An Evaluation Of The Effects Of

The Forest Practices Act

Submitted to

The Joint Standing Committee of the 117th Legislature

Agriculture, Conservation, and Forestry

April 11, 1995

Maine Forest Service, State House Station 22, Augusta, Maine 04333
(207)287-2791 or instate 1-800-367-0223

EXECUTIVE SUMMARY
An Evaluation of the Effects of the Forest Practices Act
A Report to the 117th Legislature
The Joint Standing Committee on Agriculture, Conservation and Forestry
by the
Maine Forest Service
April 11, 1995

Overview

The 116th Legislature directed the Maine Department of Conservation to evaluate the implementation of the Forest Practices Act (FPA) and its effects on forest management practices in Maine.

Specifically, the legislature directed the Department to examine:

- The extent to which forest landowners are harvesting to the minimum standards adopted in the forest harvest regulations.
- How the separation zones around clear-cuts are being managed.
- The total acreage, the average acreage, the range of acreage and the geographic distribution of clear-cuts in the State; and
- Research into any other question the department considers essential to obtain an understanding of how the Forest Practices Act and the forest harvesting regulations have affected forest harvesting practices in the State.

The Maine Forest Service collected data on a statistically valid sample of harvests reported by landowners for the period 1991 to 1993.

This report provides analysis and interpretation of the data to facilitate continued discussion of the impacts of current forest management practices on forest health and productivity.

Findings

Harvesting to Minimum Standards

One criticism of the FPA is that landowners harvest to minimum standards for partial harvests in order to avoid performance standards associated with clearcuts. This study did not find widespread evidence to support this claim.

- 84% of the Partial Harvest acres sampled were harvested in such a manner that the residual stands were moderately to well stocked with healthy, well-formed trees of desirable species. On an annual basis, 339,000 acres of forest land are partially harvested resulting in healthy residual stands.
- High-grading to minimum standards occurred on 8% of the Partial Harvest acres sampled, indicating that 31,900 acres (or 0.19% of Maine's total forested acres) are high-graded each year. High-grading occurs when landowners harvest for maximum dollar value, with no planning for the quality of the next stand. While there is no historical data available, it appears that the Forest Practices Act has neither encouraged nor discouraged the practice of high-grading.

Management of Separation Zone around Clearcuts

Forest landowners are managing separation zones around clearcuts to preserve the quality and function of those forest stands that comprise the separation zones.

- 35% of the sampled separation zones around clearcuts experienced no harvesting.
- Approximately 10% of the sampled separation zones had evidence of harvesting that approached the minimum standards for separation zones.

The total acreage, the average acreage, the range of acreage and the geographic distribution of clearcuts in the State.

Another criticism of the FPA clearcutting rules is that they have led to fragmentation of forest cover by encouraging checkerboard patterns of multiple clearcuts on the landscape.

MFS estimates that patterns of multiple FPA-era (1991-1993) clearcuts on the landscape occur at approximately 44 locations, concentrated in the North and West regions of the study area. The clearcuts at these locations make up approximately 48% of all reported clearcut acres for the period 1991 to 1993.

Despite the locally significant impact of clearcutting at the above-mentioned 44 locations, the most frequent pattern of distribution on the landscape consists of single clearcuts or small groups of clearcuts widely dispersed on the landscape. The vast majority of towns and townships in each of the study regions show less than 1,000 acres of clearcuts between 1991 and 1993.

Average clearcut size has declined as a result of the FPA and rules. Clearcuts larger than 125 acres were common prior to FPA rules. Since implementation of FPA, 74% of all reported clearcut acres occur in clearcuts 35 acres or smaller. 26% of all reported clearcut acres occur in clearcuts larger than 35 acres; these clearcuts average 73 acres in size.

Other questions the Department considers essential to obtain an understanding of how the Forest Practices Act and harvesting regulations have affected harvesting practices.

Maine's forest species have a natural propensity to regenerate themselves. As a number of other studies have also shown, Maine's forests are adequately regenerating with desirable commercial species following harvests.

Conclusions

The most significant impact of the Forest Practices Act on forest management practices is the reduction in clearcut size. An unintended impact is the concentration of checkerboard patterns of clearcuts in some portions of the North and West regions.

Landowners are not hiding behind minimum stocking standards for Partial Harvests on any large scale to avoid clearcut performance standards. Forest industry landowners tend to report partial harvests that approach the minimum stocking standards as clearcuts.

The study quantifies the amount of high-grading occurring annually in Maine's forests. The majority of high-grading in the sample occurred on small private ownerships. The Maine Forest Service recognizes that reducing the rate of high-grading presents an opportunity to improve the quality and yield from Maine's forest resources in the future.

Introduction

Forests are Maine's most important natural resource -- providing jobs, clean water and air, wildlife habitat and recreational opportunities. Maine's forests are key to the quality of life and economic prosperity of the citizens of the State.

- Maine has 17.2 million acres of commercial timberlands (87% of the state's total land area) .
- Maine's forest-based economy - both recreation and manufacturing - provides employment for over 50,000 people and generates annual payrolls of over $888 million.
- The overall contribution of the forest resource to Maine's economy exceeds $7.5 billion.

The Maine Forest Service (MFS) works to ensure that the forests of Maine will continue to provide these benefits for present and future generations of Maine people.

The Forest Practices Act (12 MRSA Chapter 805, subchap. III-A), enacted in 1989, directed the Commissioner of the Department of Conservation to adopt standards for regeneration after harvests and performance standards for clearcuts.

LD 1764, "An Act to Preserve Productive Forests" was considered during the second session of the 116th Legislature in 1994. The original bill proposed to ban clearcutting in the unorganized territories of Maine. Debate over LD 1764 focused on whether or not Maine's forests are being managed to ensure the long term health of forest ecosystems to provide sustainable ecological and economic benefits. In the absence of reliable data, the basis for much of the discussion was individuals' perceptions and anecdotal evidence.

As a result of the discussion the 116th Legislature, through P&S 93 c.98, directed the Maine Department of Conservation to evaluate the implementation of the Forest Practices Act (FPA). The purpose of this evaluation is to provide reliable, scientific and statistically sound data to facilitate continued discussion of the effects of current forest management practices.

Specific directives in P&S 93 c.98 require the Department to conduct "research necessary to determine:

A. The extent to which forest landowners are harvesting to the minimum standards adopted in the forest harvest regulations;
B. How the separation zones around clear-cuts are being managed;
C. The total acreage, the average acreage, the range of acreage and the geographic distribution of clear-cuts in the State; and
D. Research into any other question the department considers essential to obtain an understanding of how the 12 MRSA, Chapter 805, subchap. III-A and the forest harvest regulations have affected forest harvesting practices in the State."

Methodology

The MFS designed a methodology to obtain the data necessary to address the 4 directives in P&S 93 c.98. A field survey was required to address directives A, B, and D. Information for directive C concerning clearcut acreage and distribution was obtained from existing MFS databases and additional sources.

The survey was designed in consultation with a technical advisory group, including faculty from the University of Maine College of Forest Resources, US Forest Service inventory specialists, the Maine Department of Inland Fish and Wildlife, and representatives of the environmental community and forest industry. The survey was designed to provide a statistically valid sample of harvests reported by landowners to the MFS. The field survey sampled harvests conducted during the period 1991 to 1993. (Harvest reports for 1994 were not complete when the field survey was designed.)

Harvest Site Selection - 150 harvest sites on 136 towns were randomly selected by computer from the MFS Notification, Tracking and Reporting (NOTAR) database. NOTAR is built on the landowner reports required by the FPA, and contains all reported harvests since the creation of the FPA. Sample sites were stratified by region and harvest size to ensure a representative selection of harvesting sites across the state. Figure 1 illustrates the regional stratification and sample site locations. The field work was conducted from September to mid-December 1994 by a senior forester from the MFS with the assistance of a private consulting forester under contract to MFS.

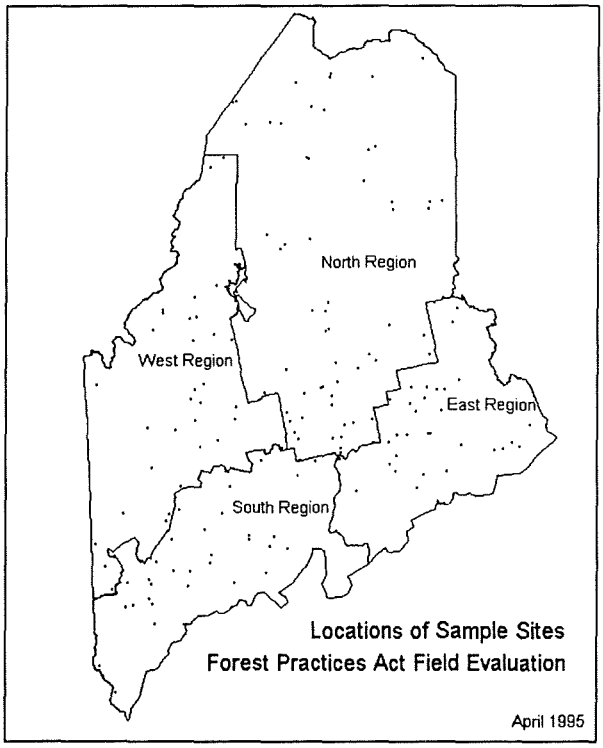


Figure 1. Location of Sample Sites

Definitions

For the purposes of discussion in this report, the following terms have the following meanings:

- **Basal Area.** Basal area means the area of cross-section of a tree stem, measured at 4½ ft above the ground. The total basal area of trees per acre is a commonly used measure of stand density and stocking, and is directly related to stand volume.

- **Clearcut Harvest.** A harvest greater than 5 acres in size that leaves less than 30 square feet basal area of residual trees per acre.

- **Forestland Ownership Type**

  Forest Industry. Land owned by a company that owns primary wood processing facilities such as sawmills, pulp and paper mills, or biomass plants. Much of the wood harvested on a company's land is used by that company.

  Large Non-Industrial. Land owned or managed by companies that do not own primary wood processing facilities. In this report, a large non-industrial owner owns or manages more than 5,000 acres of forest land.

Private. Land owned or managed by private individuals. In this report, private owners own less than 5,000 acres of forest land.
Other. Lands owned by a government entity -- municipal, county or state, quasi-public lands, etc.

- **Harvest Quality.** Harvest quality is a professional assessment of the suitability of the harvest based on accepted silvicultural standards. Harvest quality was assessed at each sample point and an average harvest quality calculated for each harvest site. The field investigators used the following criteria to evaluate harvest quality: 1) the spacing, species, and condition of trees retained in the residual stand; and 2) damage to residual trees, regeneration, and site. Examples of damage include soil compaction and scars on residual trees from harvesting equipment and yarding techniques. Harvest quality was rated on a scale of 1 to 5. Each harvest site was assigned an initial Harvest Quality rating of 1. Evidence of exemplary cutting and yarding techniques received up to 2 additional points. Evidence that the appropriate trees were harvested or left in the stand received up to 2 more points.

Harvest Quality

Low **High**

|------|------|------|------|

1 2 3 4 5

- **High-grading** - Removing the biggest and best trees in a harvest without regard for the quality of the future stand. High-grading results in stands that are dominated by low quality trees, and is considered undesirable as it reduces the quality of products and future yield from the forest.

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

- **Residual Basal Area Classes** - For purposes of discussion and analysis in this report, basal area of residual forest stands following harvest was divided into classes to evaluate compliance with FPA minimum stocking standards.

  Clearcut. Less than 30 square feet basal area.

  Minimum Standard. Between 30 and 39 square feet basal area.

  Moderate. Between 40 and 69 square feet basal area.

  Well Stocked. Equal to or greater than 70 square feet basal area.

- **Separation Zone** "Separation zone" means an area which surrounds a clearcut area and separates it from other clearcut areas. (Separation zones have performance

standards, which are discussed further in Directive B.)

Provisions of the Maine Forest Practices Act

The Forest Practices Act and MFS Rules Chapter 20 (Forest Regeneration and Clearcutting Standards) establish regeneration standards for all harvests, and performance standards for clearcuts.

FPA rules define two categories of clearcuts:

- A Category I clearcut is any clearcut that is greater than 5 acres and less than or equal to 35 acres.
- A Category II clearcut is any clearcut greater than 35 acres but less than or equal to 125 acres in size. A Category II Exception clearcut may be created between 125 and 250 acres with certain restrictions.

Performance standards applied to clearcuts relate to regeneration stocking, the size of separation zones, and harvesting within the separation zones.

The Forest Practices Act also imposes reporting requirements on landowners.

- Landowners must provide notification to the MFS prior to starting harvesting operations.
- Landowners are required to report annually to the MFS the location and size of each clearcut greater than 35 acres..
- Landowners who sell or harvest forest products for commercial use must report to the MFS annually the species harvested, volume cut, price received, location of harvest, size of harvest and harvesting methods employed.
- Before harvesting begins on clearcuts over 50 acres in size, a landowner must develop a forest management plan that is signed by a licensed professional forester. The harvest plan must demonstrate compliance with regeneration and clearcut standards, and must address the soil erosion potential of the harvest area.

In summary, the Forest Practices Act holds landowners responsible for 1) ensuring adequate regeneration following any harvest, 2) establishing separation zones around clearcuts, 3) reporting the location and size of large clearcuts to the Maine Forest Service, 4) preparing forest management plans for clearcuts larger than 50 acres, 5) certifying compliance with regeneration standards for Category 2 clearcuts to the MFS 5 years after harvest, 6) annual reporting of timber harvest, consumption, and importing and exporting.

Discussion and Results

The purpose of this report is to respond to the four directives contained in P&S 93 c.98 and to provide reliable data to facilitate continued discussion of the impacts of current forest management practices on forest health and productivity.

Directive A: To what extent are forest landowners harvesting to the minimum standards adopted in the forest harvest regulations?

One common criticism of the Forest Practices Act and Chapter 20 rules is that the minimum standards are too low to ensure a sustainable, healthy forest. It is feared by many that continued harvesting of Maine's forests at or near these minimum standards would compromise the sustainability of benefits derived from Maine's forests.

A commonly held public concern is that many acres of forests are high-graded. These harvests appear to extract the maximum volume at minimum cost without regard to the health, productivity, and yield of the next stand. Widespread occurrence of this practice would have adverse future impact on the ability of the forests to support Maine's forest-based economy.

A criticism of the Forest Practices Act is that the minimum standard of 30 square feet of basal area for non-clearcuts does not address the quality of the residual stand. Basal area provides an estimate of how many trees per acre are left in the stand to grow and gain in value. But basal area alone provides no indication of the relative quality of the trees left in the stand. The field investigation examined both the quality of the harvest operation and the quality of the residual stand to assess the extent to which high-grading is occurring. (The assessment of Harvest Quality is discussed in Definitions on pg. 4.)

The field survey measured the basal area of residual stands following Partial Harvests. Stand basal areas were divided into classes to evaluate stocking levels of residual stands following Partial Harvests.

The Residual Basal Area Classes are:

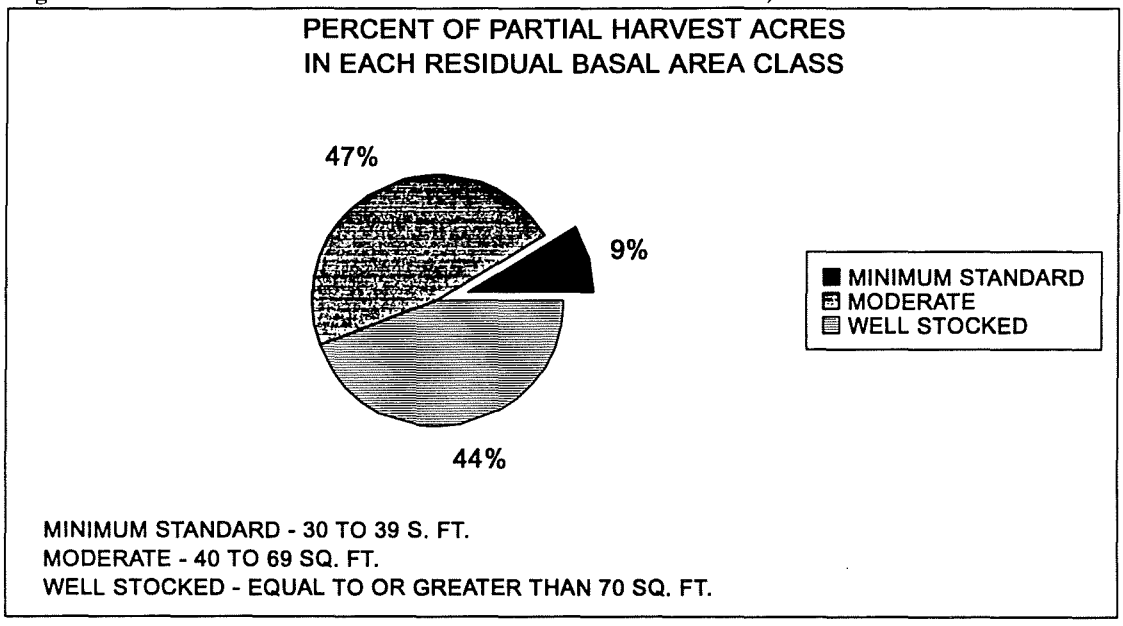
Clearcut. Less than 30 square feet basal area.
Minimum Standard. Between 30 and 39 square feet basal area.
Moderate. Between 40 and 69 square feet basal area.
Well Stocked. Equal to or greater than 70 square feet basal area.

Data for Partial Harvests was collected on 118 harvest sites throughout the state representing nearly 49,000 acres of Partial Harvests. These sites were selected from all Partial Harvests reported to the MFS for 1991 to 1993. 35% of the sample acres were on private forestland ownership, 57% of the sample acres were on forest industry ownership, and 8% of the sample acres were on other land ownership. (see definitions, page 3)

Findings: *Directive A.*

Figure 2 shows the distribution of residual basal area for all Partial Harvests sampled.

Figure 2. Distribution of Residual Basal Area for Partial Harvests, Statewide.



- On a statewide basis, 44% of all Partial Harvest acres were Well Stocked with residual basal area.
- 47% of all partial harvest acres had Moderate residual basal area.
- 9% of all partial harvest acres had Minimum Standard residual basal area.

Figure 3 illustrates trends in residual basal area by landowner type.

Figure 3. Partial Harvests - 1991 to 1993, Comparison of Post-Harvest Basal Area Classes Between Landowner Types.

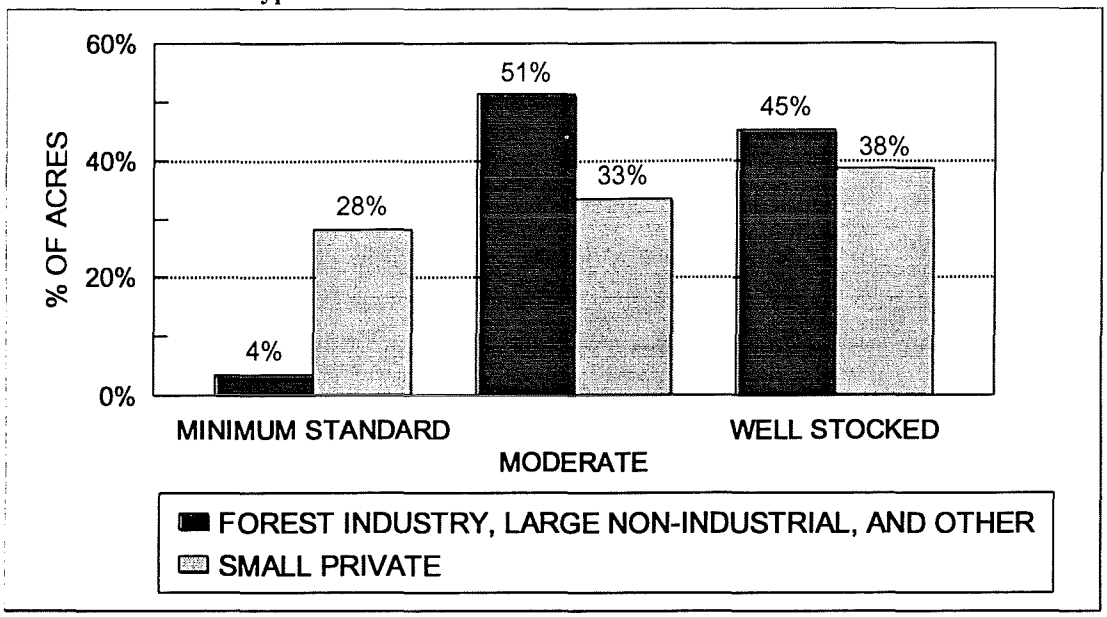


Table 1 summarizes the pre-harvest and post-harvest species composition for all partial harvest sites that were sampled to determine if high-valued species are being targeted for harvesting.

Table 1. Species Composition of Partial Harvest Sample Sites.

SPECIES	PERCENT OF PRE-HARVEST STAND	PERCENT OF POST-HARVEST STAND
WHITE PINE	10%	10%
SPRUCE	23%	18%
FIR	6%	3%
HEMLOCK	11%	14%
CEDAR	8%	12%
ALL SOFTWOOD	60%	58%
BEECH	7%	8%
WHITE BIRCH	2%	2%
YELLOW BIRCH	5%	6%
SUGAR MAPLE	7%	8%
RED MAPLE	10%	10%
RED OAK	4%	4%
ASPEN	3%	2%
ALL HARDWOOD	40%	42%

- The table shows an apparent downward shift in spruce and fir and a corresponding upward shift in hemlock and cedar in the post-harvest species composition.

To address the issue of high-grading, this analysis uses both Residual Basal Area and Harvest Quality to identify harvests resulting in high-graded residual stands. Residual stands with both low Basal Area and a low Harvest Quality rating indicate a high -graded residual stand with lack of silvicultural planning in conducting the harvest. (There are instances where it is silviculturally appropriate to leave low residual Basal Area, provided that healthy, vigorous trees dominate the residual stand.) In this analysis, residual stands with low Basal Area and high Harvest Quality are not considered as high-graded.) For the purposes of this evaluation MFS established the criteria of Harvest Quality Rating of 1 or 2 in the Minimum Standard basal area class to indicate a high-graded residual stand.

Table 2. Harvest Quality Ratings And Basal Area Classes For All Partial Harvest Acres Sampled.

BASAL AREA CLASS	*LOW QUALITY RESIDUAL STANDS HARVEST QUALITY RATED AT 1 OR 2*		*HEALTHY RESIDUAL STANDS HARVEST QUALITY RATED AT 3, 4 OR 5*	
MINIMUM STANDARD	**8 %**	**(31,900 acres)**	**1 %**	**(4,000 acres)**
MODERATE	**6 %**	**(23,900 acres)**	**41 %**	**(163,500 acres)**
WELL STOCKED	**1 %**	**(4,000 acres)**	**43 %**	**(171,500 acres)**
TOTAL	**15 %**	**(59,800 acres)**	**85 %**	**(339,000 acres)**

Footnote: Percentages list the percent of all partial harvest acres sampled that occur in each Basal Area Class and Harvest Quality Rating. Acres are based on 1993 Partial Harvest.

- **85 % of the partial harvest acres sampled are stocked with Healthy Residual Stands.** Applying this rate to all partial harvests reported for 1993 (398,743 acres) would indicate that, on an annual basis, **339,000 acres of forest land are partially harvested and result in healthy residual stands.**

  - **84 % of the partial harvest acres sampled are moderately to well stocked and demonstrate sound silvicultural planning** (Harvest Quality rated 3, 4 or 5) in implementing the harvest. These stands are stocked with well -formed trees of desirable species, and will continue to grow in value.

  - 1 % of the partial harvest acres sampled are stocked at Minimum Standard with well-formed, desirable trees.

- **15 % of the partial harvest acres sampled are stocked with low quality residual stands.**

  - **The acreage of greatest concern are those sites harvested to Minimum Standard residual basal area with Harvest Quality rated 1 or 2.** These stands are dominated by undesirable trees with low value. (It will be many years before these sites yield forest products of value.) 8% of all Partial Harvest acres sampled resulted in a high-graded stand. Applying this rate to all partial harvests reported for 1993 (398,743 acres) would indicate that **31,900 acres of forest land are high-graded annually**. (This is equivalent to 0.19% of Maine's total forested acres.)

  - Also of concern are those sites with Moderate residual basal area and Harvest Quality rated 1 or 2. The quality of these residual stands has been compromised; they are also dominated by undesirable trees with low value. Their higher basal area may allow for quicker recovery of these stands. This subset represents 6% of all partial harvest acres sampled. Applying this rate to all partial harvests reported for 1993 would indicate that **23,900 acres of forest land are annually harvested to low-valued residual stand conditions with moderate stocking levels.** While the Maine Forest Service views these acres as less critical in nature than the case cited above, they are of concern.

- The high-graded acres occur more frequently on small private ownership. 64% of the high-graded acres (Minimum Standard basal area and Harvest Quality 1 or 2) occur on small private ownership, while 36% occurs on forest industry ownership and large non-industrial ownership.

- 68% of the acres with Moderate Stocking and Harvest Quality rated 1 or 2 occur on small private ownership, while 32% occur on forest industry and large non-industrial ownership.

Additional Information on the Silvicultural Technique Known as Shelterwood

A portion of the sample for partial harvests was in fact managed under a shelterwood system. The shelterwood system is often applied in softwood stands that lack adequate advance regeneration. One-third to one-half of the stand basal area may be removed in two or more harvests, opening the stand to permit establishment of regeneration under the shelter of the remaining trees. The system may require 10 to 15 years before regeneration has developed enough that the remaining overstory can be harvested.

A final overstory harvest may in practice appear very similar to a clearcut. The characteristic that distinguishes an overstory harvest from a clearcut is that regeneration is generally sufficiently established to fully occupy the site when the overstory harvest occurs. The FPA rules treat an overstory harvest in a Shelterwood as a Partial Harvest, provided that *"after harvesting, the site has a well-distributed stand of trees at least 5 feet in height, that meets the regeneration standards applicable under ....(Section 4 of these rules.)"*

This study sampled four sites harvested by overstory removal, representing 4,300 acres. More overstory removal harvests should be sampled before definitive statements fully supported by field data can be made. However, several conclusions are offered, based on the professional assessment of the field investigators. These conclusions provide important insights for consideration.
The analysis indicates that:

- Advance softwood regeneration was abundant on all four sites. Harvest operations were conducted in such a manner that damage to the advance regeneration was minimal.
- Overstory harvests accounts for 8% of the combined overstory harvest and partial harvest acres sampled. If the small number of sample sites is representative of overstory harvests state-wide, the Maine Forest Service estimates that approximately 27,000 to 30,000 acres are harvested each year by overstory removal. Final overstory harvests may in practice appear very similar to clearcuts. These harvests are distinguished from clearcuts by the presence of adequate, well-developed regeneration.

Directive B: How are the separation zones around clear-cuts being managed?
Separation zones are required around each clearcut to provide spatial distance between other clearcut areas. A Category I clearcut (less than or equal to 35 acres in size) requires a separation distance from any other clearcut of not less than 250 feet, with no minimum acreage requirement. The forest in the separation zone may be harvested, as long as the area does not meet the clearcut definition of less than 30 square feet of basal area.

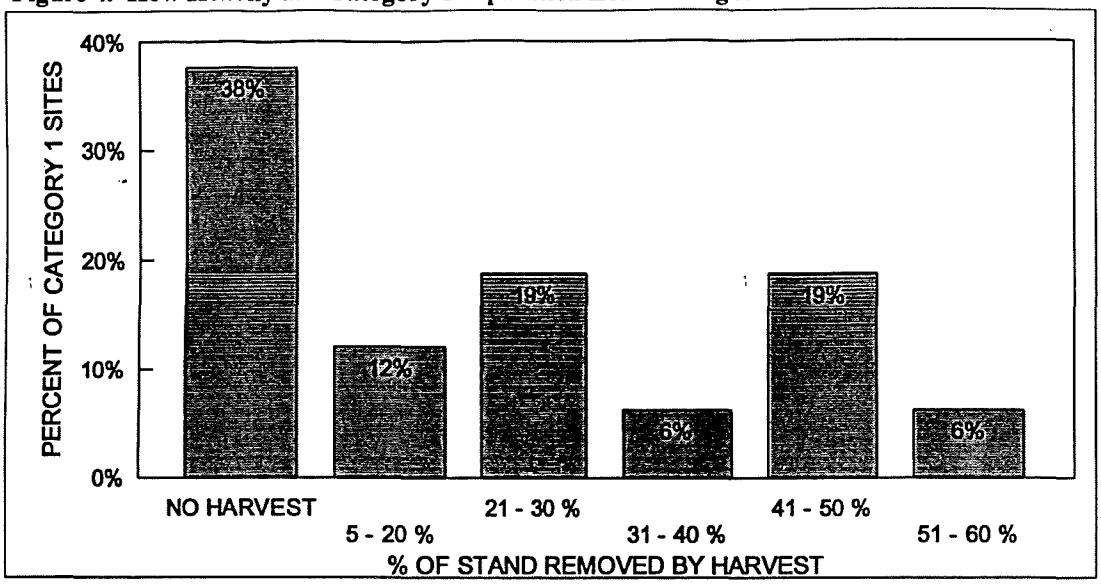
Category II clearcuts (36 to 125 acres in size) require a separation zone of at least 1.5 times the total area contained within the clearcut, with a minimum dimension of 250 feet. A Category II Exception (126 to 250 acres in size) clearcut requires a separation zone of at least 2.0 times the total area contained within the clearcut, with a minimum width of 500 feet. Harvesting in Category II or II Exception separation zones may not remove more than 40% of the original stand volume or basal area, and the residual stand must have at least 50 square feet of basal area.

The field survey collected data on 16 Category 1 separation zones and 15 Category 2 separation zones to answer the question: "Are landowners maximizing volume removal in separation zones by harvesting to the limit of the FPA rules?" Category 1 and Category 2 separation zones are discussed individually in order to examine compliance with their differing minimum basal area stocking standards

Category 1 Clearcut (35 acres or less) Separation Zones

Figure 4 illustrates the amount of harvesting taking place in Category 1 clearcut separation zones.

Figure 4. How Heavily are Category 1 Separation Zones Being Harvested ?



- **38% of the sample sites had no harvesting in the separation zones.** Basal area in these separation zones ranged from 80 to 140 sq. ft., with an average of 99 sq. ft.

- **On 37% of the sample sites volume removal was between 5 and 40%.** Basal area ranged from 32 to 148 sq. ft., with an average of 90 sq. ft.

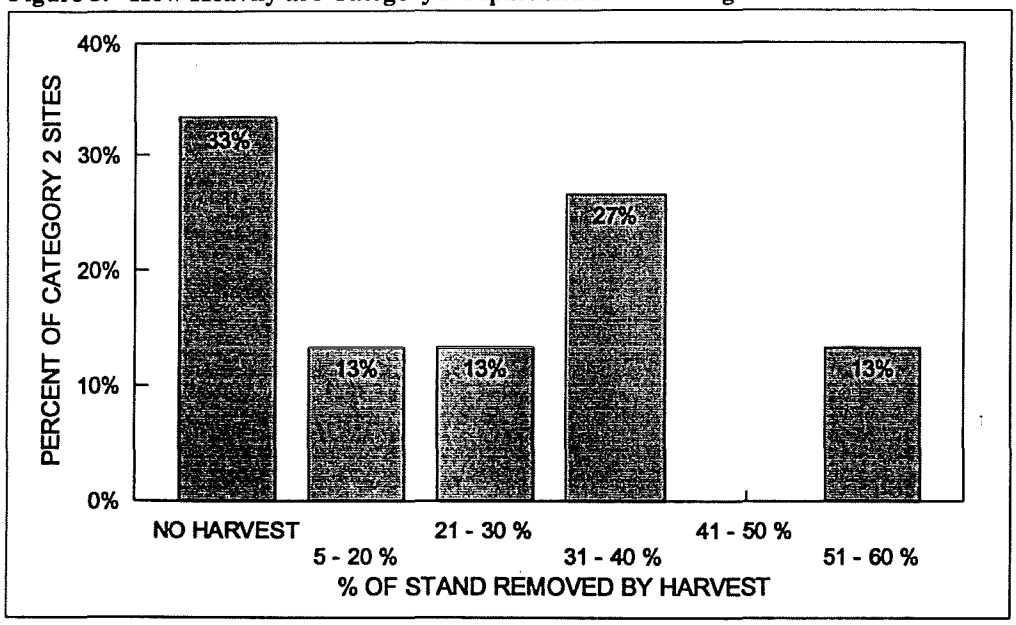
- **On 25% of the sample sites volume removal was approximately 50%.** Residual basal area ranged from 50 to 70 sq. ft., with an average of 55 sq. ft.

- **One of the sample sites (6%) was harvested to the minimum required residual basal area stocking.**

Category 2 Clearcut (36 to 250 acres) Separation Zones

Figure 5 illustrates the amount of harvesting taking place in Category 2 clearcut separation zones.

Figure 5. How Heavily are Category 2 Separation Zones Being Harvested?



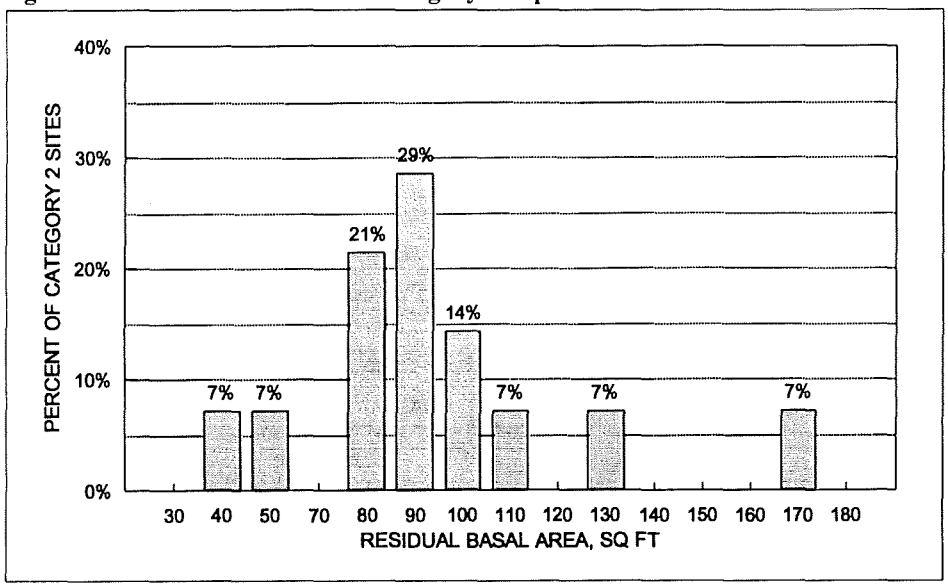
- **33% of the sample sites had no harvesting in separation zones.** Basal area in these separation zones ranged from 38 to 167 sq. ft., with an average of 101 sq. ft.

- **On 53% of the sample sites, volume removal was between 5 and 40%.** Residual basal area in these separation zones ranged from 70 to 100 sq. ft., with an average of 83 sq. ft.

- 13% of the Category 2 separation zone sample sites exceeded the limit of 40% volume removal. The residual stocking for these two sites was 35 and 49 sq. ft. of basal area. These sample points, but not the entire separation zones at these sites, are below the minimum standards for volume removal and the minimum basal area stocking.

- Figure 6 illustrates the distribution of residual basal area stocking classes in the Category 2 separation zones. **85% of the sample sites are well stocked with over 80 square feet of basal area, independent of the amount of harvesting.**

Figure 6. How Well Stocked are Category 2 Separation Zones?



Species Composition in Separation Zones

The field survey examined the species composition in separation zones to determine if high-valued species are targeted for harvesting. Table 3 illustrates the pre-harvest and post-harvest species composition for those clearcut separation zones where harvesting occurred.

Table 3. Species Composition of Partially Harvested Separation Zones

SPECIES	PERCENT OF PRE-HARVEST STAND	PERCENT OF POST-HARVEST STAND
WHITE PINE	2%	1%
SPRUCE	39%	36%
FIR	10%	5%
HEMLOCK	7%	7%
CEDAR	4%	5%
ALL SOFTWOOD	62%	54%
BEECH	12%	14%
WHITE BIRCH	2%	4%
YELLOW BIRCH	7%	7%
SUGAR MAPLE	6%	8%
RED MAPLE	9%	10%
ASPEN	2%	2%
ALL HARDWOOD	38%	46%

- The proportion of each species does not exhibit any significant changes from the pre-harvest to the post-harvest stand.

The survey found no widespread evidence of harvesting to minimum standards in Category 1 separation zones, and limited evidence of harvesting to minimum standards in Category 2 separation zones. In the majority of sample sites, where harvesting does occur in separation zones, harvests were conducted in a manner that preserves the quality and function of the residual stand

.

Directive C: The total acreage, the average acreage, the range of acreage and the geographic distribution of clear-cuts in the State.

Information for this section was extracted from the MFS Notification, Tracking and Reporting (NOTAR) database. NOTAR is built on the landowner and wood processor reports required by the FPA. Several trends in clearcutting rates, distribution and size are evident for the period 1991 - 1993.

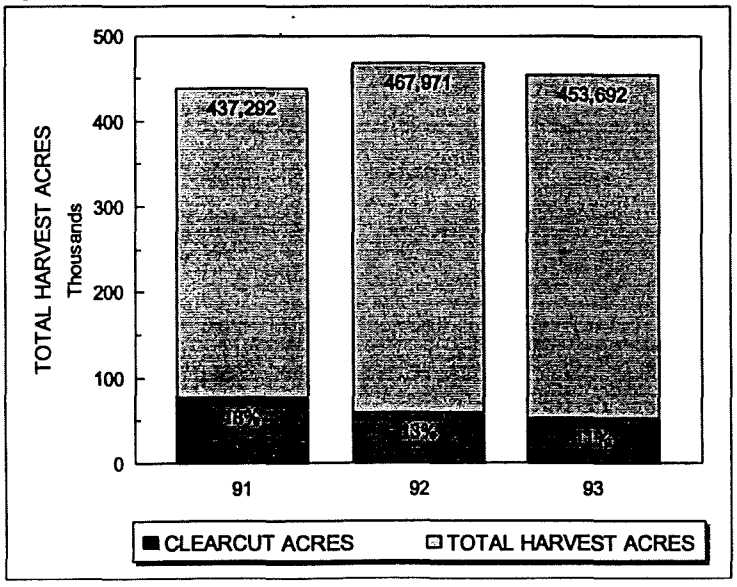
Geographic Distribution of Clearcuts

Table 4. Regional Distribution of Clearcut Acres, 1991 to 1993.

Region	1991	1992	1993	3 Year Average Clearcut Acres	Total Forested Acres By Region	3 Year Average Clearcut Acres As Percent Of Total Forested Acres
North	36,395	25,943	22,734	28,357	7,879,200	0.36%
West	30,533	23,634	20,630	24,932	4,539,300	0.55%
East	7,900	7,993	5,756	7,216	2,230,500	0.32%
South	1,847	2,022	2,286	2,052	2,411,200	0.09%
State Total Clearcut Acres	76,675	59,592	51,406	62,558	17,060,200 TOTAL FORESTED ACRES	0.37%

- Clearcut acres declined statewide from 76,625 acres in 1991 to 51,406 acres in 1993.

Figure 7. Clearcut Acres, 1991 to 1993, as Percent of Total Harvest



- Clearcut acres as a percentage of statewide harvest acres declined from 18% in 1991 to 11% in 1993.

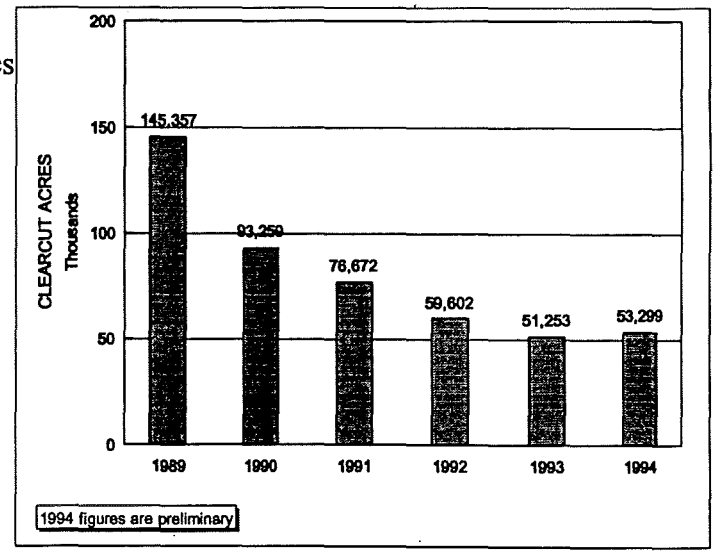
Table 5. Regional Summary of Average Annual Clearcut Acres as a Percent of Total Harvest Acres

	North	West	East	South	State Total
Average Annual Harvest Acres, 1991 to 1993	229,764	127,581	54,603	41,126	452,985
Average Annual Clearcut Acres, 1991 to 1993	28,357	24,932	7,216	2,052	62,558
Average Annual Clearcut Acres as Percent of Average Annual Harvest Acres	12%	20%	13%	5%	14%

Figure 8 illustrates trends in acreage clearcut for the period 1989 to 1994.

Figure 8. Clearcutting Trends, 1989 to 1994

- 1989 Prior to Forest Practices Act.
- 1990 First year of clearcut standards and definitions.
- 1991 First year FPA rules were in effect.
- 1994 Preliminary acres



Clearcut Size

Table 6 summarizes the total acres and average size for each of the clearcut size categories for the three year period 1991 to 1993.

Table 6. Summary Table of all Reported Clearcuts, 1991 to 1993.

CLEARCUT SIZE CATEGORY	NUMBER REPORTED	TOTAL REPORTED CLEARCUT ACRES, 1991 TO 1993	PERCENT OF ALL REPORTED CLEARCUT ACRES	AVERAGE SIZE, ACRES
CATEGORY 1 (35 acres or less)	unknown	138,845	74 %	unknown, < 35
CATEGORY 2 (36 to 125 acres)	640	43,329	23%	68
CATEGORY 2E (126 to 250 acres)	30	5,499	3%	183
TOTAL ACRES		187,673		

Patterns of Clearcut Distribution on the Landscape

A criticism of the FPA clearcutting rules is that they have led to fragmentation of forest cover by encouraging landowners to replace large rolling clearcuts with patterns of multiple smaller clearcuts separated by the minimum required separation zones. It was not the intent of MFS to encourage such a pattern when developing clearcutting rules and standards.

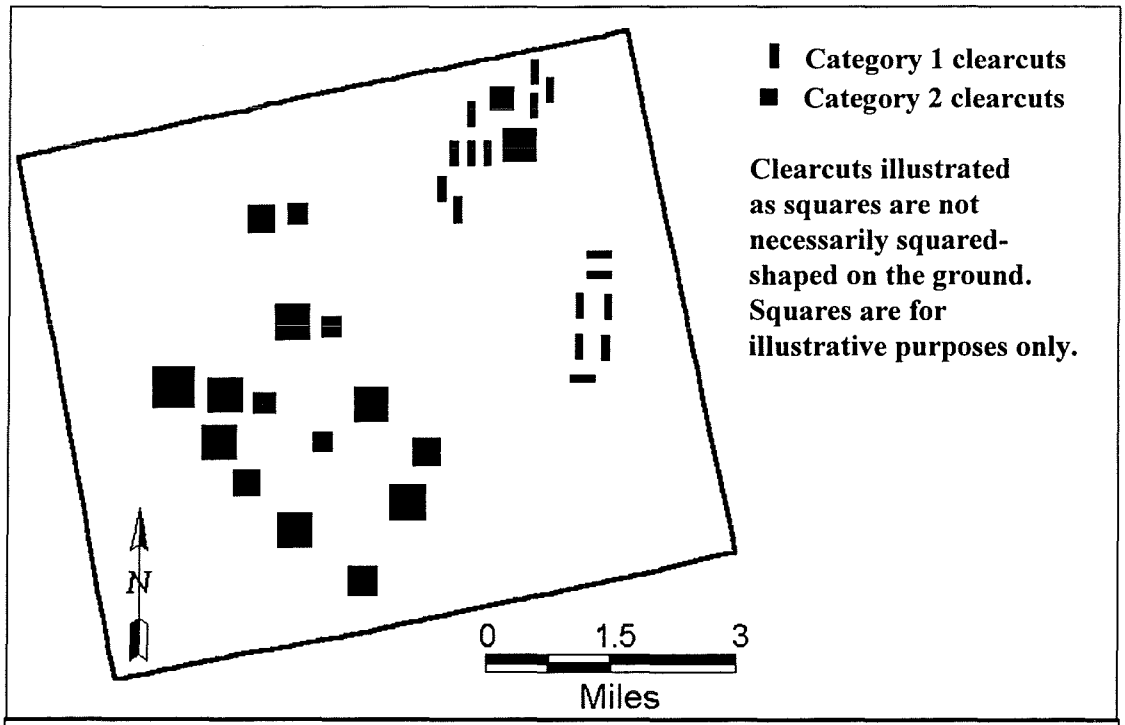
It is difficult to say in the absence of comprehensive data what effect the FPA rules have had on the patterns of clearcut deployment and how extensive are the patterns. The MFS does not have information on individual clearcut size and locations prior to 1991. NOTAR only identifies the exact locations of Category 2 and 2E clearcuts. Category 1 clearcuts are reported on a town-wide basis; data on their exact location and number of occurrences is unavailable.

Two case studies were constructed using data extracted from NOTAR to illustrate the patterns of clearcut distribution on the ground

.

Case Study 1 - Patterns of Clearcut Distribution

The following is an illustration of clearcutting patterns that occurred on an actual township in Maine during the period 1991 to 1993.



Case Study 1 - Total Clearcut Acres 1991 - 1993		1,852 acres
▮	16 Category 1 clearcuts	403 acres
■	17 Category 2 clearcuts	1,449 acres

The town is approximately 7 miles long on each side. There are approximately 30,000 forested acres on the town, predominantly hardwood forest types. The management strategy for the clearcuts is conversion to softwood forest type.

- The geographic centers and size of each Category 2 clearcut from 1991 to 1993 were plotted by MAPINFO (a GIS-based mapping program).
  In order to show the relative size of Category 2 clearcuts, this case study assumes that the Category 2 clearcuts are square in shape. (The clearcuts are not necessarily square-shaped on the ground.)
- The location and size of Category 1 clearcuts are estimated from an oblique 35 mm aerial photograph

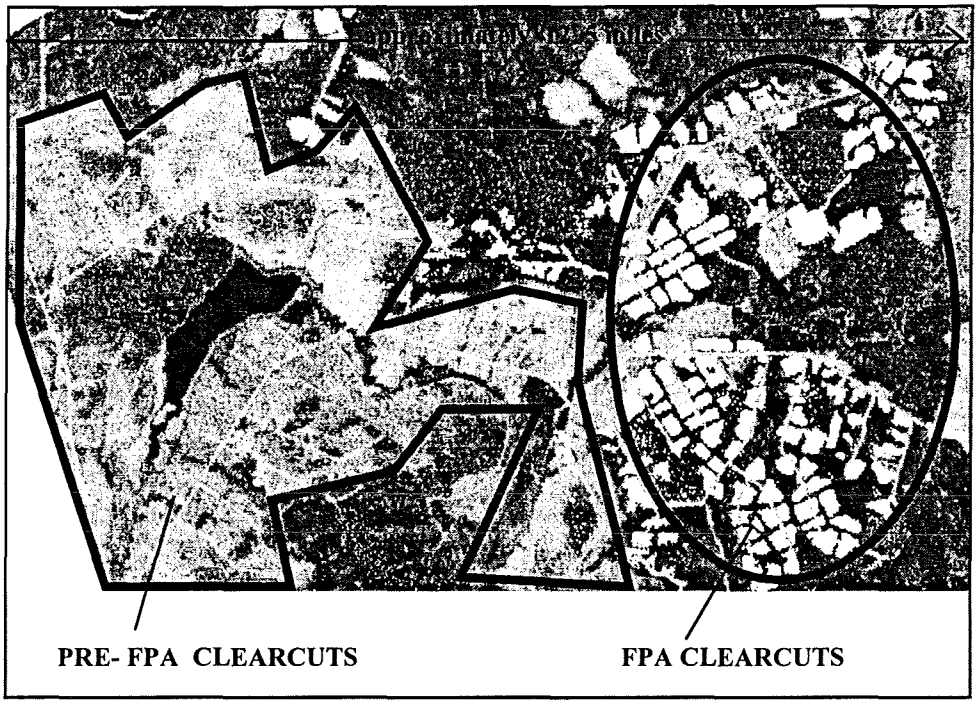
The clearcuts on this example occur in 3 clusters:

- Fifteen Category 2 clearcuts are grouped in the west half of the town.
- A cluster in the northeast corner contains two Category 2 and nine Category 1 clearcuts.
- A third cluster in the southeast corner contains seven Category 1 clearcuts.

- **The pattern of clearcut deployment in this case study is described as groups of clearcuts in discrete units, with the units dispersed on the landscape.**

Case Study 2 - Patterns of Clearcut Distribution

This case study uses satellite imagery of a location in Maine to compare patterns of FPA clearcuts to an adjacent area of pre-FPA clearcuts. The image below is a composite of satellite images taken in June 1991 and September 1993. Areas that have experienced a decrease in vegetative cover between those dates appear white. Areas that have experienced little or no change in vegetative cover appear in various shades of gray or black. The forest type is predominantly spruce-fir.



- The area on the right side of the image (outlined with a circle) contains multiple Category 1 and Category 2 clearcut created from 1991 to 1993.
  There are approximately 3,400 acres of FPA clearcuts on the right side of the image.

- The area outlined on the left side of the image contains approximately 10,000 acres of pre-FPA clearcuts (before 1991). These are large rolling clearcut areas. The water body in the left center of the image has the required buffer areas. An uncut stand of timber is adjacent to the left side of the water body.

Case Study 2 illustrates a worst-case example of the response to FPA clearcut rules. **This pattern of clearcut deployment is described as blanketing the landscape with multiple clearcuts in close proximity to each other.**

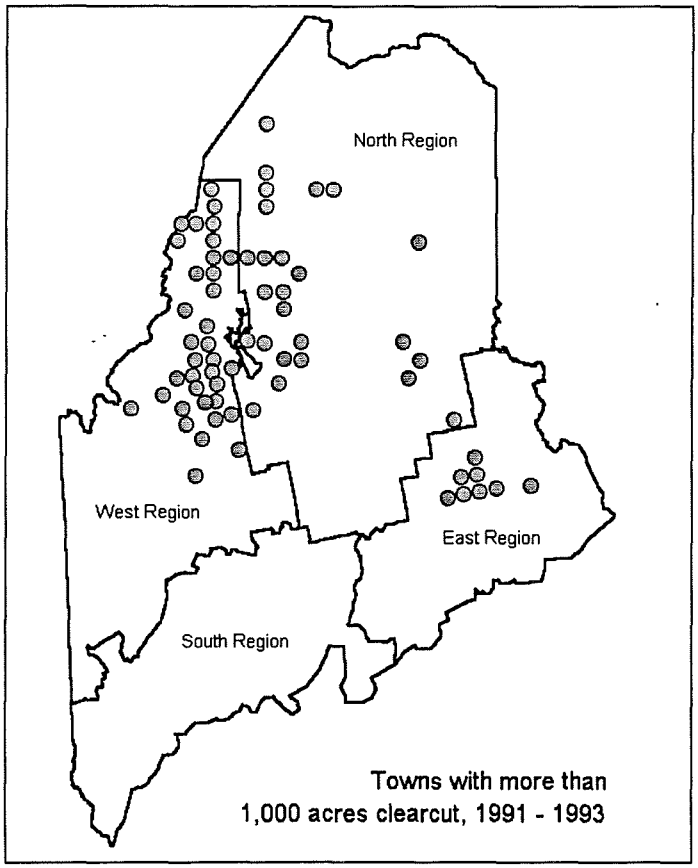
Case Study Findings

The above case studies are useful to visually interpret two differing patterns of FPA clearcut distribution. The next question is "Do these two examples represent prevalent patterns of clearcut distribution throughout the State?"

MFS conducted a data search from NOTAR to identify towns with more than 1,000 acres of clearcuts reported for the period 1991 to 1993. A collection of more than 1,000 acres of clearcuts on one township is indicative of the density of clearcuts. The data search identified 68 towns state-wide that each have more than 1,000 acres of FPA clearcuts:

North region - 25 towns (out of 388 in region) with more than 1,000 acres FPA clearcuts.
West region - 35 towns (out of 219 in region) with more than 1,000 acres FPA clearcuts.
East region - 8 towns (out of 132 in region) with more than 1,000 acres FPA clearcuts.
South region - none of the 174 towns in the South region had more than 1,000 acres of FPA clearcuts.

Figure 9. Towns with More than 1,000 acres of Clearcut Reported for 1991 to 1993.



The Maine Forest Service identifies 3 conditions associated with the clearcut pattern identified in Case Study 1:

1. predominantly hardwood forest types
2. forest industry ownership
3. more than 1,000 acres clearcut during 1991 to 1993 to convert hardwood forest types and mixed wood forest types to softwood forest types.

MFS estimates there are 33 towns that meet the above conditions where the prevailing clearcut pattern is groups of clearcuts dispersed on the landscape: 4 towns in the North region, 23 towns in the West region, and 6 towns in the East region. The clearcuts on these towns account for 62,000 acres, approximately 33 % of all clearcuts reported for 1991 to 1993.

The clearcut pattern in Case Study 2 illustrates a worst-case example of FPA clearcut patterns. The Maine Forest Service estimates that this pattern of clearcutting occurs at approximately 11 locations in the North and West regions, accounting for 28,000 acres, approximately 15% of all clearcuts reported for the period 1991 to 1993.

Although the two clearcut patterns discussed above account for a significant proportion (48%) of all clearcut acres reported for 1991 to 1993, their occurrence is localized on approximately 46 townships. **A case could be constructed for a third pattern consisting of single clearcuts or small groups of clearcuts widely scattered on the landscape.** NOTAR identifies a total of 348 towns with between 50 and 1,000 acres of clearcut and 519 towns with 0 to 49 acres of clearcut reported for 1991 to 1993. The Maine Forest Service estimates that the predominant clearcut pattern at these locations is single or small groups of clearcuts widely scattered on the landscape.

The three examples described above were constructed using available data. They are the Maine Forest Service's best estimate of clearcutting patterns since implementation of the Forest Practices Act. This study did not characterize pre-FPA clearcutting patterns.

Prior to developing FPA rules in 1990, the MFS predicted the need to measure FPA effects on forest inventory and health. The MFS cooperated with other state and federal agencies to complete an aerial photo survey of the entire state prior to implementation of FPA rules and standards. This one time photographic record serves as a benchmark of the status of the forest at the beginning of the FPA. **To conduct a thorough analysis of the change in clearcutting patterns, recent satellite imagery should be obtained to make comparisons to the 1990 benchmark.**

Findings: Directive C.

Based on data extracted from NOTAR, available maps and satellite imagery, and aerial reconnaissance, the following conclusions are offered concerning clearcut acres and the patterns of clearcut distribution.

- **Annual clearcut acres has declined from pre-FPA levels of 145,000 acres annually to approximately 51,000 acres annually.**

- **Average clearcut size is smaller.** Clearcuts larger than 125 acres were common prior to FPA rules. Since implementation of FPA rules 74% of reported clearcut acres occur in clearcuts 35 acres or smaller. 26% of all reported clearcut acres occur in clearcuts larger than 35 acres, and have an average size of 73 acres.

- **Clearcutting accounts for 14% (based on the three year average) of the acres harvested annually in the state. 91% of all clearcut acres occur on forest industry ownership and large non-industry ownership; 9% occur on small private ownership.**

- **The most frequently found pattern of clearcutting consists of single clearcuts or small groups of clearcuts widely dispersed on the landscape.**

- **Clearcutting is found most frequently on land owned by the forest industry in the West region.** For the period 1991 to 1993, 20% of all harvested acres in the West region were clearcut.

- **48% of all reported clearcuts during the period 1991 to 1993 (90,000) acres occurred at 44 locations in the North and West regions.**

D. Research into any other question the department considers essential to obtain an understanding of how the 12 MRSA, Chap. 805, subchap. III-A and the forest harvest regulations have affected forest harvesting practices in the State.

Regeneration

Regeneration refers to the seedling-size or sapling-size trees in a forest stand that will occupy the site in the future and become the next stand. The field survey measured regeneration on nearly 1,200 individual plots in both partial harvests and in separation zones around clearcuts.

Regeneration on each plot was tallied in one of three categories, based on the forester's assessment: Understocked, Adequately Stocked, and Overstocked. Understocked plots have insufficient numbers of seedlings or saplings to produce a fully stocked stand of trees. Adequately Stocked plots have sufficient numbers of seedlings or saplings to produce a fully stocked stand. Overstocked plots have so many seedlings or saplings that a non-commercial thinning will be required to maintain optimal stand growth rates.

Findings: Directive D.

Figure 10 illustrates how often each species was the dominant species on the sample sites.

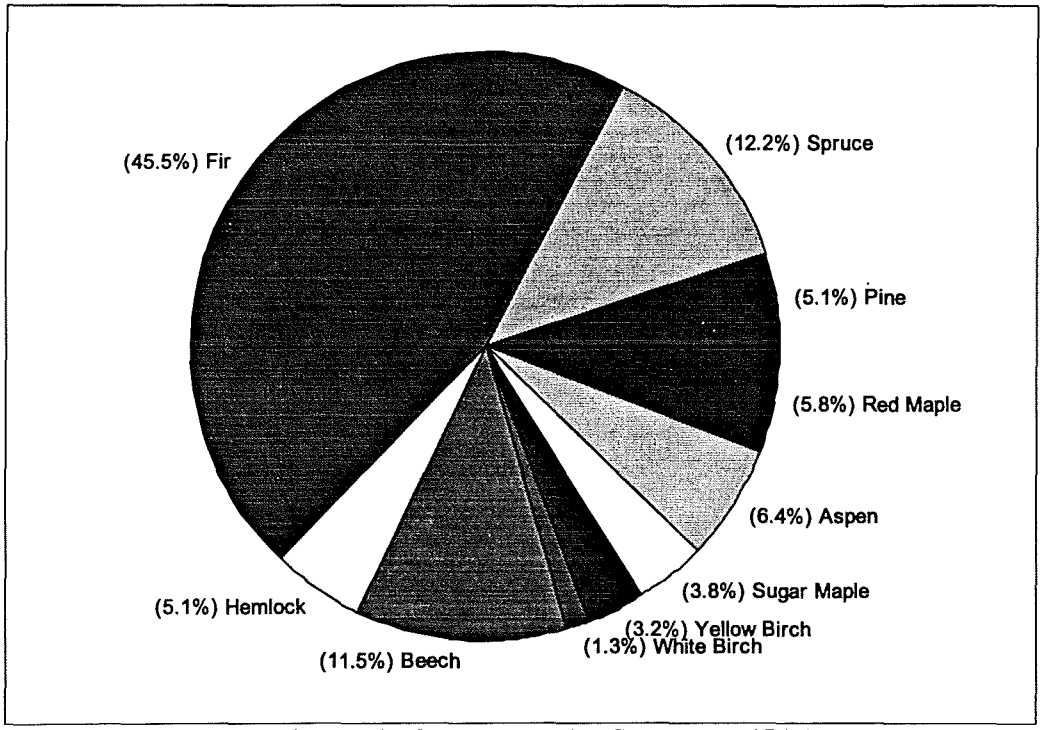


Figure 10. Dominance of Species in the Regeneration Stratum on 156 Harvest Sites

- Balsam fir is the dominant regeneration species on nearly half of all sample sites.

- Spruce is the dominant regeneration species on 12% of all samples sites.

- Softwoods are the dominant species on 68% of all sample sites.

- Beech is the dominant regeneration species on 12% of all sample sites.

- 96 % of all regeneration plots were Adequately Stocked or Overstocked. 4% of all regeneration plots were Understocked; of these, two-thirds were on sites harvested in 1993 and have not had sufficient time to develop adequate stocking of regeneration.

Reporting Errors

The Forest Practices Act requires all landowners harvesting wood to:

1. Notify the Maine Forest Service prior to beginning any harvest activities,
2. To report annually the volume of wood harvested,
3. To report annually the acreage harvested by selection, shelterwood, or clearcut harvest methods.

Although a check on the accuracy of the reports to MFS was a secondary objective, the following discussion relates to the accuracy of landowner reports, based on the harvest sites sampled in the field study.

- Six sample sites on small private ownership that were reported to MFS as Partial Harvests included areas in the harvests where residual basal area was below the minimum standard. The Maine Forest Service interprets this as inadvertent reporting error by the landowners. With the exception of one site where MFS had already initiated enforcement action prior to the field survey, these clearcuts all met the size limit for Category 1 clearcuts. Total clearcut acres on these sites is equal to one percent of the total partial harvest acres in the field survey.

- Over twenty harvest sites in the field survey were reported as Clearcut but met the definition for Partial Harvests. On small private ownerships these harvest sites were moderate to heavy Partial Harvests which retained more than 30 square feet of

residual basal area. On forest industry and large non-industry ownership, these reporting errors were for overstory harvests with abundant regeneration that were reported as clearcuts. Between 12 and 15 percent of reported clearcut acres in the field survey were actually Partial Harvests, with the majority of these occurring on forest industry ownership. Field interviews with industry foresters indicate that reporting errors result from conservative interpretation of the clearcut definition for those harvests resulting in minimum residual basal area.

Conclusions

Harvesting Trends

- During the period 1991 to 1993, Partial Harvests make up 86 % of all reported harvesting of forested acres.

- Clearcutting declined as a percent of all harvesting from 18% in 1990 to 11% in 1993. The Maine Forest Service concludes that the decline in the rate of clearcutting is more in response to the end of budworm salvaging and to public concern than a direct response to the Forest Practices Act. The FPA has caused landowners to plan and consider alternatives before creating clearcuts.

Partial Harvests

- A large majority of forest landowners are harvesting to retain residual stocking significantly higher than the Forest Practices Act's minimum standards for Partial Harvests.

- 84% of all harvest acres reported to MFS as Partial Harvests have residual stands that are moderately to well stocked with well-formed trees of desirable species.

- 8 % of all harvest acres reported to the MFS as Partial Harvests result in a high-graded stand. This is equivalent to 0.19% of Maine's total forested acres.

- High-grading occurs more often on small private ownerships. This situation has not occurred in response to the Forest Practices Act - this practice continues despite the Forest Practices Act. High-grading will continue as long as landowners harvest for maximum dollar value, without planning for the quality of the next stand.

- 1 % of the sample acres reported as Partial Harvests had residual stocking so low that the resulting stands meet the legal definition of a clearcut.

Management of Clearcut Separation Zones

- The majority of clearcut separation zones are managed to assure the quality and function of separation zones.

- Approximately one-third of all separation zones sampled had no harvesting.

Clearcutting Trends

- In response to the Forest Practices Act rules, nearly three-fourths of all clearcut acres occur in clearcuts 35 acres or smaller. While comparative data is not available to characterize pre-FPA clearcut size, it is evident that clearcuts are smaller as a result of the Forest Practices Act.

- Clearcutting accounts for 14 % (based on a three year average) of the acres harvested annually in Maine.

- The most frequent pattern of clearcut distribution on the landscape consists of single clearcuts or small groups of clearcuts widely dispersed on the landscape.

- Large concentrations of clearcuts on the landscape are limited to approximately 44 locations. 48% of the reported clearcut acres for the period 1991 to 1993 occurred at these 44 locations.

Regeneration

- 96% of all sample harvest sites were adequately stocked with regeneration.

- Spruce, fir, pine and hemlock were the dominant regeneration species on 68% of the sample sites.

Reporting Errors

- Most harvest acres are reported correctly to the Maine Forest Service. Actual clearcut acres may be less than reported due to conservative interpretation in labeling harvesting methods.