FROM THE CHAPTER CHAIRMAN

It is my pleasure to transmit this copy of Maine Forest Review as it includes the report of the Chapter's Committee on Forest Practices Goals and Standards. This report was discussed and its main sections voted upon during the 1974 Winter Meeting. Subsequent to that meeting, the major items of the report were put out as a referendum vote by the entire Chapter membership. All items were approved by a two-thirds or greater majority, except for two, and a substitute statement for the two unapproved items was simultaneously approved.

Those members who worked at much personal sacrifice are acknowledged herein. We all owe them much by way of thanks. Additionally, the work of two of our past Chairmen, Hal Klaber, and Bob Fiske, for initiating the project and seeing it through to completion deserves our sincere thanks.

We should not consider this report to be the final product of our efforts toward improved forest practice goals and standards. Portions of the report will need revision and additions to them with the passage of time. Much of what is written will have to be explained to persons who might otherwise misinterpret our meanings. Hence, I ask you all to become familiar with the report to the extent that you can answer enquiries about its contents.

James C. Whittaker
Chairman

MAINE FOREST REVIEW
VOLUME 7-1974 (DECEMBER)

This issue contains Forest Practice Statement (pages 1-21) and a summary of Maine's Timber Resource (pages 22-23).

The Maine Forest Review, established in 1972, is published by the Maine Chapter, Society of American Foresters. Address correspondence to Editor, Maine Forest Review, A. D. Nutting Hall, University of Maine, Orono, Maine 04473.

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Many thanks to Gwyneth Bayer and Jim Hatch for their help in preparing this issue. Cover photography courtesy of Jack Wolas, Public Information and Central Services, University of Maine at Orono.
FOREST-PRACTICE GOALS AND STANDARDS
FOR THE IMPROVEMENT, MAINTENANCE, AND PROTECTION
OF THE FOREST RESOURCES OF MAINE

FOREWORD

THIS DOCUMENT was prepared by the following members of the Forest Practices Study Committee,
Maine Chapter, New England Section, Society of American Foresters:

MEMBER -- John M. Bulger, Service Forester, Bureau of
          Forestry, Maine Department of Conservation
MEMBER -- Jerry J. Durgin, Woodlands Manager, Kennebec
          River Pulp and Paper Co., Inc.
MEMBER -- R. Alec Giffen, Supervisor of Planning and
          Research, Land Use Regulation Commission, Maine
          Department of Conservation
MEMBER -- Theodore C. Tyron, Chief Forester, James W. Sewall
          Company
SECRETARY -- Ralph H. Griffin, Professor of Forest Resources,
             School of Forest Resources, University of Maine,
             Orono
CO-CHAIRMAN -- George W. Weiland, General Manager, Timberlands,
               Dead River Company
CO-CHAIRMAN -- Robert M. Frank, Jr., Research Forester,
               Northeastern Forest Experiment Station, United
               States Forest Service, Orono, Maine

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</tbody>
</table>
INTRODUCTION

INCREASING national and world populations and improving standards of living are putting ever greater demands on our natural resources, including our forests. For example, in 1960 timber removals from Maine's forests totalled approximately 250 million cubic feet. By 1970 removals had increased 60 percent to about 400 million cubic feet. And if present trends continue, by the year 2000 removals are projected to increase by 30 percent of 1960 levels to exceed 1,000 million cubic feet. There has also been an increasing demand for forest recreational activities. And there has been an increasing awareness of environmental problems and pressing demands for improved environmental quality.

These demands and concerns are focused on the forests that cover nine-tenths of the land area of Maine. In the past this area has been subjected to varying degrees of extensive management. It is now producing wood at a fraction of its potential. To meet the demands of the future, the intensity of management must be increased dramatically (Ferguson and Kingsley 1972).

Increasing demands for the many varied uses of forest lands and concerns for environmental quality have resulted in inevitable conflicts. Justifiably, some landowners are motivated by economic reasons, while some other segments of the public are equally concerned with the long-term effects of forest-management practices and with the maintenance of certain forest qualities and attributes that have no direct economic value to the landowner. A result of these conflicts has been a growing awareness that the days of seemingly unlimited forest resources are gone, that what a landowner does with his land affects his neighbors and in fact the whole of society now and in the future, and that society has a legitimate concern about how forest lands are managed.

Concern with and awareness of these conflicts as well as knowledge of impending legislation spurred professional foresters to action resulting in this document. The primary intent of this document is to provide a statement of forest-practice goals and standards from the Maine Chapter, New England Section, of the Society of American Foresters. In reading this document, please note the meaning of terms used as defined.

PURPOSE OF FOREST-PRACTICE GOALS AND STANDARDS

The purpose of forest-practice goals and standards is to improve, maintain, and protect forest land. While the concern of forest landowners for sound forest-management practices to achieve certain goals and benefits is readily acknowledged, the importance of the non-landowners' interest in forest-management practices traditionally has been less firmly established. However, attitudes are changing. Viewed from a global and historical perspective, sound forest practices are an accepted fact in many European countries where historical experience, population densities, and growth-drain relationships have indicated the wisdom of such practices.

The interest in forest practices in New England dates back to colonial times, when certain high-quality eastern white pines were reserved for use first by the English Navy and then by the Continental navies. Concern with forest practices in the United States and Maine has exhibited a cyclical pattern of increase and decrease corresponding with crises that have developed. Tax relief for owners of newly established forest plantations in Maine in the late 19th century; passage of the Weeks Law and the subsequent establishment of the national forest system in the early 20th century; designation of "Auxiliary State Forests" in Maine in the 1920's; existence of forest-practices study groups; establishment of state forest-management programs; and passage of many state forest-practices acts in the years following World War II are but a few of the indications of both professional and public concern with forest-management practices.

At present, with a diminishing usable forest-land base, rapidly increasing demands for forest products, projections showing future timber shortages, and increased environmental awareness, the concern with forest practices is especially acute. The Maine Chapter, New England Section, of the Society of American Foresters has the responsibility to promote effective forest-land management through formulation and support of sound forest-practice standards. These standards should insure that the inherent suitability and potential capability of forest lands to provide goods and services of value to man on a perpetual basis are improved, maintained, and protected for the benefit of present and future generations.

Specific goals for the management of forest lands of Maine attainable through forest-practice standards are as follows:

1. Improvement, maintenance, and protection of the productivity and quality of forest stands.
2. Optimum utilization of forest lands for primary forest products.
3. Improvement, maintenance, and protection of forest soil resources.
4. Improvement, maintenance, and protection of forest water resources.
5. Improvement, maintenance, and protection of fish habitat and wildlife habitat of particular importance.
6. Improvement, maintenance, and protection of the visual qualities of the forest.

FOREST-PRACTICE GOALS AND STANDARDS

In the interests of brevity and clarity, the subject matter was divided into parts, and duplication of content was avoided wherever possible. Nonetheless, the reader should be aware that many interrelations exist between the subject areas discussed and that certain recommendations serve more than one purpose though not explicitly stated in some cases.

IMPROVEMENT, MAINTENANCE, AND PROTECTION OF THE PRODUCTIVITY AND QUALITY OF FOREST STANDS

Timber Resource

A description of the extent, composition, and condition of the timber resource on Maine's commercial forest-land area and a discussion of the future timber-
supply situation are contained in a report of a statewide survey made in 1971 (Ferguson and Kingsley 1972). Findings presented in the report of particular significance to the silvicultural management of Maine's timber resource are summarized below:

Stocking — When all live trees, including two categories of growing-stock trees (desirable trees and acceptable trees) and two categories of non-growing-stock trees (rotten trees and rough trees) were counted in the determination of stocking, 54.6 percent of the commercial forest-land area in 1971 was classified as being overstaked, 59.9 percent fully stocked, 7.8 percent medium stocked, and 1.7 percent poorly stocked. No acreage of commercial forest land was classified as nonstocked.

When only growing-stock trees (desirable trees and acceptable trees) were counted, 15.6 percent of the commercial forest-land area was classified as being overstaked, 42.9 percent fully stocked, 34.3 percent medium stocked, 6.6 percent poorly stocked, and 0.6 percent nonstocked.

When only desirable trees were counted, 0.1 percent of the commercial forest-land area was classified as being fully stocked, 0.2 percent medium stocked, 33.9 percent poorly stocked, and 65.8 percent nonstocked. The acreage of commercial forest land in each of the above stocking classes is given below:

<table>
<thead>
<tr>
<th>Stocking class</th>
<th>All (thousands of acres)</th>
<th>Only live trees</th>
<th>Only growing-stock trees</th>
<th>Only desirable trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overstaked</td>
<td>9,224.8</td>
<td>2,634.2</td>
<td>7,590.6</td>
<td></td>
</tr>
<tr>
<td>Fully stocked</td>
<td>6,063.4</td>
<td>7,249.0</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>Medium stocked</td>
<td>1,313.2</td>
<td>5,790.1</td>
<td>37.8</td>
<td></td>
</tr>
<tr>
<td>Poorly stocked</td>
<td>292.9</td>
<td>1,111.5</td>
<td>5,719.0</td>
<td></td>
</tr>
<tr>
<td>Nonstocked</td>
<td>--</td>
<td>109.5</td>
<td>11,123.5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16,894.3</td>
<td>16,894.3</td>
<td>16,894.3</td>
<td></td>
</tr>
</tbody>
</table>

Stand volume — Classification of the commercial forest-land area in 1971 according to stand volume in board feet per acre indicated that 44.9 percent (7,590.6 acres) of the commercial forest-land area was less than 5,000 board feet per acre, 44.1 percent (7,454.4 acres) was 5,000 to 9,000 board feet per acre, and 11.0 percent (1,894.1 acres) was over 9,000 board feet per acre. The 36.3 percent (6,142.8 acres) of the commercial forest-land area classified as supporting sawtimber stands averaged 3,800 board feet per acre.

Growing stock — Ninety-nine percent of all growing stock trees 5.0 inches or more in diameter at breast height (7,249.0 million softwood trees and 3,638.5 million hardwood trees) were more than 15.0 inches in diameter; 94 percent of the softwood growing-stock trees were less than 5.0 inches in diameter; and 96 percent of the hardwood growing-stock trees were less than 11.0 inches in diameter.

Rough and rotten trees — In addition to the growing-stock trees, Maine's commercial forest land supported 3,292.3 million rough and rotten trees 1.0 inch or more in diameter at breast height, 95 percent of which were either saplings or pole timber. Thirty-seven percent of the rough and rotten trees were softwood trees, and 63 percent were hardwood trees. Rough and rotten trees contained 8.4 percent (1,362.6 million cubic feet) of the total softwood growing-stock volume and 18.2 percent (1,445.8 million cubic feet) of the total hardwood growing-stock volume.

Annual mortality — In 1970, the annual mortality of growing stock and the annual mortality of sawtimber were estimated at 13.00 million cubic feet (roughly 1.6 million cords) and 244.0 million cubic feet, respectively. Seventy-four percent of the growing-stock mortality and 71 percent of the sawtimber mortality were among softwood species, balsam fir, spruce and white pine accounting for 63 percent of the growing-stock mortality and 59 percent of the sawtimber mortality, respectively. Twenty-five percent of the growing-stock mortality and 53 percent of the sawtimber mortality were attributed to diseases. Diseases and weather together accounted for 81 percent of the growing stock mortality and 85 percent of the sawtimber mortality.

Growth and removals — Annual net growth of growing stock and sawtimber on commercial forest land in 1970 exceeded annual growing stock removals and sawtimber removals by 42 percent and 20 percent, respectively. However, more of the growing stock of four species (northern white cedar, northern red oak, ash, and yellow birch) and more of the sawtimber volume of seven species (white pine, northern white cedar, sugar maple, northern red oak, ash, yellow birch, and beech) were harvested than were grown in 1970.

Average annual net growth — While 80 percent of the commercial forest-land area in Maine has the potential inherent capability of producing more than 50 cubic feet of industrial wood per acre per year and 43 percent more than 85 cubic feet per acre per year, an average growth rate of only 42 cubic feet per acre per year is now being obtained.

Future timber supply — Assuming no appreciable change in (1) total area of commercial forest land, (2) average annual net growth, (3) trend in timber removals, and (4) intensity of forest management during the next 30 years, we predict that the harvest of hardwood timber will probably exceed growth in a relatively short period of time, and the harvest of softwood timber before the year 2000.

The present condition of Maine's timber resource has resulted largely from major emphasis having been placed upon the harvesting of merchantable timber, with little if any special effort to control the establishment, composition, and stocking of young stands. Since the beginning of exploitation over 350 years ago, the forests of Maine have been harvested customarily by some method of cutting that usually removed only a portion of the growing stock at any one time.

Three general methods of cutting have been applied: commercial clearcutting, diameter-limit cutting, and selective cutting. Under favorable market conditions, commercial clearcutting usually results in a greater reduction of the growing stock than either diameter-limit cutting or selective cutting, both of which intentionally provide for the reservation of a certain portion of the growing stock on the cutting area.

However, because of the presence of trees of unmarketable species as well as trees of marketable species too small to be merchantable, commercial clearcuttings in Maine may seldom be used in complete removal of the growing stock except on (1) areas supporting only trees of marketable species of
merchantable size, and (2) areas harvested in recent years with highly mechanized harvesting equipment that usually destroys all growing-stock trees too small to be utilized except possibly small seedlings that manage to survive the harvesting operation under the protection of slash and snow.

Partial cutting and the inherent ability of many of Maine's commercial tree species to become established under the shade of residual trees, to survive rather long periods of suppression, and to grow upon release from competition have tended to maintain sufficient growing stock on Maine's commercial forest land to supply past timber demands. Under such favorable circumstances, there has been little incentive for owners of forest land to invest in silvicultural treatments required to ensure the establishment and maintenance of forest stands composed of a high proportion of desirable growing-stock trees. Consequently, Maine's commercial forest land, commonly characterized by forest stands either too densely or too sparsely stocked and by stands having a sizable proportion of their timber volume in rough and rotten trees, is presently producing wood at a rate considerably below its potential capability.

If Maine's commercial forest land is to continue to produce sustained yields of timber in sufficient quantity and quality to supply the increasing demands of wood-based industries, a more intensive silvicultural treatment program than is being practiced in Maine will need to be undertaken on all commercial forest-land ownerships of the State. Silvicultural treatments that, when appropriately and judiciously applied, will tend to increase substantially and to maintain indefinitely the quantity and quality of Maine's timber resources are described below under (1) regeneration methods, (2) intermediate cutting, (3) protection, and (4) silvicultural management standards.

Regeneration methods

A regeneration method is a silvicultural treatment undertaken near the end of the rotation with the two-fold purpose of (1) harvesting mature even-aged forest stands or mature trees occurring singly or in small groups in uneven-aged forest stands, and (2) replacing them with young stands established either naturally from seed or vegetative regeneration or artificially by planting tree seedlings or sowing seed. A regeneration method includes not only the harvesting of mature trees but also any subsequent cultural treatment that may be required to insure the rapid replacement of the trees harvested by adequately stocked stands of desirable tree species.

Such cultural treatments may include the disposal of logging slash and/or scarification of the forest floor to increase the receptiveness of seedbeds for germination and the establishment of the desired tree species and/or the artificial regeneration of areas failing to regenerate naturally by planting tree seedlings or sowing seed and/or eliminating less desirable tree species or other vegetation that may be hindering the growth of established seedlings of desirable tree species.

Numerous methods of regenerating a high forest (forest stand originating from seed) and low forest (forest stands originating vegetatively from stump sprouts, root suckers, or layers) have found application. However, any given method can usually be classified under one of the six standard regeneration methods, each of which denotes distinctly different methods. The six standard regeneration methods are defined below:

1. Selection method -- The removal of mature timber, usually the oldest and largest trees, either as single or scattered individuals (single tree selection) or in small groups (group selection) from areas rarely exceeding 1/4 acre in size at relatively short intervals, repeated indefinitely, by means of which the continuous establishment of the regeneration of desirable tree species is encouraged and an uneven-aged forest stand is developed and maintained.

2. Shelterwood method -- The removal of all trees on an area to be regenerated in a series of cuttings extending over a period of years equal usually to no more than one-quarter and often not more than one-tenth of the rotation, the establishment of natural regeneration of desirable tree species being obtained under the partial shelter of the trees remaining after each cutting. Regeneration of a mature forest stand by the shelterwood method may involve a series of different kinds of cutting applied in the order given below:

Preparatory cuttings -- Cuttings made to prepare dense mature forest stands under which regeneration of desirable tree species has failed to become established for regeneration by: (1) removing defective trees and trees of undesirable species; (2) improving the vigor, seed production, and wind-firmness of desirable tree species; and (3) increasing the rate of decomposition of thick humus layers that tend to preclude the establishment of natural regeneration.

Seed cuttings -- Cuttings made in a mature forest stand to create permanent openings of sufficient size in the crown canopy to permit heat, light, and moisture to penetrate to the forest floor in amounts required for germination and seedling establishment of desirable tree species. The seed cutting should (1) be made in a year when the desirable tree species bear seed in abundance, (2) remove the least desirable trees in the stand, and (3) be confined to a single operation to secure uniformity of the regeneration in age and size.

Removal cuttings -- Cuttings made to remove the remainder of the mature stand. Removal cuttings are commenced as soon as regeneration has become established over a sizable portion of the cutting area and are continued periodically as required to prevent the mature stand from unduly retarding the growth of established regeneration and to secure an adequate stocking of established regeneration over the entire cutting area. The last removal cutting (final cutting) is made when all portions of the cutting area have been regenerated satisfactorily.

The number and kinds of cuttings required to regenerate a mature forest stand by the shelterwood method depend upon the species composition, abundance, and distribution of advance regeneration present beneath the stand. For example, regeneration of an overstocked mature stand under which no advance regeneration has become established may require a preparatory cutting, a seed cutting, and several removal cuttings. At the other extreme, regeneration of an understocked mature stand under which well-distributed advance regeneration of desirable species has become established may require only one removal cutting to complete the regeneration process. Such a cutting may be classified erroneously as clearcutting, but inasmuch as the regeneration has become established under the partial shelter and protection of the parent stand, it is properly classified as being the final removal cutting of the shelterwood method.

3. Seed-tree method -- The removal of all trees on an area to be regenerated in one cutting move for a small number of seed-bearing trees, usually from 1 to 10 trees per acre, retained either singly (single seed-tree method) or in small groups (group seed-tree method)
to provide seed for the subsequent natural regeneration of the area. Following the establishment of adequate regeneration, the seed-bearing trees may be removed in a second cutting or left indefinitely.

4. Clearcutting method — The removal of all trees on an area to be regenerated in one cutting, with regeneration of desirable species being subsequently obtained either naturally from seed disseminated over the cutting area from adjacent forest stands and/or from trees removed in the harvesting operation and/or from advance regeneration, or artificially by either planting tree seedlings or sowing seed on the cutting area.

Since natural regeneration of a clearcut area usually either wholly or in part depends upon seed disseminated naturally by wind subsequent to the harvesting operation, no portion of the clearcut area should be more distant from adjacent forest stands containing seed-bearing trees of the species to be regenerated than the distance to which the seed can be effectively disseminated.

The distance of effective seed dissemination — the distance seed is disseminated in quantities sufficient to produce adequately stocked stands — depends upon (1) amount of viable seed available for dissemination; (2) capability of the seed to be transported by wind, (3) velocity and turbulence of the wind during periods of dissemination, (4) height of seed-bearing trees and their topographic position in relation to the area to be regenerated, (5) amount of seed surviving until germination, and (6) favorableness of the seedbed for germination and seedling establishment. Reliable estimates of the distance to which wind-disseminated seed are likely to be effectively disseminated on level terrain ranges, depending upon species, from 1 to 2 1/2 times the height of the seed-bearing trees.

3. Coppice method — Any type of cutting in which dependence is placed primarily on vegetative regeneration (stump sprouts, root suckers, and layers).

6. Coppice-with-stumps method — The production of coppice and trees of seedling origin on the same area with selected stems of seedling origin being carried through much longer rotations than those of vegetative origin.

The six standard regeneration methods differ in one or more of three principal respects: (1) whether the regeneration originates primarily from seed (high forest) or primarily from vegetative growth (low forest); (2) arrangement of regeneration cuttings on the ground, which determines not only the quantity of seed available for dissemination over the cutting area but also the environmental conditions (heat, light, and moisture) under which seeds germinate and seedlings become established; and (3) spacing of regeneration cuttings over time, which determines whether the new stand will be even-aged or uneven-aged. Uneven-aged stands are produced by the selection method and the coppice-with-stumps method. Even-aged stands are produced by the shelterwood method, seed-tree method, clearcutting method, and coppice method.

To be successful, methods of regenerating a high forest naturally must provide for the dissemination of seed of desirable species over the area to be regenerated in sufficient quantities to give raise to a new stand and must create seedbed environments favorable for germination and establishment of seedlings. Thus the applicability of a particular regeneration method is determined largely by the edaphic characteristics of the tree species to be regenerated.

In general, tree species having the capability of becoming established and growing under the shade of and in competition with other trees (shade-tolerant species) are regenerated most effectively by either the selection method (uneven-aged stands), shelterwood method (even-aged stands), or modifications of these methods. Tree species lacking the capability of becoming established and growing under the shade of and in competition with other trees (shade-intolerant species) are regenerated most effectively in even-aged stands by either the seed-tree method, clearcutting method, or modifications of these methods.

The relative shade tolerance of tree species native to Maine is given below:

<table>
<thead>
<tr>
<th>Relative tolerance</th>
<th>Softwoods</th>
<th>Hardwoods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very tolerant</td>
<td>Fir, balsam</td>
<td>Beech, American</td>
</tr>
<tr>
<td></td>
<td>Hemlock, eastern</td>
<td>Maple, black</td>
</tr>
<tr>
<td></td>
<td>Spruce, white</td>
<td>Maple, sugar</td>
</tr>
<tr>
<td>Tolerant</td>
<td>Cedar, northern white</td>
<td>Basswood, American</td>
</tr>
<tr>
<td></td>
<td>Spruce, black</td>
<td>Maple, red</td>
</tr>
<tr>
<td></td>
<td>Spruce, silver</td>
<td>Maple, white</td>
</tr>
<tr>
<td></td>
<td>Spruce, white</td>
<td>Maple, silver</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Cedar, Atlantic white</td>
<td>Ash, black</td>
</tr>
<tr>
<td></td>
<td>Pine, eastern white</td>
<td>Ash, green</td>
</tr>
<tr>
<td></td>
<td>Pine, white</td>
<td>Ash, white</td>
</tr>
<tr>
<td></td>
<td>Pine, red</td>
<td>Birch, sweet</td>
</tr>
<tr>
<td></td>
<td>Pine, pitch</td>
<td>Birch, yellow</td>
</tr>
<tr>
<td></td>
<td>Pine, red</td>
<td>Elm, American</td>
</tr>
<tr>
<td></td>
<td>Pine, pitch</td>
<td>Elm, slippery</td>
</tr>
<tr>
<td></td>
<td>Pine, red</td>
<td>Hickory, shagbark</td>
</tr>
<tr>
<td></td>
<td>Pine, pitch</td>
<td>Oak, black</td>
</tr>
<tr>
<td></td>
<td>Pine, red</td>
<td>Oak, bur</td>
</tr>
<tr>
<td></td>
<td>Pine, pitch</td>
<td>Oak, chestnut</td>
</tr>
<tr>
<td></td>
<td>Pine, red</td>
<td>Oak, northern red</td>
</tr>
<tr>
<td></td>
<td>Pine, pitch</td>
<td>Oak, swamp white</td>
</tr>
<tr>
<td></td>
<td>Pine, red</td>
<td>Oak, white</td>
</tr>
<tr>
<td></td>
<td>Pine, pitch</td>
<td>Tupelo, black</td>
</tr>
<tr>
<td></td>
<td>Pine, red</td>
<td>Birch, paper</td>
</tr>
<tr>
<td></td>
<td>Pine, pitch</td>
<td>Butternut</td>
</tr>
<tr>
<td></td>
<td>Pine, red</td>
<td>Oak, scarlet</td>
</tr>
<tr>
<td></td>
<td>Pine, pitch</td>
<td>Sycamore, American</td>
</tr>
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</table>
Intermediate Cuttings

Intermediate cuttings are silvicultural treatments undertaken in immature even-aged forest stands and immature even-aged groups of trees in uneven-aged forest stands between the time for formation and the time of the first regeneration cutting. The two principal objectives of intermediate cuttings are: (1) to enhance the future value of existing forest stands by eliminating defective trees, wolf trees, weed trees, and surplus trees, thereby improving the vigor, resistance to injury (insect, disease, and wind), growth, and wood quality of the trees that remain; and (2) to increase the total yield of stands by utilizing all of the merchantable wood produced during the rotation. Intermediate cuttings differ from regeneration cuttings in that no effort is directed toward obtaining regeneration, and the creation of permanent openings in the crown canopy is carefully avoided.

Eight different kinds of intermediate cuttings, each designed for a particular purpose and each applicable to either immature even-aged forest stands or immature groups of trees in uneven-aged forest stands, are defined below:

1. Weeding -- A cultural operation performed in a young forest stand, not past the sapling stage and usually not past the seedling stage, for the purpose of releasing potential crop trees from the competition of other plants irrespective of whether they are woody plants or herbaceous plants, or whether their crowns are above, beside, or below the crowns of the crop trees.

2. Cleaning -- A cutting made in a young forest stand, not past the sapling stage, for the purpose of releasing potential crop trees from other individuals of similar age but of less desirable species or form, which are overtopping or are soon likely to overtop them.

3. Liberation cutting -- A cutting made to release a young forest stand, not past the sapling stage, from the competition of older overtopping individuals, which because of species, form, or defect are less desirable than the young growth.

4. Thinning -- A cutting made in an immature forest stand with the two fundamental objectives of (1) maintaining and/or stimulating the growth of the trees that remain and (2) utilizing all the merchantable material produced by the stand during the rotation. In making thinnings, trees are selected for removal or retention on the basis of crown class. Among trees equal in form and quality, dominant trees are favored over codominant trees; codominant trees over intermediate trees; and intermediate trees over overtopped trees. Trees removed in a thinning represent a surplus when compared to the number required for optimum stocking.

5. Improvement cutting -- A cutting made in a forest stand past the sapling stage for the purpose of improving its composition and quality by removing trees of undesirable species, form, or condition from the main canopy (dominant and codominant crown classes).

6. Salvage cutting -- A cutting made in a forest stand to remove trees killed or injured by fire, insects, disease, or other harmful agencies for the specific purpose of utilizing merchantable material before it becomes worthless.

7. Sanitation cutting -- A cutting made in a forest stand to remove trees killed or injured by fire, insects, disease, or other harmful agencies for the specific purpose of preventing the spread of an insect or a disease.

8. Pruning -- A cutting in which live or dead side branches are removed from crop trees with the objective of producing knot-free lumber on rotations shorter than those that would be required in the absence of pruning. Trees may also be pruned to improve access to stands during thinning operation, to prevent the spread of disease from branches into the boles of trees, and to improve the appearance of forest stands.

While the protection and regeneration of forest stands are essential requirements of sustained-yield management, intermediate cuttings -- other than those that may be required to regenerate forest stands successively -- may not be necessary and -- depending upon accessibility, markets, site quality, and objectives of management -- may prove to be unprofitable from an economic standpoint. On the other hand, the judicious application of intermediate cuttings in the management of a forest provides the best means of increasing the yield and quality of merchantable wood.

The range between the minimum intensity of silviculture required to secure a sustained yield of forest products useful to society and the maximum intensity permitted without incurring unrecoverable financial losses to management may be quite wide. Somewhere between the two extremes lies an optimum intensity of silviculture that will fulfill most nearly the needs of both management and society. A close approximation of the optimum intensity of treatment for each forest stand under management is fundamental to the efficient silvicultural management of a forest.

Protection

Protection of forest stands from injurious agencies is prerequisite to attainment of silvicultural management goals. From the time of establishment to the time of harvest, forest stands are subject to damage by wild fires, insects, diseases, animals, and various atmospheric agencies (temperature, drought, frost, snow, wind, lightening, and pollinants).

Losses of and damage to growing stock resulting from the activities of normal populations of insects, fungi, and animals as well as those from the damaging influences of most atmospheric agencies, can usually be reduced considerably, if not prevented entirely, by timely application of the silvicultural treatments needed to maintain forest stands in a healthy, vigorous state through all stages of development. Because of the complexity of operations and the number of ownerships that may be involved, the protection of forests from wild fires and epidemic infestations of insects and diseases must depend largely upon research, prevention, detection, and suppression programs established through the cooperative efforts of forest-land owners and public agencies.
The Maine Department of Conservation, Bureau of Forestry, is charged with the overall responsibility of protecting the timber resource from fire, insects, and diseases. Forest-land owners have the responsibility of complying with the State's forest protection laws and cooperating with the Bureau of Forestry in the administration of forest-protection programs.

Silvicultural Management Standards

The three principal major forest types in Maine are the spruce-fir type occupying 47.1 percent (1,949,400 acres) of the total commercial forest land; the maple-beech-birch type, 21.1 percent (5,561,300 acres); and the white pine-red pine-hemlock type, 10.7 percent (1,812,200 acres). Together, the three major types occupy almost four-fifths (78.9 percent) of Maine's commercial forest land (Ferguson and Kingsley 1972). Silvicultural management standards for each of the three types are given below:

Spruce-Fir Forest Type

Red spruce, white spruce, black spruce, and balsam fir, occurring either singly or in various combinations, account for a plurality of stocking in the spruce-fir forest type. Softwood associates may include eastern hemlock, eastern white pine, northern white cedar, and tamarack. Hardwood associates are sugar maple, red maple, American beech, yellow birch, white birch, gray birch, bigtooth aspen, quaking aspen, balsam poplar, black ash, and green ash.

Two subdivisions of the spruce-fir forest type are recognized, based on site, as follows: (1) primary (dominant) softwood sites occurring on the poorly drained soils of swamps, flats, and lower slopes as well as on the thin soils of steep mountain slopes from about 3,000 feet to timber line, the hardwood component making up less than 25 percent of the stand and consisting primarily of paper birch, aspen, and red maple; and (2) secondary softwood sites occurring on the better drained soils of lower mountain slopes and ridge lands of medium elevation, the hardwood component making up over 25 percent of the stand and consisting primarily of American beech, sugar maple, and yellow birch (Westveld 1953, 1956; Frank and Bierkman 1973). The spruces, balsam fir, and associated softwood species are unable to compete advantageously with the tolerant hardwood associates occupying the better-drained secondary softwood sites; and unless clearings are undertaken to favor the softwoods, they tend to be replaced eventually by the more aggressive American beech and sugar maple.

Regeneration methods

The establishment, maintenance, and regeneration of uneven-aged stands require application of the selection method. Even-aged stands are regenerated more assuredly by the shelterwood method. Even-aged stands are also regenerated by the clearcutting method but the clearcutting method without advance regeneration is not recommended unless provisions are made for artificially regenerating the clearcut area in locations where natural regeneration fails to become established within 5 years. The seed-tree method is not applicable in the spruce-fir type.

Stocking Guides

<table>
<thead>
<tr>
<th>Table 1: Stocking goals for uneven-aged spruce-fir stands at the start of 5-, 10-, and 20-year operating intervals in MBH class, number of trees per acre, and basal area per acre when the management objective is the maximum production of spruce-fir pulpwood (Frank and Bierkman 1973).</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMH class (inches)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
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<tr>
<td>7</td>
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<tr>
<td>8</td>
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<tr>
<td>9</td>
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<tr>
<td>10</td>
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<tr>
<td>11</td>
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<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>17</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>19</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
management objective is the maximum production of the highest value timber products of all species present are similarly presented in table 2. Irrespective of the management objective, residual basal areas at the end of the operation should be about 120, 105, and 80 square feet per acre for the 5-, 10-, and 20-year operating intervals, respectively (Frank and Bjorkbom 1973). Each periodic operation should include the regeneration cutting and any intermediate cuttings that may be required. The cuttings should be directed toward the attainment and maintenance of a balanced uneven-aged stand structure similar to one of those presented in tables 1 and 2.

Even-aged stands — For untreated even-aged sapling stands, the average numbers of acceptable stems of spruce and balsam fir growing stock required to produce a stand capable of fully utilizing the site when the mean stand diameter averages 5 inches are (Frank and Bjorkbom 1973):

<table>
<thead>
<tr>
<th>Mean Stand diameter (inches)</th>
<th>Acceptable stems per acre number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,660</td>
</tr>
<tr>
<td>2</td>
<td>1,345</td>
</tr>
<tr>
<td>3</td>
<td>1,075</td>
</tr>
<tr>
<td>4</td>
<td>850</td>
</tr>
</tbody>
</table>

The minimum stocking required, in terms of the number of trees per acre, average distance between trees, and basal area per acre, for full utilization of the site by even-aged spruce-fir stands in various stages of development as indicated by the average diameter of the trees in the main stand, are presented in table 3 (Frank and Bjorkbom 1973). Intermediate cuttings should not reduce the stocking of even-aged spruce-fir stands below those indicated in table 3.

Table 3 — Minimum stocking required for full utilization of the site by even-aged spruce-fir stands in the Northeast based on the average diameter, number of trees per acre, and basal area per acre of the main stand. 1/

<table>
<thead>
<tr>
<th>Average DBH of trees in main stand (inches)</th>
<th>Trees per acre</th>
<th>Average distance between trees</th>
<th>Basal area per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Feet</td>
<td>Square feet</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>448</td>
<td>9.9</td>
<td>61</td>
</tr>
<tr>
<td>6</td>
<td>387</td>
<td>10.6</td>
<td>76</td>
</tr>
<tr>
<td>7</td>
<td>322</td>
<td>11.6</td>
<td>86</td>
</tr>
<tr>
<td>8</td>
<td>293</td>
<td>12.2</td>
<td>102</td>
</tr>
<tr>
<td>9</td>
<td>264</td>
<td>12.8</td>
<td>117</td>
</tr>
<tr>
<td>10</td>
<td>233</td>
<td>13.7</td>
<td>127</td>
</tr>
<tr>
<td>11</td>
<td>210</td>
<td>14.4</td>
<td>139</td>
</tr>
<tr>
<td>12</td>
<td>189</td>
<td>15.2</td>
<td>148</td>
</tr>
<tr>
<td>13</td>
<td>172</td>
<td>15.9</td>
<td>159</td>
</tr>
</tbody>
</table>

1/ Includes all trees in the intermediate, codominant, and dominant crown classes.

Maple-Beech-Birch Type

The maple-beech-birch forest type, also known as the northern hardwood type, occurs intermingled with the spruce-fir forest type and attains its best development on the steep, fertile well-drained soils of lower mountain slopes and ridges. Sugar maple, American beech, and yellow birch, occurring either singly or in various combinations, account for a plurality of stocking. Important hardwood associates are paper

Table 2 — Stocking goals for uneven-aged spruce-fir stands at the stages of 5-, 10-, and 20-year operating intervals by DBH class, number of trees per acre, and basal area per acre when the management objective is the maximum production of the highest value timber products of all species present or adapted to the site (Frank and Bjorkbom 1973).

<table>
<thead>
<tr>
<th>DBH class (inches)</th>
<th>5-Year</th>
<th>10-Year</th>
<th>20-Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trees</td>
<td>Basal area</td>
<td>Trees</td>
</tr>
<tr>
<td>1</td>
<td>122</td>
<td>1</td>
<td>153</td>
</tr>
<tr>
<td>2</td>
<td>135</td>
<td>3</td>
<td>118</td>
</tr>
<tr>
<td>3</td>
<td>104</td>
<td>5</td>
<td>92</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>5</td>
<td>61</td>
<td>8</td>
<td>54</td>
</tr>
<tr>
<td>6</td>
<td>47</td>
<td>9</td>
<td>41</td>
</tr>
<tr>
<td>7</td>
<td>36</td>
<td>10</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>26</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>9</td>
<td>21</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>13</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>13</td>
<td>7</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>17</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Total  | 740 | 122 | 560 | 105 | 330 | 80 |
birch, white ash, red maple, and aspen. Softwood associates include eastern hemlock, balsam fir and red spruce.

Regeneration methods

While the establishment, maintenance, and regeneration of uneven-aged stands require application of the selection method, even-aged stands may be regenerated, depending upon the tree species desired in the new crop, by either the shelterwood method, clearcutting method, or seed-tree method.

The selection method favors the regeneration of the tolerant tree species (American beech, sugar maple, eastern hemlock, and red spruce).

The shelterwood method, when uniformly applied, also tends to favor the regeneration of the tolerant tree species. However, the representation of tree species of intermediate tolerance (yellow birch, white ash, and red maple) and intolerant tree species (paper birch and aspen) in the regeneration can be increased by removing all trees 3 inches or more in diameter at breast height from relatively narrow strips (50 to 100 feet wide) or from small patches (less than 3/4 acre in size) located successively in a forest stand (Leak et al. 1969; Marquis et al. 1969). Since both types of cutting result not only in assisting advance regeneration, but also in providing shade on the major portion of the area to be regenerated, they are best viewed as being modifications of the shelterwood method.

The clearcutting method and seed-tree method favor the regeneration of the intolerant tree species (paper birch and aspen) (Marquis et al. 1969).

Stocking guides

Uneven-aged stands — The interval between successive cuttings should not exceed 20 years, shorter intervals down to 10 years would be preferable. At the start of an operating interval, the basal area in growing-stock trees greater than 5.0 inches in diameter breast height should be around 80 square feet per acre, distributed among trees of various size classes as given below.

<table>
<thead>
<tr>
<th>DBH class (inches)</th>
<th>Trees (number) per acre</th>
<th>Basal area (square feet) per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-10</td>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td>12-16</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>18+</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>80</td>
</tr>
</tbody>
</table>

Each periodic operation should include the regeneration cutting and any intermediate cuttings that may be required. The cuttings should be directed toward the attainment and maintenance of a balanced uneven-aged stand structure similar to the one presented above. No cutting should remove more than 40 square feet of basal area per acre (Leak et al. 1969).

Even-aged stands — The average numbers of acceptable stems of growing stock required to produce a stand capable of fully utilizing the site when the mean stand diameter averages 5 inches are given below for (1) all commercial hardwood species (Leak et al. 1969); (2) intolerant species (paper birch and aspen) and species of intermediate tolerance (yellow birch, white ash, and red maple) (Leak et al. 1969); and (3) paper birch (Marquis et al. 1969).

<table>
<thead>
<tr>
<th>Mean stand diameter (inches)</th>
<th>Trees per acre (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,480</td>
</tr>
<tr>
<td>2</td>
<td>2,320</td>
</tr>
<tr>
<td>3</td>
<td>1,550</td>
</tr>
<tr>
<td>4</td>
<td>770</td>
</tr>
</tbody>
</table>

All Commercial Hardwoods

<table>
<thead>
<tr>
<th>Intolerants - Intermediates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

Paper Birch

| 1                           | 1,250                   |
| 2                           | 890                     |
| 3                           | 650                     |
| 4                           | 485                     |

The minimum stock in terms of the number of trees per acre, average distance between trees, and basal area per acre required for full utilization of the site by even-aged northern hardwood stands and even-aged paper birch stands in various stages of development as indicated by the mean diameter of the trees in the main stand, are presented in table 4 (Leak et al. 1969) and table 5 (Marquis et al. 1969), respectively. Intermediate cuttings should not reduce the stocking of even-aged northern hardwood stands and even-aged paper birch stands below that indicated in tables 4 and 5, respectively.

Table 4 — Minimum stocking required for full utilization of the site by even-aged northern hardwood stands in the Northeast, based on the average diameter, number of trees per acre, and basal area per acre of the main stand.¹/ (Leak et al. 1969).

<table>
<thead>
<tr>
<th>Average DBH of trees in main stand (inches)</th>
<th>Trees per acre</th>
<th>Average distance between trees</th>
<th>Basal area per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>387</td>
<td>10.6</td>
<td>53</td>
</tr>
<tr>
<td>6</td>
<td>289</td>
<td>12.3</td>
<td>57</td>
</tr>
<tr>
<td>7</td>
<td>230</td>
<td>13.8</td>
<td>61</td>
</tr>
<tr>
<td>8</td>
<td>187</td>
<td>15.3</td>
<td>65</td>
</tr>
<tr>
<td>9</td>
<td>154</td>
<td>15.8</td>
<td>68</td>
</tr>
<tr>
<td>10</td>
<td>134</td>
<td>18.0</td>
<td>73</td>
</tr>
<tr>
<td>11</td>
<td>117</td>
<td>19.3</td>
<td>77</td>
</tr>
<tr>
<td>12</td>
<td>103</td>
<td>20.6</td>
<td>81</td>
</tr>
<tr>
<td>13</td>
<td>92</td>
<td>21.8</td>
<td>85</td>
</tr>
<tr>
<td>14</td>
<td>82</td>
<td>23.0</td>
<td>88</td>
</tr>
<tr>
<td>15</td>
<td>76</td>
<td>24.3</td>
<td>91</td>
</tr>
<tr>
<td>16</td>
<td>67</td>
<td>25.5</td>
<td>94</td>
</tr>
<tr>
<td>17</td>
<td>61</td>
<td>26.7</td>
<td>96</td>
</tr>
<tr>
<td>18</td>
<td>55</td>
<td>28.1</td>
<td>97</td>
</tr>
</tbody>
</table>

¹/ Includes all trees in the intermediate, co-dominant, and dominant crown classes.
Table 5 -- Minimum stocking required for full utilization of the site by even-aged paper birch stands in the Northeast, based on the average diameter, number of trees per acre, and basal area per acre of the main stand. 1/ (Parquin et al. 1969).

<table>
<thead>
<tr>
<th>Average DBH of trees in main stand (inches)</th>
<th>Trees per acre</th>
<th>Average distance between trees</th>
<th>Basal area per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Feet</td>
<td>Square Feet</td>
</tr>
<tr>
<td>5</td>
<td>387</td>
<td>10.6</td>
<td>53</td>
</tr>
<tr>
<td>6</td>
<td>314</td>
<td>11.8</td>
<td>62</td>
</tr>
<tr>
<td>7</td>
<td>259</td>
<td>13.0</td>
<td>69</td>
</tr>
<tr>
<td>8</td>
<td>218</td>
<td>14.1</td>
<td>76</td>
</tr>
<tr>
<td>9</td>
<td>186</td>
<td>15.3</td>
<td>82</td>
</tr>
<tr>
<td>10</td>
<td>160</td>
<td>16.5</td>
<td>87</td>
</tr>
<tr>
<td>11</td>
<td>140</td>
<td>17.6</td>
<td>92</td>
</tr>
</tbody>
</table>

1/ Includes all trees in the intermediate, codominant, and dominant crown classes.

White Pine-Red Pine-Hemlock Type

Eastern white pine, red pine, and eastern hemlock, occurring either singly or in various combinations, account for a plurality of stocking in the white pine-red pine-hemlock forest type. Softwood associates include red spruce, white spruce, balsam fir, and northern white cedar. Hardwood associates are gray birch, paper birch, yellow birch, red maple, sugar maple, bigtooth aspen, quaking aspen, northern red oak, and white oak.

Regeneration methods

The growth characteristics of eastern white pine, red pine, and eastern hemlock indicate that they can be grown best in even-aged stands. Although the environment required for germination, initial establishment, and subsequent growth of the three species is apparently provided best by the shelterwood method (Smith 1951; Tyre and Zehngraff 1948; Foster and Kirkland 1969), both eastern white pine and red pine may be regenerated by either the seed-tree method or the clearcutting method.

Stocking guides

Estimates of the numbers of acceptable stems of white pine growing stocked required to produce a stand capable of fully utilizing the site when the mean stand diameter averages 5 inches, as extrapolated from data provided by Philbrook et al. (1973), are given below for untreated even-aged stands of white pine.

<table>
<thead>
<tr>
<th>Mean stand diameter (inches)</th>
<th>Acceptable stems per acre (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>740</td>
</tr>
<tr>
<td>2</td>
<td>670</td>
</tr>
<tr>
<td>3</td>
<td>600</td>
</tr>
<tr>
<td>4</td>
<td>530</td>
</tr>
</tbody>
</table>

The minimum stocking required in terms of the number of trees per acre, average distance between trees, and basal area per acre for full utilization of the site by even-aged eastern white pine stands in various stages of development as indicated by the average diameter of the trees in the main stand are presented in Table 6 (Philbrook et al. 1973). Intermediate cuttings should not reduce the stocking of even-aged eastern white pine stands below those indicated in Table 6.

Table 6 -- Minimum stocking required for full utilization of the site by even-aged eastern white pine stands in the Northeast, based on the average diameter, number of trees per acre, and basal area per acre of the main stand. 1/

<table>
<thead>
<tr>
<th>Average DBH of trees in main stand (inches)</th>
<th>Trees per acre</th>
<th>Average distance between trees</th>
<th>Basal area per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Feet</td>
<td>Square Feet</td>
</tr>
<tr>
<td>5</td>
<td>675</td>
<td>9.6</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
<td>695</td>
<td>10.5</td>
<td>78</td>
</tr>
<tr>
<td>7</td>
<td>330</td>
<td>11.5</td>
<td>88</td>
</tr>
<tr>
<td>8</td>
<td>285</td>
<td>12.4</td>
<td>99</td>
</tr>
<tr>
<td>9</td>
<td>245</td>
<td>13.3</td>
<td>108</td>
</tr>
<tr>
<td>10</td>
<td>215</td>
<td>14.2</td>
<td>117</td>
</tr>
<tr>
<td>11</td>
<td>185</td>
<td>15.3</td>
<td>122</td>
</tr>
<tr>
<td>12</td>
<td>155</td>
<td>16.2</td>
<td>130</td>
</tr>
<tr>
<td>13</td>
<td>145</td>
<td>17.3</td>
<td>134</td>
</tr>
<tr>
<td>14</td>
<td>130</td>
<td>18.3</td>
<td>139</td>
</tr>
<tr>
<td>15</td>
<td>120</td>
<td>19.1</td>
<td>147</td>
</tr>
<tr>
<td>16</td>
<td>110</td>
<td>19.9</td>
<td>154</td>
</tr>
<tr>
<td>17</td>
<td>100</td>
<td>20.9</td>
<td>158</td>
</tr>
<tr>
<td>18</td>
<td>90</td>
<td>22.0</td>
<td>159</td>
</tr>
</tbody>
</table>

1/ Includes all trees in the main crown canopy.

Artificial regeneration

Natural regeneration methods are not infallible and, even when carefully and correctly executed in accordance with sound recommendations, may result on occasion in areas failing to become adequately stocked with desirable species. In such instances, artificial regeneration—planting tree seedlings or sowing seed on the areas to be regenerated—should be undertaken. Abandoned fields, areas burned over by wild fires, and other areas suitable and available for the production of timber crops but failing to become reforested satisfactorily by natural means, should be regenerated artificially.

Nursery-grown seedlings of eastern white pine, red pine, white spruce, and Norway spruce for reforestation of forest lands within the State of Maine may be purchased from the State Forest Nursery in Greensburg, Maine. To be eligible to purchase nursery stock, a forest-land owner must have the proposed planting site inspected and approved for planting by a District Forester, Maine Bureau of Forestry. Upon a forest-land owner's request, the District Forester will examine the proposed planting site and provide assistance in determining the acreage, number of trees required, and tree species best suited to the site.
OPTIMUM UTILIZATION OF FOREST LANDS
FOR PRIMARY FOREST PRODUCTS

Objective

Improve the quantity and quality of timber yields and insure the continuous production and flow of forest products from forest lands.

Implementation

The following are needed to attain the foregoing objective:

1. Periodically review, analyze, and plan relative to forest management, growing-stock data, growth-drain ratios, and current utilization practices by product and ownership class on a state or regional basis.

2. Improve communications and coordination between owners, operators, and markets in regard to:
   a. Operating techniques
   b. Product sizes and species
   c. Fertilization of individually trees
   d. Access to forest land and transportation of forest products
   e. Future wood commitments and plans

3. Encourage a variety of markets to attain full utilization of all tree species and wood residue.

4. Attract, develop, and maintain skilled forest labor personnel by:
   a. Providing adequate compensation, other benefits, and job security
   b. Improvement of working conditions
   c. Education in use of equipment, safety techniques, and management objectives
   d. Encouragement of training programs in schools

Standards

1. Trees should be harvested with a minimum of waste
2. All salvageable trees should be harvested whenever possible
3. Logging damage to residual growing stock should be kept at a minimum

IMPROVEMENT, MAINTENANCE, AND PROTECTION OF THE FOREST SOIL RESOURCE

The Four Damaging Processes

At least four processes are capable of causing damage to forest soils. These are erosion, compaction, addition of chemical amendments, and forest-management activities resulting in nutrient depletion. At present the forces attributed to erosion are by far the most significant.

Forest soil compaction, damage to soils by chemical amendments, or nutrient depletion caused by overutilization are not apparently widespread problems. But it must be acknowledged that little is known about these specific attributes at present. With changing harvesting and utilization technologies resulting in greater nutrient removals, with the present danger of insect epidemics possibly requiring chemical control, and with increased interest in forest fertilization, closer monitoring of forest soil conditions will be necessary.

General Statement

In general, forest practices ranging from site preparation for regeneration to harvesting of mature stands should not be conducted so as to lower the total productive capability of the soil. Damage to the biological, chemical, and physical properties of the soil should be minimized. Where practical, measures for soil improvement should be adopted.

Erosion of Forest Soils

Erosion may be divided into two categories:

1. Geologic or natural: that which is normal to an area and is not influenced by man.
2. Accelerated: that which is initiated or caused by man.

Accelerated or man-caused erosion is usually more rapid than geologic erosion. In Maine, geologic erosion is not a major problem on commercial forest lands but can be a significant problem on steep timbered areas and near timberline. Accelerated erosion in areas under forest management is a problem almost exclusively confined to sub-areas in the forest transportation system used for primary skid trails, primary and secondary haul roads, landings, and borrow pits (Hornebeck 1967). In the remainder of the forest the high infiltration rate of unscarified forest soils prevents overland flow and erosion.

The following forest-practice standards relative to forest transportation systems are designed to improve, maintain, and protect the forest soil resource:

1. A qualified individual should plan the forest transportation system.
2. Soil moisture conditions should be recognized in preparing preliminary road and trail surveys.
3. Cross streams where stream banks are narrow, high and straight. Otherwise, cross at a suitable rocky or gravelly ford. Install proper crossing structures and approaches. This should be done when water flow is lowest.
4. In critical areas having potential for unacceptable erosion, skidding operations should be conducted so that accelerated erosion is minimal.
5. Provide adequate drainage for road surfaces during periods of use by employing one or a combination of the following techniques:
   a. Grading the road to a high crown (1 to 4 inches).
   b. Providing and maintaining ditches and culverts.
   c. Providing and maintaining water breaks. The spacing between these water breaks will vary with both the grade and the erodibility of the soil. As a guide they should be spaced as follows (Kochenderfer 1970):

<table>
<thead>
<tr>
<th>Road grade (percent)</th>
<th>Spacing (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4</td>
<td>300-200</td>
</tr>
<tr>
<td>5-7</td>
<td>190-160</td>
</tr>
<tr>
<td>8-10</td>
<td>150-140</td>
</tr>
</tbody>
</table>

Note: Actual distances between water breaks will depend upon the nature of the road surface material and its tendency to erode.
6. Non-gravel unsurfaced roads should be closed to non-essential traffic to prevent and reduce erosion.
7. Where the practice of waste-and-borrow or cut-and-fill construction is used, the disturbed area should be kept at a minimum.
8. Roads or trails should not be built in stream channels.
9. Depressions where runoff will be concentrated should be avoided.
10. Flat areas or heavy soils where drainage is difficult should be avoided.
11. Steep slopes adjacent to roadways, discontinued roads, skid trails, yards, and other disturbed areas having erosion potential should be stabilized by mulching, seeding, or riprapping.
12. Road grades should not exceed 10 percent except for short stretches.
13. Grades should be broken occasionally, and long straight grades should be avoided.
14. Slopes of cut banks should be 1:1 or less.
15. Slopes of fill banks should be 1:1 1/2 or less.
16. Discontinued roads and primary skid trails should be provided with adequate waterbars. The distance between waterbars will depend on the grade and the erodibility of the soil. As a guide, waterbars should be spaced as follows:

<table>
<thead>
<tr>
<th>Grade of road (percent)</th>
<th>Distance between water bars (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>250</td>
</tr>
<tr>
<td>5</td>
<td>135</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>25</td>
<td>40</td>
</tr>
<tr>
<td>30</td>
<td>35</td>
</tr>
</tbody>
</table>

Compaction of Forest Soils

Long-term compaction detrimental to forest soils and forest vegetation seldom seems to be a problem in Maine. However, compaction can occur in some soils during periods of certain combinations of moisture conditions and logging operations exist. Most problem areas are centered around the network of roads and trails. Reduction of logging activity during these critical periods will prevent a loss of soil quality due to the physical compaction of the soil.

Chemical Amendments to Forest Soils

The addition of chemicals to forest soils as insecticides, herbicides, and fertilizers can cause biological, chemical, and even physical changes to the soil. We need to know more about the effects these amendments have in the forest ecosystem.

The chemical compounds used in massive spraying operations, such as the spruce budworm projects, are carefully tested, screened, and monitored. Their effects on forest soils and on other parts of the forest ecosystem are being ascertained. Applications of fertilizers on a commercial basis will also require careful and complete evaluation.

Timber-stand-improvement operations employing the use of herbicides likewise must be determined as being safe. Harmful build-up of residual chemicals in forest soils should not be allowed.

Nutrient Depletion of Forest Soils

At present it seems that current timber-removal programs do not result in irreversible depletion of forest soil nutritional reserves (Maki 1972). Research publications currently available indicate that present methods and degrees of utilization--regardless of the silvicultural method used--involve tolerable depletion of nutrients from forest soils, which are offset by inputs of nutrients in dust, precipitation, and weathering. As rotations are shortened and utilization becomes more complete, alertness to significant nutrient-concentration changes is necessary if soil quality is to be maintained (Neetman and WEBBER 1972).

IMPROVEMENT, MAINTENANCE, AND PROTECTION OF THE FOREST WATER RESOURCE

The Resource

Water is an integral part of the forest ecosystem. The average annual precipitation of 40 inches in Maine not only supplies the necessary water requirements of the timber and vegetative complex of the forest, but also yields--through runoff and percolation--the surface waters that provide recreation, visual character, aquatic habitat, and much of the State's domestic and industrial water supply.

Forests significantly influence the hydrologic cycle and water quality. The energy of falling rain is dispersed by forest cover and forest litter on the ground. The humus layer and the vegetative root mass have a metering effect on water flow and hold soil in place. Large amounts of water are moved in the forest by evapotranspiration. Shading from vegetative cover modifies watercourse temperatures. Percolation through forest soils alters the chemical and particulate quality of ground and stream waters. Natural forest debris accumulates in surface waters and affects water quality. Man's activities in the forest can affect water quality and the intricate relationships between forest and water.

Problems

Certain practices associated with timber harvesting, transportation of wood products, use of structures, and the use of chemicals affect the suitability of water for human uses and as aquatic habitat. Specific problems result from:
1. Introduction of soil sediment into surface waters.
2. Introduction of slash and other waste material into surface waters.
3. Introduction of chemicals into surface waters.
4. Increases in water temperatures.

Standards

The standards in this section do not deal with the problem of aquatic habitat; these are dealt with in Goal 5.

Timber Harvesting

Slash and waste material should be disposed of so as to prevent their entering surface waters and in such manner as to conform to existing laws and regulations governing slash and waste disposal.

Transporting Wood Products

All road and skid trails should be constructed in conformance with the provisions of Goal 3.

Watercourse crossings should be kept to a minimum, and their design and construction should ensure minimal channel disturbance and capacity for peak flows. It
is particularly important to locate crossing approaches on stable, well-drained sites with minimum grade.

Yarding or operating equipment in or across watercourses in an unfrozen state should be avoided. When such waters need to be crossed, adequate structures that do not interfere with natural water flow should be provided that will keep equipment and logs out of the water, or crossings should be made at suitable rocky or gravelly fords where such crossings will not cause damaging sedimentation or impairment to the watercourse.

To prevent sedimentation, roads, primary skid trails, yards, and other substantial areas of exposed mineral soil should be located so that an unsacrificed area of soil of suitable width is located between such areas and any watercourse. The width of such areas will vary according to slope, soil type, size of watershed, and vegetative cover. As a guide, the width of such areas should vary with the general slope of the land, as follows (Hausmann 1960):

<table>
<thead>
<tr>
<th>Slope (percent)</th>
<th>Slope Distance (feet)</th>
<th>Slope (percent)</th>
<th>Slope Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
<td>50</td>
<td>125</td>
</tr>
<tr>
<td>10</td>
<td>45</td>
<td>60</td>
<td>145</td>
</tr>
<tr>
<td>20</td>
<td>65</td>
<td>70</td>
<td>165</td>
</tr>
<tr>
<td>30</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>105</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Divert sediment-laden waters in roadside ditches into settling basins and across filter strips as above before ditches discharge into watercourses.

Stabilize cut or fill banks adjacent to watercourses with a vegetative cover or by riprapping.

**Structures**

All structures used in forest operations should be located, constructed, and used in such a manner that damaging sedimentation does not occur, watercourse channels are not impaired, and pollution of the water resource will not result.

**Chemicals**

To prevent pollution of surface waters, the use of chemicals such as insecticides, herbicides, and fertilizers should conform to the requirements of existing state and federal laws and regulations.

**IMPROVEMENT, MAINTENANCE, AND PROTECTION OF FISH HABITAT AND WILDLIFE HABITAT OF PARTICULAR IMPORTANCE**

A large percentage of Maine's total area consists of commercial forests, noncommercial forest land, and waterways. All of these areas provide fish or wildlife habitat and support a population of some species. Good forest-management practices will maintain and improve areas of general wildlife use and habitat.

**Habitats of Particular Importance**

There are several types of areas of particular importance to the maintenance of fish and wildlife. These are areas that provide winter shelter for deer, natural stream habitat; and other areas such as old fields, alder swamps, and apple orchards.

**Critical deer winter areas** -- Critical deer-wintering areas are those portions of a deer-wintering area providing shelter during periods of extreme stress brought about by low temperatures, high winds, and restrictive snow conditions. Timber stands in the above-described areas consist mainly of dense stands of coniferous species. Landowners should cooperate with the Maine Department of Inland Fisheries and Game in the identification and management of critical deer-wintering areas.

**Natural stream habitats** -- Natural stream habitats are watercourses in which water flows in a defined channel or bed throughout the year. Standards to preserve natural stream habitats:

1. Adequate vegetation should be maintained along stream banks to prevent damaging increases in stream temperature.
2. Roads, skid trails, and yards should be constructed in conformance with the provisions of Goals 3 and 4 to prevent sedimentation.

**Other areas of particular importance to game management** -- Old fields, alder swamps, ruminant apple orchards and other areas identified by wildlife biologists as being particularly important, should be managed for their best use through cooperation of the managing agency and the landowner.

**IMPROVEMENT, MAINTENANCE, AND PROTECTION OF THE VISUAL QUALITIES OF FORESTS**

Although concern with the visual qualities of the forest may seem unnecessary or a costly luxury to some, these qualities are extremely important to the general public. This is not to say that visual qualities should be a concern in all areas in the forest, but they are an important concern in some areas.

**Areas Where Visual Qualities Are of Particular Importance**

The following areas are those where visual qualities are of particular importance because of their impact on the public:

- **Roadsides** -- Land areas within 250 feet on either side of the edge of right-of-way of any public road where no natural topographic screen intervenes.
- **Shorelands** -- Land areas within 250 feet of the northerm high water mark of any surface water reasonably navigable by canoe or other watercraft.

**Vista background areas** -- Areas distant from but commonly seen from public roads and public recreation areas, and surface waters reasonably navigable by canoe or other watercraft.

**Standards for Achieving the Stated Goal**

**Roadside and Shoreland Areas**

For roadside and shoreland areas, the following measures are recommended to maintain and improve the visual quality of the landscape:

1. Minimize logging debris and slash through the maximum utilization feasible.
2. Except where silvicultural conditions dictate otherwise or where openings are needed to increase visual diversity, perform light harvest cuttings.
that leave the forest largely intact. Such harvests should normally be conducted under the individual tree or group selection systems of management.
3. Favor trees of special interest for foliage coloration, form, and branching habit.
4. Enhance aesthetic qualities of the landscape by developing vistas and emphasizing desirable topographic features of the area by either creating or maintaining existing openings in the forest.
5. Avoid unnecessary destruction of residual trees, seedlings, and shrubs by careful felling, skidding and hauling practices.
6. Insure adequate regeneration of harvested stands by natural or artificial means except where creating or maintaining openings to increase visual diversity.
7. Haul roads, skid trails, and log yards should be located, designed, constructed, and maintained to fit harmoniously within the landscape by having minimum visual impact.
8. Conduct after-logging clean-up of such unsightly things as refuse, tin cans, and discarded equipment and parts.
9. Fell snags, stubs, and severely damaged trees in harvested areas and cut up logging slash so that it lies close to the ground.
10. The manager of forest land should seek to create and perpetuate a forest diversified in plant species, plant sizes, plant shapes, and the spatial distribution of objects.
11. Areas on which the clearcutting method is employed for regeneration purposes should be kept to the minimum size necessary and be designed in irregular shapes to fit harmoniously with the landscape.

Vista Background Areas

The following measure is recommended to maintain and improve the landscape quality of the vista background areas:

Areas on which the clearcutting, seed-tree, or shelterwood methods are employed for regeneration purposes should be designed in irregular shapes to fit harmoniously with the landscape and have minimum visual impact.

OTHER CONCERNS RELATIVE TO THE FOREST RESOURCES OF MAINE

Equitable Treatment of Landowners

If as a result of forest-practice laws, an owner of forest land is subjected to substantial restrictions in the use of his land for the common good, direct or indirect compensation to the landowner in terms of his services, reduced taxes, or payment should be made.

Land-Use Planning

If Maine is to remain an important producer of primary forest products, forest land must be retained in forest management. The demand for conflicting land uses such as urban, suburban, and recreational development are growing and potentially threaten our forest land base. This is not currently a problem in Maine, as the amount of forest land increased 3 percent between 1959 and 1972; but it should be guarded against the future. This is particularly true of highly productive forest lands, which are the most suitable for conflicting land uses. On the national level this is a continuing problem with both agricultural and forest land.

Education

Public understanding of an appreciation for the values and complexities of forest ecosystems and their sound management should be actively sought through:

a. Formal forestry and conservation education at all educational levels.
b. Increased dissemination of information to the public by foresters through:
   (1) Speaking engagements
   (2) Articles in forestry publications
   (3) Radio and television appearances
   (4) Participation in civic activities
   (5) Preparation and distribution of informational materials
   (6) Assisting with the planning and preparation of educational programs
   (7) News releases
c. Establishment of forest-management field demonstrations
d. Conducting forest-management tours

OTHER RECOMMENDATIONS

The following recommendations not only deal with specifics relative to forest-practice standards, but also cover a scope that will have a beneficial influence on the forests of the State of Maine.

1. It is recommended that these forest-practice standards be recognized as a first effort, and that periodic revisions and additions be made to take into account changing conditions as well as advances in technology.
2. It is recommended that these forest practice standards be regarded as ultimate goals and ideals and be used as such.
3. It is recommended that the values of forest land in continuously providing goods and services be recognized and continually reevaluated.
4. It is recommended that an organization be established to suggest research priorities and to promote better communications between researchers, forest industries, and forest landowners.
5. We recognize the need to and recommend the expansion of private, state, and federal forest-related research that pertains to the forest resources of Maine.
6. We recognize the need for and support of forestry education in Maine. In this we support the School of Forest Resources at the University of Maine, and recommend that its administrative position be made equal to that of agriculture, a position commensurate with the importance of the forest resources to the State of Maine.
7. Due to the complexities of wildlife management, its interplay with and importance to forest management, we recommend that a cooperative study of forestry-wildlife problems be conducted by the Maine Chapter and wildlife professionals.
8. We recommend that commercial forest lands of Maine be managed for the production of wood products within the framework of the multiple-use concept.
DEFINITIONS OF TERMS USED IN THIS REPORT

ACCELERATED EROSION
Abnormally rapid erosion in an environment disturbed by animal life, mainly man, and due primarily to such disturbance.

ACCEPTABLE TREES
Growing-stock trees that meet specified standards of size and quality, but do not qualify as desirable trees.

ADVANCE REGENERATION
Young trees that become established naturally before the first regeneration cutting is made.

ALDER RUN
A particular strip, patch, or area of vegetation whose primary and usually only species consists of alders.

ARTIFICIAL REGENERATION
The removal of a tree crop by either seedling or planting or both.

ASPEN-BIRCH TYPE
Forests in which aspen, balsam poplar, paper birch, or gray birch, singly or in combination, make up a plurality of the stocking.

ASSOCIATION
An assemblage of plants and animals having ecologically similar requirements, and including one or more dominant.

AVERAGE ANNUAL NET GROWTH
An average of the change (resulting from natural causes) in volume of sound wood in pole timber and sawtimber trees during the period between surveys, divided by the length of the period.

BASE AREA
The area of the cross-section of a tree stem near its base, generally at breast height and inclusive of bark.

BOARD FOOT
The amount of timber equivalent to a piece 1 inch by 1 foot and 1 inch thick; the unit in board-foot measure.

BOLK
A tree stem once it has grown to substantial thickness, roughly capable of yielding sawtimber, veneer logs, or large poles.

BOLT
Any short log, as a pulpwood or veneer bolt.

BRANCHING HABIT
The typical configuration of arrangement, angle, and size of the branches of a tree.

BUFFER STRIP
A protective area adjacent to an area requiring special attention.

CHEMICAL AMENDMENT
Any addition of a chemical substance, such as fertilizer, pesticide, or herbicide, to the environment.

CLEANING
A cutting made in a young forest stand, not past the sapling stage, for the purpose of releasing potential crop trees from other individuals of similar age but of less desirable species or form which are overtopping or are soon likely to overtop them.

CLEARCUTTING
The removal of all trees on an area to be regenerated in one cutting, regeneration of desirable species being obtained subsequently either naturally from seed disseminated over the cutting area from adjacent forest stands and/or from trees removed in the harvesting operation, or artificially by either planting tree seedlings or sowing seed on the cutting area and/or the presence of advance regeneration.

CODOMINANT TREE
Trees with crowns forming the general level of the crown cover and receiving full light from above and partly from the side; larger than the average trees in the stand, with crowns well developed but possibly somewhat crowded on the sides.

COMMERCIAL CLEARCUT
The removal from the cutting area of merchantable-size trees of marketable species.

COMMERCIAL FOREST LAND
Forest land that is producing or capable of producing crops of industrial wood (all roundwood products except fuelwood) in amounts of more than 20 cubic feet per acre per year and is not withdrawn from timber utilization.

COMPACTION
Any process by which the soil grains are rearranged into closer contact.

COMPLETE TREE
The total live and dead material of a tree, consisting of leaves or crown, branches, bole, bark, and root system.

COMPOSITION
The relative proportions of the various species included in the total cover on a given area.
COPPICE
A method of renewing the forest in which reproduction is by sprouts.

COPPICE WITH STANDARDS
Production of coppice and seedling high forest upon the same area by clearcutting the coppice at short intervals and at the same time removing some of the mature high forest trees.

CRITICAL DEER-WINTERING AREAS
That portion of a deer-wintering area providing shelter during periods of extreme stress brought about by low temperatures, high winds, and restrictive snow conditions.

CROP TREK
Generally a tree selected in a young stand or plantation for carrying through to maturity.

CROWN CANOPY
The canopy of green leaves and branches formed by the crowns of all the trees in a forest.

CROWN CLASS
Any class into which the trees forming a crop or stand may be divided on the basis of both their crown development and crown position relative to the crowns of adjacent trees and the general canopy.

CUT AND FILL
A road-construction procedure that establishes grades and roadbed.

CUTTING CYCLE
The planned period with which all designated areas should be cut over in prescribed sequence.

CUTTING SECTION
A subdivision of a cutting series, formed with the object of regulating fellings in some special manner.

DESIRABLE TREE
Growing-stock trees of commercial species that have no serious quality defects that limit present or prospective use for timber products, or that are of relatively high vigor and contain no pathogens that may result in death or serious deterioration before rotation age.

DIAMETER BREAST HEIGHT (DBH)
The diameter of a tree at 4.5 feet above ground level, abbreviated dbh or DBH.

DIAMETER CLASS
Any of the intervals into which a range of diameters of tree stems or logs may be divided for classification and use.

DIAMETER-LIMIT CUTTING
The removal from the cutting area of all trees of marketable species with a diameter at breast height greater than a specified minimum.

DIRECTIONAL FELLING
The process of felling trees in a predetermined direction to accomplish a given objective.

DOMINANT TREE
A tree whose crown extends above the general level of the crown cover and receives full light from above and partly from the side; larger than the average trees in the stand, with crown well developed but possibly somewhat crowded on the sides.

DRAINAGE DIP
A shallow depression built diagonally across a light-duty road, so as to lead water, particularly storm water, off it.

ECOSYSTEM
Any complex of living organisms and their environment.

ELM-ASH-RED MAPLE TYPE
Forests in which elm, ash, or red maple, singly or in combination, make up a plurality of the stocking.

EROSION
The combined action of weathering, ablation, deflation, and abrasion on land surfaces.

ESTABLISHED SEEDLING
A seedling tree that may be considered safe from normal adverse influences and no longer needs special protection.

EXTENSIVE FORESTRY
The practice of forestry on a basis of low operating and investment costs per acre.

EVAPO-TRANSPIRATION
The conversion of water, whether open or as soil moisture or within plants, into water vapor that is released to the atmosphere.

EVEN-AGED-STAND
A stand in which relatively small age differences exist between individual trees. The maximum difference in age permitted in an even-aged stand is usually 10 to 20 years, though where the stand will not be harvested until it is 100 to 200 years old, larger differences up to 25 percent of the rotation age may be allowed.

FELLING
The process of cutting trees to make them fall.

FERTILIZER
A substance used to make soil more fertile.
FIRE DETECTION
The act or system of discovering and locating fires.

FOREST FLOOR
The surface layer of a soil supporting forest vegetation.

FOREST LAND
Land that is at least 10 percent stocked (contains at least 1.5 square feet of basal area) with forest trees of any size or that formerly had such tree cover and is not currently developed for non-forest use.

The minimum area for classification of forest land is 1 acre.

FOREST LITTER
The uppermost layer, the L-layer, of organic debris on a forest floor, essentially the freshly fallen or only slightly decomposed vegetable material.

FOREST MANAGEMENT
Generally, the practical application of scientific, economic, and social principles to the administration and working of a forest estate for specified objectives.

FOREST PRODUCT
A commodity produced for utilization by man, having its original derivation from raw material yielded by the forest.

FOREST STAND
An aggregation of trees or other woody growth occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so as to be distinguishable from the forest or other growth on adjoining areas.

FOREST TYPE
A classification of forest land based upon the species forming a plurality of live-tree stocking.

FULL UTILIZATION
Utilization of the forest tree to the highest degree, in which all products merchantable are utilized.

FULLY STOCKED
A forest stand in which all growing space is effectively occupied, but in which there is ample room for development of the crop trees.

GEOLOGIC EROSION
Erosion that is normal to an area and is not influenced by man.

GROUP SELECTION
A modification of the selection method whereby the trees are removed in small groups at a time.

GROWING STOCK TREES
All live trees of commercial species (tree species that are presently or prospectively suitable for industrial wood products) except rotten trees and rough trees.

GROWTH-DRAIN RATIO

HARDWOOD
Generally, one of the botanical group of trees that have broad leaves, in contrast to the conifers.

HARDWOOD COMPONENT
That part or percentage of the forest or stand comprising hardwood growth.

HAUL ROADS
A road used primarily for the hauling of loads.

HAULING
Transporting loads by traction, whether by skidding or carrying on a vehicle.

HERBICIDE
Any chemical used to control or inhibit plant growth.

HIGH FOREST
A forest that originated from seed.

HUMUS
The plant and animal residues of the soil, litter excluded, which are undergoing decomposition.

HYDROLOGIC CYCLE
The large-scale circulation of water between atmosphere and earth, involving precipitation, runoff, evaporation, condensation, etc.

IMMATURE TIMBER
A timber crop that has not yet reached physical maturity.

IMPROVEMENT CUTTING
A cutting made in a forest stand past the sapling stage for the purpose of improving its composition and quality by removing trees of undesirable species, form, or condition from the main canopy.

INSECTICIDE
Any chemical used to control insects.

INTENSIVE FORESTRY
The practice of forestry so as to obtain a high level of volume and quality of cut per unit of area, through the application of the best techniques of silviculture and management.

INTERMEDIATE CUTTING
A silvicultural treatment undertaken in immature uneven-aged forest stands and immature even-aged groups of trees in uneven-aged forest stands between the time of formation and the time of the first regeneration cutting.
INTERMEDIATE TREE
Trees shorter than those in the dominant and codominant classes, but having crowns either below or extending into the crown cover formed by the dominant and codominant trees, receiving a little direct light from above, but none from the sides, usually with small crowns considerably crowded on the side.

INTOLERANCE
The incapacity of a tree to develop and grow in the shade of and in competition with other trees.

LANDING
A place where logs are assembled for transportation in loads or rafts.

LIBERATION CUTTING
The release of young trees, not past the sapling stage, from competition from older trees that are overtopping them.

LOG YARD
A centrally located collection area for timber products removed in a cutting operation.

LOW FOREST
A forest that originates vegetatively.

MAPLE-BEECH-BIRCH TYPE
Forests in which sugar maple, beech, or yellow birch, singly or in combination, make up a plurality of the stocking.

MATURE
1. (Physiology) A loose term for the stage at which a tree or other plant has attained full development, particularly height, and is in full seed production.
2. (Management) The stage at which a tree, crop, or stand best fulfills the (main) purpose for which it was maintained; e.g., produces the best possible supply of specified products or earns a specified rate of interest.
3. (Economics) Of a tree, crop, or stand, the age beyond which value increase is insufficient to earn a specified rate of interest obtained from other sources.

MERCHANTABLE
Of trees, crops or stands of a size, quality, and condition suitable for marketing under given economic conditions, even if so suited as not to be immediately accessible for logging.

MORTALITY
Death or destruction of forest trees as a result of competition, disease, insect damage, drought, wind, fire, and other factors.

NATURAL REGENERATION
The process by which a forest or range is renewed by self-sown seeds, sprouts, rhizomes, etc.

NET GROWTH
The total increase in diameter, basal area, height, or volume of a tree or stand, less mortality and including ingrowth.

NON-MARKETABLE
Trees not of size, species, or quality suitable for marketing or utilization.

NON-STOCKED
Forest land with less than 7.5 square feet of basal area per acre.

NUTRIENT DEPLETION
The temporarily or permanent loss of nutrients from the forest ecosystem.

OAK TYPE
Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking.

OAK-PINE TYPE
Forests in which hardwoods make up a plurality of the stocking but in which pines make up 25 to 50 percent of the stocking.

OLD GROWTH
A forest consisting of mainly mature trees.

OPEN-TO-WOODED
A transverse drain or passageway constructed beneath a road or passageway to lead water from the upper side to the lower, and having no covering.

OPERATOR
One who operates, usually referred to as a logging contractor or logger.

OVERTOPPED TREE
A tree whose crown is entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.

OVERSTOCKED
A condition of stand or forest indicating more trees than normal full stocking would require. Actual stocking of a stand is evaluated against the standard basal area of 75 square feet per acre; more than 133 percent of the standard is classed as overstocked.

PARTIAL CUTTING
A cutting in which only a part of the stand is removed. It usually implies a series of such cuttings.

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PARTICULATE
One of the minute subdivisions of matter and soil.

PERCOLATION
The downward movement of water through the soil.

POLE TIMBER
Trees 5 inches or more in diameter breast height, but smaller than sawtimber size.

POORLY STOCKED
A stand containing 10 to 60 percent of a standard stocking of 75 square feet per acre (7.5 to 45 square feet per acre).

POST LOGGING CLEAN-UP
The removal of debris after harvesting is completed.

PREPARATORY CUTTING
Removing trees near the end of a rotation so as to open the canopy and enlarge the crowns of seed bearers, with a view to improving conditions for seed production and natural regeneration, as typically in shelterwood systems.

PRUNING
The removal of live or dead branches from standing trees.

REGENERATION METHOD
The process by which a forest is renewed.

RELEASE
To free trees from competition.

REMOVAL CUTTING
Removing trees between the seed cutting and the final cutting under a shelterwood system, so as gradually to reduce the shelter and admit more light to aid the regenerated crop and to secure further recruitment.

RESIDUAL TREES
A general term for trees remaining after cutting operations.

ROTATION
The period of years required to establish and grow timber crops to a specified condition of maturity.

ROTEN TREE
A live tree of commercial species that does not contain at least one 12-foot sawlog or two noncontiguous sawlogs, each 8-feet or longer, now or prospectively, and do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

ROUGH TREE
The same as a rotten tree, except that rough trees do not meet the regional specifications for freedom from defect primarily because of roughness or poor form. This category also includes all live trees that are of non-commercial species.

RUNOFF
The total stream discharge, including both surface and subsurface flow.

SALVABLE TREE
A tree that is worth being salvaged.

SANITATION CUTTING
A cutting made to remove trees killed or injured by fire, insects, fungi, or other harmful agencies, for the purpose of preventing the spread of insects or disease.

SAW TIMBER STANDS
A cutting made to remove trees killed or injured to utilize merchantable material before it becomes worthless.

SAVAGE CUTTING
Live trees of commercial species that are in the 2- to 5-inch diameter classes at breast height and of good form and vigor.

SAPLINGS
Stands that are at least 10 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber trees or pole timber trees, with sawtimber stocking at least equal to pole timber stocking.

SCARIFICATION
Loosening the top soil of open areas, or breaking up of the forest floor, in preparation for regenerating by direct seeding or natural seedfall.

SEED CUTTING
Removing trees in a mature stand so as to effect permanent opening of its canopy (if there was no preparatory cutting to do this) and so provide conditions for securing regeneration from the seed of trees retained for that purpose.

SEEDLING
A young tree grown from seed less than 0.5 inch in diameter at breast height.

SEED-TREE METHOD
Removal in one cut of the mature timber from an area, save for a small number of seed bearers left singly or in small groups.

SEDIMENTATION
The action or process of depositing solid material in streams, watercourses, lakes, ponds, or other bodies of water.
SELECTION METHOD

Removal of trees, usually the oldest or largest, either as single scattered trees or in small groups rarely exceeding 1/4 acre in size at relatively short intervals, commonly 5 to 20 years, repeated indefinitely, by means of which the continuous establishment of natural reproduction is encouraged and an uneven-aged stand is maintained.

SELECTIVE CUTTING

The removal from the cutting area of only those trees that have been previously selected and/or marked for harvesting.

SHELTERWOOD METHOD

Removal of all trees in a series of cuttings, which extend over a period of years, usually equal to not more than one-quarter and often not more than one-tenth of the time required to grow the crop, by means of which the establishment of natural reproduction under the partial shelter of seed trees is encouraged.

SILTATION

The process of the deposition of water-borne sediments in stream channels, lakes, reservoirs, or on flood plains, usually resulting from a decrease in the velocity of the water.

SILVICULTURE

The theory and practice of controlling the establishment, composition, constitutive growth, and quality of forest stands.

SITE

An area, considered as to its ecological factors with reference to capacity to produce forests or other vegetation; the combination of biotic, climatic, and soil conditions of an area.

SITE CLASS

A measure of the relative productive capacity of a site for the crop or stand under study, based usually on volume or height or the maximum mean annual increment that is attained or attainable at a given age.

SKID TRAIL

Any way, more or less prepared, over which logs are dragged.

SKIDDING

A loose term for hauling loads by sliding, not on wheels, as developed originally from stump to roadside, deck, skidway, or other landing.

SLASH

Branches, bark, tops, chunks, cull logs, up-rooted stumps, and broken or up-rooted trees left on the ground after logging, or large accumulation of debris after wind or fire.

SNAG

A standing dead tree from which the leaves and most of the branches have fallen, or a standing section of the stem of a tree broken off at a height of 20 feet or more.

SOFTWOOD

Generally, one of the botanical group of trees that in most cases have needle or scale-like leaves; the conifers; also the wood produced by such trees.

SPRUCE-FIR TYPE

Forests in which spruce or balsam fir, singly or in combination, make up a plurality of the stocking.

STABLE SOIL

Soil able to retain its dimensions, composition, position, and shape.

STAND DENSITY

Density of stocking expressed in number of trees, basal area, volume, or other criteria, on a per-acre basis.

STAND ESTABLISHMENT

The process of developing a crop to the stage at which the young trees may be considered established.

STOCKING

An indication of the number of trees in a stand as compared with the desirable number for best growth and management.

STUR

A standing section of the stem of a tree, broken off at a height of less than 20 feet, from which the leaves and most of the branches have fallen.

STEMPAGE

The value of timber as it stands uncut.

SUPPRESSED TREE

A tree whose crown is entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.

SUSTAINED YIELD

The yield that a forest can produce continuously at a given intensity of management.
THINNING
A cutting made in an immature WEEDING forest stand with the two fundamental objectives of (1) maintaining and/or stimulating the growth of the trees that remain, and (2) utilizing all the merchantable material produced by the stand during the rotation.

TIMBERLINE
The uppermost extension of forest growth in mountainous regions where further extension is prevented because of environmental influences.

WHITE PINE-RED PINE-
H-barlock TYPE

TIMBER-STAND-IMPROVEMENT
A loose term comprising all treatments made to improve the composition, condition, and increment of a timber stand.

WINDFIRM

WOLF TREE

TOLERANCE
The capacity of a tree to develop and grow in the shade of and in competition with other trees.

UNEVEN-AGED
Applied to a stand in which there are considerable differences in age of trees and in which three or more age classes are represented.

WOOD-BASED INDUSTRY

WOOD YARD

UTILIZATION
That branch of forestry concerned with the operation of harvesting and marketing the forest crop and other resources of the forest.

YARDING

YIELD

VEGETATIVE REGENERATION
Production of new plants by any asexual method.

VIRGIN FOREST
A mature or overmature forest growth essentially uninfluenced by human activity.

VISTA BACKGROUND AREAS
The view of the distant part of a landscape or surrounding which is ordinarily focused or constrained by adjacent trees or vegetation, often created by man, and subject to design criteria.

VISUAL QUALITY
A mental image attained by sight of the degree of excellence which a vista possesses.

WATER BAR
A linear object or structure angled across a road or trail to intercept drainage and divert runoff.

WEED TREE
Any tree of a species having little or no economic value on the site in question.

A cultural operation performed in a young forest stand, not past the sapling stage and usually not past the seedling stage, for the purpose of releasing potential crop trees from the competition of other plants irrespective of whether they are woody plants or herbaceous plants, or whether their crowns are above, beside, or below the crowns of the crop trees.

Forests in which eastern white pine, red pine or hemlock, singly or in combination, make up a plurality of the stocking.

Ability to withstand wind without tipping or falling.

A vigorous tree, generally of bad growth form, that occupies more growing space than its value warrants, so harming, or threatening to harm potentially better neighbors.

Industries that depend, either in part or whole, upon products produced by forest lands.

An initial collection area for timber products.

The operation of the initial haul to a collecting point of transporting timber from stump to a yard or landing.

The amount of forest products harvested.

LITERATURE CITED AND SELECTED REFERENCES

1. Literature Cited


2. Selected Additional References


MAINE'S TIMBER RESOURCE IN 1971 - A SUMMARY
BASED ON INFORMATION
PRESENTED BY

Ferguson, Ronald H. and Neal P. Kingsley, 1972. The
Timber Resources of Maine. U.S.D.A. Forest Service
Experiment Station. Upper Darby, Pa. 129 pp. illus.

PREPARED BY
RALPH H. GRIFFIN
PROFESSOR OF FOREST RESOURCES

Forest Land Area

An estimated area totaling 17,748,600 acres in
aggregate and accounting for 90 percent of the total
land area in the State of Maine was classified as forest
land in 1971. Of the total acreage in forest land, 95
percent (16,894,300 acres) was classified as commercial
forest land with the remaining 5 percent (854,300 acres)
being classified as noncommercial forest land.

Potential Productivity of Forest Land

When classified on the basis on the inherent capa-
ibility to produce crops of industrial wood under
natural conditions, 14.1 percent (2,386,300 acres) of
the commercial forest land area in 1971 was considered
capable of producing from 120 to 165 cubic feet of wood
per acre per year; 30.6 percent (5,165,800 acres), from
85 to 120 cubic feet per acre per year; 34.7 (5,854,300
acres), from 50 to 83 cubic feet per acre per year; and
20.6 percent (3,487,900 acres), from 20 to 50 cubic
feet per acre per year.

Forest Land Ownership

Of the total area of commercial forest land, only
2 percent (311,500 acres) was in public ownerships
(national forest, other Federal, state, county and
municipalities) in 1971. The remaining 98 percent
(16,532,800 acres) was in private ownerships with
49 percent (8,235,000 acres) being in forest industry
ownership; 7 percent (1,122,100 acres), being in
farmer ownerships; and 42 percent (7,205,700 acres),
being in either individual or corporate ownerships.

Forest Types

Over three quarters of the commercial forest land
area of Maine was occupied by two major forest types
in 1971, namely the spruce-fir forest type occupying
47.1 percent (7,949,400 acres) and the maple-birch-
birch forest type occupying 21.1 percent (2,561,300
acres). The two forest types covering the next largest
acreage were the white pine-red pine-hemlock forest
type and the elm-ashe-red maple forest type occupying
10.7 percent (1,812,000 acres) and 10.1 (1,714,200
acres) respectively. Of the remaining commercial
forest land acreage, 8.4 percent (1,419,100 acres)
supported the aspen-birch forest type and 2.6 percent
(438,300 acres), the oak and oak-pine forest types.

Stocking

When all live trees, including two categories of
growing-stock trees (desirable trees and acceptable
trees) and two categories of nongrowing-stock trees
(rotten trees and rough trees) were considered in the

* Does not include 311,500 acres in public lands
determination of stocking, 56.6 percent (9,224,000 acres) of the commercial forest land area in 1971 was classified as being overstocked; 35.9 percent (6,063,400 acres), fully stocked; 7.8 percent (1,313,200 acres), medium stocked; and 1.7 percent (292,900 acres), poorly stocked with no acreage of commercial forest land being classified as nonstocked.

When only growing stock trees (desirable trees and acceptable trees) were considered in the determination of stocking, 15.6 percent (2,634,200 acres) of the commercial forest land area was classified as being overstocked; 42.9 percent (7,269,000 acres), fully stocked; 34.3 percent (5,790,100 acres), medium stocked; 6.6 percent (1,111,500 acres), poorly stocked; and 0.6 percent (109,500 acres), nonstocked.

When only growing stock trees in the desirable tree category were considered in the determination of stocking, 0.1 percent (14,000 acres) of the commercial forest land area was classified as being fully stocked; 0.2 percent (37,800 acres), medium stocked; 33.9 percent (5,719,000 acres), poorly stocked; and 65.8 percent (11,123,500 acres), nonstocked.

Stand Size

Classification of the commercial forest land area in 1971 according to stand-size classes indicated that 36.3 percent (6,142,800 acres) supported sawtimber stands; 31.6 percent (5,339,600 acres), poletimber stands; 31.3 percent (5,268,800 acres), seedling-maple stands with the remaining 0.8 percent (143,100 acres) being classified as nonstocked areas.

Stand Volume

Classification of the commercial forest land area in 1971 according to stand volume in board feet per acre indicated that 44.9 percent (7,580,800 acres) supported stands, containing less than 1,500 board feet per acre; 44.1 percent (7,454,400 acres), from 1,500 to 5,000 board feet per acre; and 11.0 percent (1,859,100 acres), more than 5,000 board feet per acre. The 36.3 percent (6,142,800 acres) of the commercial forest land area classified as supporting forest stands of sawtimber size in 1971 averaged 3,800 board feet per acre.

Growing Stock

In 1971, Maine's commercial forest land supported a net growing-stock volume of 21,253.6 million cubic feet including a net sawtimber volume of 34,519.7 million board feet. More than 55 percent of the growing-stock volume and 49 percent of the sawtimber volume was contained in the spruce-fir forest type. Three forest types - spruce-fir, maple-beech-birch, and white pine-red pine-hemlock - contained more than 85 percent of both the growing-stock volume and sawtimber volume.

Softwood species accounted for 70 percent of the growing-stock volume and 66 percent of the sawtimber volume with three species - balsam fir, red spruce, and white pine - containing 54 percent of the growing-stock volume and 50 percent of the sawtimber volume. Among the hardwood species, the soft maples (red maple and silver maple) and sugar maple were the principal species and together contained 13 percent of the growing-stock volume and 16 percent of the sawtimber volume.

The growing-stock trees on Maine's commercial forest land in 1971 numbered 7,235.6 million softwood trees and 3,638.5 million hardwood trees.

Only 6 percent of the softwood growing-stock trees and 4 percent of the hardwood growing-stock trees were large enough in diameter at breast height to be classified in either the small timber or large sawtimber categories. Less than 1 percent of the total number of trees in each of the species groups were large enough in diameter to be classified as large sawtimber.

In addition to the growing stock trees, Maine's commercial forest land contained 3,292.3 million rough and rotten trees, 95 percent of which were in either the sapling or poletimber size classes. Of the total number of rough and rotten trees, 37 percent (1,213.6 million) were softwood trees and 63 percent (2,058.9 million) were hardwood trees. Rough and rotten softwood trees contained 8.4 percent (1,362.6 million cubic feet) of the total net volume of softwood timber and rough and rotten hardwood trees contained 18.2 percent (1,445.8 million cubic feet) of the total net volume of hardwood timber of commercial forest land in 1971.

Annual Mortality

In 1970, the annual mortality of growing-stock and the annual mortality of sawtimber were estimated at 136.3 million cubic feet and 244.0 million board feet, respectively. Seventy-four percent of the growing-stock mortality and 71 percent of the sawtimber mortality were among softwood species with balsam fir, spruce, and white pine accounting for 63 percent of the growing-stock mortality and 59 percent of the sawtimber mortality respectively.

In 1970, disease caused 55 percent of the growing-stock mortality and 53 percent of the sawtimber mortality. Disease and weather together accounted for 41 percent of the growing-stock mortality and 83 percent of the sawtimber mortality.

Growth and Removals of Growing Stock

The annual net growth of growing-stock on Maine's commercial forest land in 1970 was 710.8 million cubic feet with annual growing-stock removals totaling 408.7 million cubic feet. Softwood species accounted for 77 percent of the net growth and 67 percent of the growing-stock removals with spruce, balsam fir, and white pine together accounting for 67 percent of the growth and 54 percent of the removals. Removals of growing-stock in 1970 exceeded the net annual growth in the case of northern white cedar, northern red oak, ash, and yellow birch. Growing-stock removals also exceeded net annual growth of those species in the "other softwoods" and "other hardwoods" categories.

Growth and Removals of Sawtimber

The annual net growth of sawtimber on Maine's commercial forest land in 1970 was 1,622 million board feet with annual sawtimber removals totaling 1,299 million board feet. Seventy-six percent of the net growth of sawtimber and 68 percent of the sawtimber removals were among softwood species with spruce, white pine, and balsam fir together accounting for 64 percent of the net growth and 55 percent of the net removals. The removals of sawtimber in 1970 exceeded the net growth of sawtimber in the case of white pine, northern white cedar, sugar maple, northern red oak, ash, yellow birch, beech and those species in the "other hardwoods" category. The removals of hardwood sawtimber in 1970 exceeded the net growth of hardwood sawtimber by 23 million board feet.
Your Chapter salutes these two public agencies. Their generosity has made this issue possible.