners in Maine. He assesses their cutting practices in terms of the percentage of wood removed rather than the amount of basal area remaining, a more standard measure. According to Lansky, the best forest practices are being done by organizations in the “other” category.⁶ Most of the landowners in this category are various levels of government, but it also includes the Native American communities and organizations such as the University of Maine and the Maine Audubon Society. Such organizations all meet minimum standards, and some do an exemplary job. For example, at the Penobscot Experimental Forest in Bradley run by the U.S. Forest Service, 40 years of selective cutting has produced both high-productivity and high-quality stands of trees (U.S. Forest Service, 1991). (It should be noted that governments in Canada and other parts of the world have not done a good job at conserving forests.)

Companies in the “large nonindustrials” category have done a reasonably good job of maintaining their forests in recent years. Baskahegan Land Company and Seven Islands Land Company are doing “shelterwood thinning” and selective cutting and use a minimum amount of herbicides. They are not doing much clearcutting. These companies do not own paper mills and are essentially in the business of producing timber for sale to other companies. It is not in their best interests to cut small trees for

⁶There were only a small number of landowners in the “other” category.

pulpwood when they can be cut for high-value saw logs in a couple of decades (Hunter, 1990; Lansky, 1992, p. 191). Of all of the types of land owners, the "large nonindustrials" had the highest percentage of low-removal partial cuts. Sixty percent of the partially cut land of the "large nonindustrials" passed the 33% removal test (Lansky, 1996, p. 18).

In 1998 and 1999, two large nonindustrials landowners have sold the development rights to very large amounts of acreage to organizations committed to forest conservation, with the stipulation that they would be permitted to harvest timber on the land, but would never develop it. The actions of these two family-owned companies are being applauded by environmental groups (Izakson, 1998c; Young, 1999).

Some of the best and some of the worst forestry is being practiced on *private land*. Many private land owners do nothing with their plots, allowing trees to grow for long periods without removing diseased trees or harvesting anything. When these people have their land cut, many hire contractors who then strip the land bare. Such land is rarely replanted, with the result that low value pioneer species establish themselves and many of the remaining trees "blow down." It takes decades for such land to recover to the point where it can be harvested again. Still other small land owners practice some of the best forestry in the state by "low-grading" (taking the worst trees), with the result that the stands are continually improved.

Forest *contractors* make their living by purchasing wood lots, cutting all of the salable wood, and then selling the cut-over land. There can be little question that the contractors are severely denuding the forests they cut (Lansky, 1996, p. 23). Data from the Maine Forest Service survey point out that all of the area harvested by contractors exceeded the percentage of removal rate standards, leaving all the land understocked in a condition that used to be called "industrial clearcuts." The areas they cut typically have all of the problems associated with the worst kind of clearcutting, including poor stocking, bad residual forest quality, and extensive damage to soil and water quality.⁷

The *industrial land owners* are the paper companies. Their performance gives little cause for jubilation. They are the largest land owners in the state, and they are cutting their own land very heavily using less than optimum harvesting practices. The result is reflected in the figures reported in the Maine Forest Services inventory, which shows that on land owned by industrial companies, only one-third of the acres of partial cuts met the

⁷David Edson, Vice President of James Sewall Company, defends the practices of some of the contractors by pointing out that in many cases, they are buying up poor-quality forest lots where a lot of high-grading has occurred and then stripping them of trees, allowing them to "start over." It is a "necessary job," he said.

33% or less removal standard, as opposed to 60% of the lands owned by those in the "large nonindustrial" category (Lansky, 1996, p. 19).

Moreover, these industrial land owners are cutting their forests at a far faster rate than the forests are growing. Their practices are changing the composition of the forest in ways that have lowered the value of the forests that remain, depleted the nutrients in the soil, and severely damaged the ability of many tracts to regenerate rapidly. Both the health and the sustainability of the forests have been degraded.⁸ Even worse, these companies are buying much of their pulp supply from contractors whose forest practices are far worse.

Not all land owners have degraded their own forests, but there can be little question that some have. If we want to understand the phenomenon of overexploitation of privately owned land, we need to focus on the contractors and the industrial land owners. These firms own much of the land in the northern counties (i.e., Aroostook, Piscataquis, Somerset, and Washington Counties), and it is their activities that have resulted in the poor condition of the forests in these areas. Some attention also needs to be paid to the least responsible of the private owners, who own land more widely in the state.

FOREST PRACTICES OF CONTRACTORS AND INDUSTRIAL LAND OWNERS

Contractors

For contractors, immediate profits are paramount; conservation is not considered. These firms make maximum profits by buying wood lots, cutting all of the harvestable wood as fast as possible and then selling the land at a relatively low price. Taking most of the marketable wood on a lot in one cut allows them to make maximum use of mechanical harvesting technology, reduces the costs of road building, and decreases accidents. (It also compacts the soil, making regeneration difficult, and damages a lot of the remaining trees.) They reduce costs further by spending nothing on planting, herbicides or pesticides, much less the salaries of professional foresters. The land is left to regenerate by itself.

These companies typically practice "high-grading" of the most damaging variety, taking all of the highest-grade timber and anything else usable and leaving the rest. The result is even worse than clearcutting. Clearcutting

⁸Dr. John Omohundro, who has been gathering information on the forest industry in Newfoundland for many years, has also come to the conclusion that the forests of Newfoundland have been damaged by their owners (Omohundro and Roy, 1997).

takes everything. High-grading takes all of the good trees and leaves the poor-quality and diseased trees as breeding stock.

Contractors typically run classic “cut and run” timber operations reminiscent of the “pioneer behavior of the frontier” (Hanna, 2000, p. 26). In the nineteenth century, timber cutters moved over the landscape cutting one virgin stand after another, unencumbered by regulations or concern for conservation. When the trees in one area were gone, there were always more in another area. In Maine, the lumber barons had cut all the high-quality first-growth forests by 1900 and had left for Wisconsin and Minnesota, where they did the same thing. The forest contractors are their descendants.

Industrial Land Owners

The forest operations of industrial land owners present a mixed picture. While it cannot be said that they do nothing to care for the forest, their forest practices leave a good deal to be desired. They have two strategies. First, some landowners, including the paper companies, are turning to high-yield silvicultural practices. In some cases, they are thinning young softwood stands and applying herbicide to kill unwanted species of hardwoods. In other cases, they are establishing plantations and growing wood on an agricultural model. On these plantations, the land is cleared, planted in desirable species, treated with pesticides and herbicides, and harvested at an optimum size.⁹ While the use of pesticides and herbicides has increased in recent years, only a small amount of acreage is thinned and planted.¹⁰ High-yield silvicultural practices are being tried on only 4% of Maine’s timberland acres (Gadzick *et al.*, 1998, p. 11; Irland and McWilliams, 1997, p. 52).

Second, and most important, on most of the acreage they own, the industrial forest owners practice what one professional forester called “cut-rate forestry,” in which concern for costs usually takes precedence over good forestry practices. Foresters working for the paper companies typically

⁹The companies argue that herbicides are expensive, do little damage to the environment, and are completely legal. Their use, company spokesmen claim, reflects a commitment to enhance the growth of high value trees (Kinzie, 1998). Some environmental groups claim that herbicides are very damaging to the environment and vow to have their use curtailed. Their use is certainly not popular with the public.

¹⁰The industrial land owners do very little replanting of trees, but this is not generally indicative of poor forest practices. Dr. David Field, a forest economist at the University of Maine, points out that “there are an average of one million seedlings found on each acre of cut over land in Maine, and in certain areas the figure reaches two million seedlings per acre. The problem is thinning, not planting.”

have to manage 75,000 to 100,000 acres. This means that they do not have a fine-grained knowledge of the stands and the area and cannot do good-quality selective cuts.

The most damaging practice is poor-quality partial cutting, which is occurring on most of the acreage cut by the industrial land owners. In many cases what is termed “partial cut” is “high-grading” in which the best trees are cut, leaving diseased and poor-quality trees as breeding stock. However, the practice of the paper companies that has raised the most public ire is clearcutting. There can be little question that it is the paper companies that are doing virtually all of the clearcutting and that these clearcuts are being done in ways that have degraded the quality of the forests.¹¹ Clearcutting does not necessarily have to be bad. From the point of view of professional foresters, clearcutting, if used properly, can cut costs of harvesting substantially while promoting certain biological goals (Irland, 1996, p. 39).¹²

Unfortunately, in Maine clearcutting is usually not done well. A study done by the Irland Group concluded that much of the clearcutting that occurred in Maine in the 1970s and 1980s did not result in a healthy or sustainable forest. “Many logging operations do not employ professional foresters; some carry out the worst kinds of commercial clearcuts” (Irland, 1988, p. 15). In Maine, clearcutting has been done over wide areas and with heavy equipment that compacts the soil, which makes it difficult for seeds from surrounding areas to cover the land and begin to grow. As a result, clearcuts are often covered with raspberries and low bushes for many years. The trees that finally begin to grow have a higher percentage of low-value “weed hardwoods.” In the meanwhile, erosion has leached out the soil, making it less productive (Pierce *et al.*, 1993). It takes decades for a mature forest to establish itself. To be sure, areas that have been clearcut can be harvested again in as little as 40 years, but in comparison with older forests, the amount of pulp that can be obtained is less, the structural strength of lumber produced is inferior, and the costs/volume harvested are relatively high.

¹¹Lansky (1992, p. 252) reports that in 1989, “85% of all reported clearcuts were on industry land.”

¹²Clearcutting can substantially lower the costs of harvesting trees since it allows unimpeded use of mechanical harvesters, lowers the accident rate, reduces the amount of productive land that must be used for roads, and reduces the number of foresters needed since there is no need to mark individual trees. Clearcutting also promotes the growth of stands of trees that need a lot of sunlight and provides a habitat for animals that thrive in the dense vegetation that grows for a period of years in clearcuts [i.e., those eating berries and seeds (Lucier, 1994, p. 22)]. In Maine, clearcutting might be advised in areas where soils are very shallow and selective cutting would result in large numbers of “blow downs” (i.e., trees blown down by the wind).

In the 1990s the amount of land that has been clearcut has declined significantly. In 1989 in the unorganized townships (northern and eastern counties of Maine), 45% of the harvested area was clearcut; in 1994 only 11% was clearcut (Hagen, 1996, p. 14; Maine Forest Service, 1995, p. 18). Much, if not all, of this reduction, is due to the passage of the Forest Practices Act (Maine Public Law, 1989), which limits clearcutting and sets standards for regeneration after areas have been clearcut. However, a decline in clearcutting has not led to selective cutting of a type that will lead to healthy and sustainable forests. "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" (Irland, 1996, p. 37). In short, in the 1980s and 1990s the industrial companies did a lot of poor quality clearcutting. When they were forced to reduce the amount of clearcutting, they resorted to an older strategy—poor-quality partial cuts.

Why have the industrial land owners done so much clearcutting and poor-quality partial cutting? Much of the clearcutting was done in response to the spruce budworm epidemic of the 1970s and 1980s, which has made it necessary to salvage a lot of wood (Maine Pulp and Paper Association, n.d.). However, many experienced observers of the industry point to another compelling reason—concern with costs (Irland, 1996, p. 37). Irland (1988, p. 15) concludes, "Even where professional supervision is applied, considerations of cost and administrative ease often overrule silvicultural and multiple use considerations." Mac Hunter, a very eminent wildlife biologist at the University of Maine, echoed this theme. In an interview with the author, he said, "Clearcutting is expedient. It is low cost forestry. These companies know the forest will come back some time. It may not be high quality forest, but they know they will get something out of it." Why doesn't it pay to wait until trees are mature to harvest them? Why is it so essential to sacrifice quality forestry to cut costs? To answer these questions, one must know something about the economics and organization of the forest industry.

THE ECONOMICS OF THE FOREST INDUSTRY: BETWEEN A ROCK AND A HARD PLACE

The forest industry operates in an environment in which several economic factors work against the maintenance of healthy, sustainable forests. Many decisions of owners of forests stem from the fact that investing in

forests does not give high returns, given the long time horizons involved and the slow growth rate of trees in Maine.¹³ All knowledgeable observers agree that returns on investment in forest land average no more than 6%. Moreover, it does not pay to invest much to attempt to enhance growth and yield. Charles Simpson, the manager of the University of Maine Forest said in an interview with the author that if “we invest \$200.00 per acre, we are likely to lose money.” An analysis done by Mass and Vicary (1991) makes the same point in more technical detail. They assessed the returns that could be realized from forest plantations under the most ideal conditions. That is, they assumed that the plantation would be harvested in 50 years, that during those years there would be no outbreak of disease, that stumpage rates would rise steadily, that the land cost nothing, and that there were no taxes. At a 4% discount rate, the net present value (NPV) was \$231.00; at 5% it was \$59.05; and at 6% the NPV was -\$50.30. If conditions were less ideal and the discount rate at competitive industry levels, investment in a plantation would lead to substantial losses. The general point is that the present value of a tree 50 to 80 years in the future will be very low, regardless of the discount rate used. Under these conditions, there are strong incentives to cut forests as soon as possible.¹⁴

The contractors get around this problem by reducing the duration of an investment to a few months by purchasing land, stripping it of trees, and then selling the land. They are not tying up expensive capital for long periods in slow-growing trees. This strategy effectively reduces the cost of waiting to nothing and passes the costs of heavy, unsustainable harvesting levels onto future owners and the public.

The industrial land owners (i.e., the pulp and paper industry) face a more difficult set of circumstances. In addition to the problems stemming from the low returns on investment in forest land, they have had to contend with vastly increased competition and cut-throat price competition. Demand for magazines and newsprint has declined, and prices for paper products are very volatile (Legasse, 1997; McDonald, 1997). Moreover, Maine mills face increasing competition from the modern mills that have been built in the southern part of the United States and in foreign countries.

The strategies of the paper companies are complex and have undergone considerable change in the past few years. Throughout most of their history,

¹³In Maine it takes approximately 80 years for softwood species to mature. Growth is much faster in warmer climates. However, Maine softwood has much denser fibers, making it ideal for the production of high-quality paper.

¹⁴Baskerville (1995, p. 96) points out that forests pose very difficult resource allocation problems, particularly in those cases in which there are two or three generations between investment and harvest. In all cases, there is a strong tendency to make decisions with the interests of the current generation in mind.

the paper companies have invested in large amounts of land, which they have held for decades. If this has given them a hedge against wood shortages and sudden price jumps, it also has meant that they have tied up a lot of money in slow growing forests. The paper companies in Maine have not attempted to compete by maximizing output and efficiency using state of the art technology. Rather, they have sought to keep profits at acceptable levels by keeping costs low. They have employed four strategies to this end.

First, they have effectively lobbied the government for a variety of services such as fire control, spruce bud-worm spraying, and tax breaks in the form of reduced capital gains, reduced taxes for pesticides, the tree growth tax law, tax credits for mill investment, and, most important, low land taxes (Lansky, 1992, p. 345).

Second, the paper companies have cut costs by keeping investment in their mills low. They have invested so little in their Maine mills that most are operating with antiquated equipment. Many of Maine's 13 paper mills are running with machinery and equipment that was purchased in the 1940s or even earlier (Gagnon, 1997). For example, the Rumford mill, currently owned by Mead Corporation, has one paper machine that was built in 1895.¹⁵ In the entire state, there is not one truly modern, state-of-the-art mill. As a result, one paper machine in one modern mill in Finland can produce 10 times the amount of paper produced by some of the mills in Maine.

Companies may show better profits with old machinery which has been completely depreciated than they would had they invested in new paper-making equipment costing over \$100 million per machine (Vollmers, 1998), but there are limits to the length of time for which this strategy can be employed. After a time, antiquated machinery results in such a low output that it is impossible to compete even though the capital equipment is completely amortized. There are fears that this may already have occurred in the case of several Maine mills (McDonald, 1997; Voight, 1999).

Third, the paper companies are cutting their forests heavily, using low-cost techniques such as clearcutting and poor-quality partial cuts. These strategies avoid the full costs of investing in sustainable forests.

Fourth, the companies increase efficiency and cut costs by keeping their mills operating continually. They never let their mills lie idle even on national holidays. Woodlands, including those owned by the company itself, are simply a source of raw materials for the mills. One knowledgeable

¹⁵To be sure, there has been substantial investment in the Champion mill at Bucksport (Boyd, 1998), International Paper company invested \$100 million to convert one of its paper-making machines to produce coated paper, and a much smaller amount has been spent on the plant at Madison (Graettinger, 1997; McDonald, 1997). But on the whole, the paper industry in Maine has lagged far behind industry leaders.

forester said that the primary job of paper company foresters is “inventory control.” Running forest operations with the production needs of mills in mind does not usually lead to the type of forestry that maximizes forest yield and growth, much less the long-term health of the forests.

INDUSTRIAL CONSOLIDATION, INSTITUTIONAL CHANGE, AND THE FUTURE OF THE FORESTS

There are vast changes under way which will affect the way the contractors and pulp and paper companies treat the forests they own. The industry is in a period of consolidation and general downsizing. Virtually all of the paper companies that were in Maine for decades have left the state (e.g., Brown Company, Great Northern, Saint Regis, and Scott), and their assets have been purchased by other paper companies. Some mills have been closed, including those at Gardiner, Pejepscot, Winslow, and Augusta (Gagnon, 1997; Associated Press, 1998). The near-future will see several others closed or greatly downsized. In May 1999, it was announced that the gigantic Bowater Company had sold all of its assets in Maine. The mills and 380,000 acres of forest land were sold to Inexcon (Legasse, 1999, p. A1). [One of these mills will be closed (Legasse, 1998).] A few months previously, Bowater had sold 1.6 million acres of forest lands to J. D. Irving, Ltd., and McDonald Investment Corporation. In June 1999, it was announced that Mead Corporation would shut down four paper machines at its Rumford mill (Associated Press, 1999a), and Sappi Corporation said that it will abolish its pulp making operations in the Westbrook Mill (Associated Press, 1999b). There are fears that the mills at Woodland and Old Town will follow.

At the same time, however, a few companies, such as Champion, are expanding their Maine operations even though they are selling “5 of its 11 mills worldwide and associated timberland to refocus on its more profitable products” (Boyd, 1998). Champion’s mill at Bucksport is being partially modernized, and the company has bought 140,000 acres of land from James River Corporation (Boyd, 1998).

The paper companies remaining in Maine are divesting themselves of forest lands and forest operations. All of the large paper companies are reorganizing so that their mill operations and forest operations are owned by two different firms. They are becoming less vertically integrated and are specializing more in the manufacture of paper. Divestment has resulted in huge amounts of land being sold to different kinds of organizations, with different goals, under different kinds of contracts. In 1998, about 12% of all of the land in Maine was sold by three industrial forest owners in sales totaling 2.5 million acres (Izacson, 1999); millions of acres more were sold

in 1999. Sappi Corporation sold all of its forest holdings (almost 1,000,000 acres) to Plum Creek with a contract specifying that Plum Creek would supply wood to Sappi's mill for the next 40 years (Izakson, 1998b). Bowater sold 1,650,000 acres to Irving Corporation and McDonald Investment Corporation with a similar contract to supply its mills (Lagasse and Izakson, 1998). However, International Paper sold another 185,000 acres to the Nature Conservancy, which plans to "set the land aside for conservation" (Izakson, 1998b), and two nonindustrial land owners have sold development rights to conservation organizations (Izakson, 1998c; Young, 1999).

The companies selling Maine forest land have very different motives from those that are buying it. Paper company spokesmen say that they are selling land to enhance the value of stocks. That is, they are getting rid of assets that do not give high returns (McDonald, 1998). Other observers of the industry point out that selling forests makes another company responsible for forest management in an era when increasing regulation and public concern are raising both monetary and transaction costs. A number of the companies buying such land are large investment firms seeking to acquire assets that will lower risks. Returns on forest operations usually go counter to the economy in general, so that stocks in forest companies even out portfolio returns.

The divestment of forest lands by the paper companies will likely have both positive and negative effects on forest practices and forest health. As a result of both sales of land and reorganizations, paper companies are currently producing little of the pulp they use from their own lands. International Paper company now owns no forest land and is buying 100% of the pulp it uses from other suppliers; Champion is buying 85% of the pulp it uses. This means that most of the pulp supply is coming from lands owned by private owners, subsidiary companies, or contractors. In recent years, the paper companies have begun to loan money to contractors to help them purchase large lots. This means that the carnage caused by cutting practices of the contractors is done with the full knowledge of private owners and is financed by paper companies that buy the resulting pulpwood.

However, the massive divestment in forest lands could well work to the benefit of high-quality silviculture and forest management in the long run. David Edson, Vice President of James W. Sewall Company, said in an interview with the author that divestment "is not all that bad." By this he meant that having mills run by one company and forests owned and operated by others creates two profit centers. It will likely ensure that forests are managed profitably and that the health of forests is not sacrificed to the benefit of another company operation (i.e., mill operations), which apparently occurred when mills and forests were owned by a single firm.

Pressures to improve forestry practices are beginning to come from

still another quarter. Among small private land owners there is increased interest in "low-impact forestry" to give better yields and profits in the long run by selective cutting and stand improvement. There are also serious moves to establish marketing associations to increase the "negotiating and selling power" of the small land owners (Izakson, 1998a). Small landowners are becoming increasingly aware that their market power is growing as the paper companies become more reliant on them for pulp. One said that the paper companies "have to have our wood. . . . They have cut their own wood" (Izakson, 1998a).

There is a general consensus among educated observers of the industry that the future of Maine paper making is not bright. University of Maine economist Tom Duchesneau said in an interview with the author that "all the signs point downward." By this he means that the competitive market, the declining demand for paper, the possibility of new technologies, the investment of the paper companies in other parts of the globe, the shrinking labor force, and the unwillingness of these same companies to invest heavily in state-of-the-art equipment in Maine all indicate decline.

There is no consensus on what will happen to the industry in the next few decades. Some experienced observers, including Representative Paul Volenik,¹⁶ believe that the entire paper industry will leave Maine in the next few decades. The heavy cutting of Maine forests, they believe, are "liquidation cuts" done by companies which are using up their Maine assets preparatory to leaving the state. They buttress their argument by pointing to the low rate of investment in Maine mills and the fact that substantial industry investment is going into places such as Brazil, Korea, and South Africa, where markets are better and costs lower. It was a matter of some interest that BOWATER Corporation, which has sold all its assets in Maine, including two mills, bought a mill in Korea. Another Maine paper maker bought a mill in Brazil (Legasse, 1997). However, other knowledgeable observers, including Dr. David Field, Chair of the Forest Management Department at the University of Maine, believe that the paper companies will remain in the state for a long period. What is clear is that the industry is in a period of consolidation and downsizing. The future will see fewer mills and less employment in the paper industry in Maine and the United States as a whole.

WHY OVEREXPLOIT YOUR OWN FOREST?

One of the axioms of the theory of common property resources is that owners of those resources will conserve them and use them efficiently.

¹⁶Representative Volenik is a member of the committees of the Maine legislature dealing with both forestry and fisheries issues. He has introduced several bills into the legislature to regulate forest practices.

There is one exception. Colin Clark has proposed that it is rational for owners of property to overexploit when the rate of growth of the value of the property is less than the discount rate (Clark, 1973). It makes little sense to keep a resource that is growing at the rate of only 4% when one can earn 8% interest in the bank. In these circumstances, it would pay to sell the resource and invest in a certificate of deposit or increase the exploitation rate of that resource to increase profits and then divest oneself of the investment.

This explanation does appear to apply well to the actions of those paper companies which are selling their mills and land in Maine only to invest in forests and mills in other more profitable areas such as Alabama and Brazil. But on the whole, it does not capture the reasons that Maine forests are being overexploited.

In the recent past, both the contractors and the industrial land owners have cut very large amounts of land in ways that do not meet minimal stocking standards. Unfortunately, their behavior is rational, and the strategies they employ are profitable. Their activities demonstrate that substandard forest practices pay. The contractors are practicing "cut and run" forestry, with no concern for conservation or acceptable forestry practice. By stripping all the harvestable trees and selling the land quickly, contractors maximize profits by avoiding all the costs of high-quality forestry as well as the costs associated with owning property for long periods. When they finish, the land cannot be cut again for many decades.

In great part, the industrial land owners overexploit their forests as a result of attempts to reduce costs. This is necessary given the nature of markets for paper. Paper is a commodity. One cannot increase prices over one's competitors by differentiating one's product through advertising. One can compete only by keeping prices lower than one's competitors. The paper companies exist in a very cut-throat world in which low prices for paper and low profit margins necessitate widespread cost cutting in all of the operations of the company, including the forests. Viewed from the perspective of a mill superintendent, costs cannot be reduced by using new technology because the mill owners in New York will not provide such technology. But costs can be reduced by clearcutting, herbicide use, and high-grading. Drawing down the value of forest assets will not compensate for a lack of advanced technical equipment forever, but it may make it possible to operate at a profit for years or even a few decades longer than would be the case if such tactics were not employed.

For somewhat different reasons, drawing down the value of one's own forests also makes sense from the point of view of corporate headquarters in that this may help to avoid take-over attempts by other companies. One of the problems with capitalism is that it makes it necessary for owners and managers to orient themselves toward short term profits. In public

companies, if the value of stocks fall, or assets are too high relative to earnings, then one becomes vulnerable to take-over attempts. In the world of paper company executives, it might be very rational to draw down the value of one's forests or sell them completely, to keep earnings high and the value of assets low, even though this strategy makes one dependent on other firms for pulpwood.

Two additional factors explain some of the overexploitation of forests by the paper companies. Some of the overexploitation of company lands ostensibly stems from a tradeoff in which the welfare of the forests is being sacrificed to satisfy the requirements of the mill. The second factor is the spruce budworm epidemic, which spurred large scale salvage cuts in the 1970s and 1980s.

THEORETICAL IMPLICATIONS

The theory of common property resources is built on the axiom that owners want to maintain property in the long run to obtain a steady income stream from it. They will protect these resources for this reason. It is also assumed that the cause of conservation of resources will be furthered by the existence of competitive markets. According to neoclassical economic theory, if competitive markets are working efficiently, there should be no divergence between the aims of individuals and the goals of the greater society. Under these conditions, people making decisions in their own best interests will make choices which are socially optimal. For the neoclassical school, efficient markets are the quintessential "invisible hand" solution.

Such assumptions are very naive in the case of forest resources owned by firms operating under the conditions we find in Maine. In this industry, there are a number of economic incentives to overexploit the forests that are privately owned. Good financial management is not always congruent with forestry practices leading to sustainability and forest health, and producing healthy and sustainable forests can result in reduced profits. In this industry, there is a divergence between what is rational for the individual firm and what is in the best interests of the society at large.

In addition, the data on the forest industry present no strong evidence that firms earn maximum profits when they maintain ownership over property and resources in perpetuity. Sometimes profits are maximized through sequential investments—using up resources on one property and then investing somewhere else and depleting the resources in the new location. Contractors have built their whole business on this tactic, but some of the paper companies which are divesting themselves of Maine land only to invest elsewhere are essentially using the same strategy.

Finally, the theory of common property resources asserts that private property has favorable effects because it does away with externalities (Acheson, 1989; Cheung, 1970; Johnson, 1972; Scott, 1955). In fact, some owners cut their forests in ways that result in substantial negative externalities. Clearcutting and poor-quality partial cuts impose externalities on the public in the form of silting and chemical pollution. There are also changes in the composition of wildlife on heavily cut over land (Hunter, 1990, pp. 59–86). In addition, other costs of doing business have traditionally been passed off on the public, including forest fire protection and the spruce budworm spraying program.¹⁷ There is still another kind of negative externality that stems from heavy cutting and poor quality silviculture—namely, the costs that are passed on to another generation of owners of the land in the form of reduced quality of stands, future timber supply, and soil fertility.

In the past, companies were allowed to reduce production costs by passing these costs on to the public or other generations of forest owners. The increasingly stringent regulatory environment is forcing forest owners to curtail such practices or internalize these costs. One of the unanswered questions remaining is what effect this will have on their ability to compete globally. To what extent will regulation in Maine drive companies to other parts of the globe?

This complicated set of factors suggests that the theory of common property resources needs to be extended and modified. Secure private property rights alone will not be enough to conserve resources and do away with externalities when the owners are operating in a system demanding constant short-term profits, where they face highly competitive commodity markets, where investments in slow-growing resources bring returns far in the future, and where harvesting has so many ramifying biological and social effects.

The theory of common property resources has focused on the effects of a lack of property rights on resource exploitation. It has largely ignored the problem of overexploitation of privately owned resources, primarily because the problem was not supposed to exist. In fact, owners of privately owned resources will overexploit them under conditions which are not well understood. This means that there is a need for a far more detailed examination of the effect of institutions on incentives to conserve resources than currently exists in the literature.

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¹⁷There are also positive externalities. The industrial forest owners allow the public to use their land for recreation without charge.

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